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Drivers of Market Participation Decisions among Small-scale Farmers in Yam Growing Areas of Nigeria and Ghana

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Abstract.

Participation in agricultural markets could be the main weapon against hunger to lift millions of poor farmers out of poverty traps. Unfortunately, most of the potential beneficiaries are constrained by several factors in their quest to participate in the yam market. This study, thus, clarified the underpinning drivers of market participation among small-scale farmers in yam belt of West Africa. Using a multistage random sample of 1400 households, the study tests the hypothesis that factors affecting farmers' decision to participate are not necessarily the same as those affecting the extent of participation. Non-price constraints played a significant role in determining decisions on market participation. Policies that reduce transactions costs and induce farmers to commercialize could be critical alternatives to policies based on price to promote a marketed surplus and the commercialization of agriculture by yam farmers and thereby alleviate poverty.

Keywords: Market participation, Double-Hurdle model, yam, Nigeria, Ghana.

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1. Introduction

A high percentage of the population of most African countries is dependent on arable crop agriculture (FAO, 2009). Although the African contribution to the supplies of some of these arable crops has been phenomenal in the region, the contributions to worldwide supplies of grains are modest: maize, about five percent; rice, three percent; wheat, three percent in the late 2000s (FAO, 2013). Africa is the lead player in the supplies of cassava with 50 percent of world production and of yam with 95 percent of world production. Research efforts have been directed to cereals but cassava is now enjoying some level of support. However, yam continues to be sidelined in national food policy programs in West Africa which remains one of the main areas challenged by hunger and poverty. Yam can be a formidable weapon against these scourges, if investments in food crop Research and Development, specifically directed on yam by national governments, regional and nongovernmental organizations, and donors, are used to bring the crop into a central focus in national food policies. An approach in this regard is the encouragement of yam-growing rural farming households and other stakeholders in the yam sector to participate in the market. Agricultural growth depends on agricultural/food commercialization contributing largely to economic development. According to Mathenge et al. (2010), market-oriented production could be highly instrumental in realizing welfare gains by exploiting the opportunities and benefits provided via specialization and comparative advantage, economies of scale, and the regular interaction and exchange of ideas. Moreover, increasing agricultural output will amount only to an exercise in futility if it is devoid of markets that effectively bind the increasingly specialized activities of widely dispersed producers into an integrated national economy. Therefore, participation in agricultural markets could be a key scheme in lifting millions of poor farmers out of the hunger and poverty traps. Stimulating their participation in agricultural markets will help them to enjoy the benefits necessary to boost food security in the region. Enhancing returns from yam production through improved access to market can be a way-in for welfare gain and a way-out of poverty. Unfortunately, most of the small-scale farmers are constrained by several factors from benefiting from participation in the yam market for their goods and services. Farmers in the study area are confronted with marketing problems indicated by low farm-gate prices in spite of the high yam market value, leaving households with low income. Literature on market participation in rural areas continues to be relatively scarce (Bellemare and Barrett, 2006). The present study is primarily concerned with the question: What holds farmers back from commercialization?

This study, thus, intends to fill those knowledge gaps by clarifying the drivers of market participation among small-scale farmers in the yam area and looks beyond the decision to

participate. In the first stage, households that produce yam decide whether or not to sell that commodity in the market. In the second stage, the households that decide to sell determine the extent of their participation.

The remainder of this article is organized as follows. In the next section, we discuss the overview of yam marketing in West Africa, followed by some previous empirical work on agricultural market participation and provide some background from a theoretical model. Then we describe the farm survey data and the methodologies used, before presenting and discussing regression results. The concluding section discusses policy implications.

The state of Agricultural Market Participation and yam marketing in West Africa

Participation in the agricultural market has been conceived as the integration of subsistence farmers into the input and output markets of agricultural products with a view to increasing their income level and hence to reducing poverty (Holloway and Ehui, 2002). In the study carried out on agricultural supply response and poverty in Mozambique (Heltberg and Tarp, 2001) participation in agricultural markets by rural households has been conceived as a fundamental approach to alleviating poverty and enhancing food security in developing countries. Barrett (2007) in his study of smallholder market participation in Eastern and Southern Africa opined that farming households must have access to productive technologies and adequate private and public goods in order to produce a marketable surplus. However, such investment requires that households earn enough to save, invest, and generate adequate tax revenue for governments.

Omiti et al. (2009) while working on factors influencing the intensity of market participation by smallholders in Kenya observed that most farmers in rural areas produce lower volumes of relatively low-value and less perishable marketed surpluses than their peri-urban counterparts. They also sell mainly at the farm gate and in rural markets. Only a small proportion of the total output is taken to the more lucrative (but distant) urban markets. The study showed that distance indeed confines rural farmers to the perpetual production of low-value and less perishable commodities and suggested that farm-to-market roads should be upgraded with equipped retail market centers. However agricultural marketing may be productivity-enhancing over time. In fact, firms or farms with high productivity have tended to become highly commercialized and export-inclined (Bernard and Wagner, 1998; Bernard and Jensen, 1999; Zhang and Fan, 2004). In their work on farm productivity and household market participation in Tanzania, Vietnam, and Guatemala, Rios et al. (2009) asserted that enhancing market access through the construction of roads may not consistently

lead to improvements in agricultural productivity. In contrast, increasing output directly through investments in irrigation equipment and improved seeds is likely to have a more consistent impact on participation.

On market infrastructure and institutional factors, Tung and Costales (2007) in the study of market participation of smallholder poultry producers in northern Viet Nam found that market infrastructure and the institutional aspects of market access are crucial for improving the opportunities of smallholders to increase market participation. However, general or local market instability, manifested in unpredictable price fluctuations, has a far larger negative impact on the livelihoods of smallholder producers than the dominance of traders. Fischer and Qaim (2011) while investigating the determinants of intensity of participation in marketing asserted that participation could be expected to be driven by a clear personal benefit in terms of higher sale prices. Farmers with lower transaction costs participated in markets and sold more because they were likely to recover their production and marketing costs (Holloway et al., 2000). Distance to roads, markets, or towns, was important and farmers with the means of transportation or more labor were found to participate and sell more products. Population density positively affected market participation and sales as farmers in more densely populated areas faced greater demand for their farm produce (Holloway and Ehui, 2002; Balint and Wobst, 2005). Poor infrastructure often increases the transaction costs of smallholders' market participation (Lapar et al., 2003; Bellemare and Barrett, 2006). The ease of flow of market information to the farmers in a way that enhances their information base would improve market access (IFAD, 2001; Stifel and Sahn, 2003).

In developing countries, agrarian rural areas are among the poorest and the largest, so strategies and policies that stimulate their participation in the market will enhance economic growth. However, agricultural households often face imperfect or incomplete markets for some goods and factors, which are then non-tradable (Sadoulet and de Janvry, 1995) and decisions on production and consumption are no longer separable. Sadoulet and de Janvry (1995) summarize the sources of such incomplete or imperfect markets including costs resulting from distance to markets, poor infrastructure, high marketing margins, imperfect information and supervision, and incentive costs. These are the reasons for the literature's interest in the effects of transaction costs on market participation (Goetz, 1992; Pingali and Rosegrant, 1995; Staal et al., 1997; Zaibet and Dunn, 1998; Key et al., 2000; Holloway and Ehui, 2002; Lapar et al., 2003; Holloway et al., 2004; Holloway et al., 2005; Poulton et al., 2006; Shilpi and Umali-Deininger, 2008; Markelova et al., 2009). As a

result, the reduction of transactions costs, as a means of increasing market participation, has been identified as a goal of development policy (Delgado, 1995).

Significant barriers exist to entry into commercial staple food markets that discourage significant sales by smallholder producers. In fact, Renkow et al. (2004) observed that the food crop marketing system, including that for yam, has been inefficient in most African countries. As a result, farmers find it difficult to dispose of their produce at attractive prices and in places of their choice due to such perceived weaknesses. This development reduces any enthusiasm about raising production and improving supply; this often steps up food prices to consumers and restricts any increase in farm income (Rosegrant et al., 2005). In the case of yam markets, the perishability and bulkiness of the raw materials increase the likelihood of spoilage and losses during processing or transport. The associated costs reduce the profitability of marketing yam.

Underlying theoretical background

This paper considers farmers' participation in the market and recognizes that this decision may be made in a single or a sequential two-step process. In the sequential process, the farmers decide whether or not to participate in the market and, if they choose market participation, the next step in the decision about the quantity to sell. Simultaneous decision-making means that the farmers make choices about market participation and quantity at the same time (Abdoulaye and Sanders, 2005; Chirwa, 2005). Increasing research on sequential decisions on market participation has been done (Croppestedt et al., 2003; Holloway et al., 2005; Bellemare and Barrett, 2006; Xu et al., 2009). The last study explicitly tests whether or not farmers make sequential or simultaneous decisions and finds the evidence necessary to support sequential decision making. None of these studies explicitly tests whether the decision could be made sequentially or simultaneously, as this study does. Small-scale farmers' decision to participate in the market can be understood, based on a utility model.

Any smallholder household in rural areas engages in a range of economically significant market activities. In modeling the utility or satisfaction derived from the farmers' participation in yam markets as integrated into the smallholder farming system, the economic values or benefits associated need to be considered. A typical smallholder-farming household seeks to participate in the commercial market to maximize a multi-dimensional objective function, including increasing incomes and food security and reducing all forms of risk (Strauss et al., 1989). When there is a change in the economic parameters associated with market participation, the central question is related to how much compensation, whether paid or received, would make the decision-maker

uninterested about the change. Thus the change in welfare associated with this development was used as the basis for the economic valuation process. When an individual farmer faces a change in a measurable attribute, for example higher returns or lower expenditures from participating in the market (p), then p changes from $p0$ to $p1$ (with $p1 > p0$).

The indirect utility function U after the change becomes higher than the status quo. Now the status quo can be represented econometrically as follows:

$$u_{1j} = u_i (y_i , z_j , p^0 , \varepsilon_{0j})$$

On the other hand, the changed or final state due to market participation is shown by:

$$u_{2j} = u_i (y_i, z_j , p^1 , \varepsilon_{ij})$$

Where,

y_i, refers to the farmer's income, Z_j is a vector of the farmer's socio-economic variables and attributes of choice, and ε_j is the stochastic error term representing other unobserved utility components.

The farmer would decide to participate in markets on the following condition

$$u_i (y_i - P_i, z_j , \varepsilon_{ij}) > u_0 (y_i , z_j , \varepsilon_{0j})$$

Where:

P_i is the monetary investment associated with market participation.

Since the random components of the preferences are not known with certainty; it is possible only to make probabilistic statements about expected outcomes. Thus, the decision by farmers to participate is the probability that they will be better off if participation improves their welfare. This is represented as follows:

$$Prob\ (Yes_i) = Prob\ [u_i (y_i - P_i, z_j, \varepsilon_{ij}) > u_0 (y_i, z_j, \varepsilon_{ij})]$$

Since the above utility functions are expressed generally, it becomes critical to specify the utility function as additively separable in deterministic and stochastic preferences. Using this argument, the function becomes:

$$u_i (y_i , z_j , \varepsilon_{ij}) = u_i (y_i, z_j) + \varepsilon_{ij}$$

Where:

The first part of the right-hand side is the deterministic part and the second part is the stochastic part. The assumptions that ε_{ij} are independently and identically distributed with mean zero describe most widely used distributions.

Econometric specification: the Double Hurdle model

As to be mentioned later, generally not all households participated in yam market. This could be explained in two ways: the households do not have yam to take to market or the households have yam but did not take it to market, for some reason. The zero values in the former case are related to the respondents' yam ownership decisions, while those in the latter case are termed as random zeros as they arise from random events.[2] The traditional approach to deal with data that have many zeros, yielding a censored dependent variable, has been to use the standard Tobit model, originally formulated by Tobin (1958). The Tobit estimator fits conceptually when we think of decisions on market participation and yam supply as being made simultaneously. Using a Tobit indicates that fixed costs associated with market participation do not significantly affect a farmer's decision to participate in commercial markets. It also means that factors affecting market participation and quantity decisions are one and the same, affecting the dependent variable in the same direction.

As opposed to the Tobit model, Heckman's (1979) model considers the zero observations to arise mainly from respondents' self-selection. In other words, this means that all the zeros come from the respondents' deliberate choices. Heckman (1979) proposes a model that addresses the problem associated with the zero observations generated by non-participation decisions, arguing that an estimation on a selected subsample (i.e., censored estimation) results in sample selection bias. The model overcomes this problem by undertaking a two-step estimation procedure (known as heckit). In this estimation, a full sample Probit estimation is followed by a censored estimation carried out on the selected subsample. While the first estimates the probability of observing a positive outcome (known as the selection or participation equation), the second estimates the level of participation conditional on observing positive values (known as the conditional equation) (Dow and Norton, 2003). The model assumes that different sets of variables could be used in the two-step estimations.

[2] Carlin and Flood (1997) attribute the presence of too many zeros in the data either to censoring (behavioral or true zeros), or to faulty reporting, or other random effects (random zeros).

Tobit's model is too restrictive as it assumes all the zeros to be the respondents' deliberate choices. Cragg (1971) modifies the Tobit model to overcome the restrictive assumption inherent in it, namely, he suggests the Double Hurdle (DH) model to tackle the problem of too many zeros in the survey data by giving special treatment to the participation decision. In this model, two hurdles must be crossed in order to report participation and level of participation decisions. When thinking of decisions on market participation and yam supply as a sequential process, the DH model is appropriate for analyzing the possibility that the factors influencing a farmer's decision to participate in the yam market may not affect the quantity sold. The DH model also allows us to consider that the same factor can potentially affect participation and the amount sold in different ways. We relied on this approach and estimated a DH model using Craggit command (Burke, 2009) in Stata software (StataCorp, 2013) which combines a probit estimation with a truncated normal regression in the second step.

The heckit and the DH models are similar in identifying the rules governing the discrete (zero or positive) outcomes. Both models recognize that these outcomes are determined by the selection and level of participation decisions. They also permit the possibility of estimating the first- and second-stage equations using different sets of explanatory variables. However, the heckit, as opposed to the double-hurdle, assumes that there will be no zero observations in the second stage once the first-stage selection is passed. In contrast, the DH considers the possibility of zero realizations (outcomes) in the second-hurdle arising from the households' deliberate choices or random circumstances. In this regard, the DH model can be considered as an improvement both on the standard Tobit and generalized Tobit (heckit) models[3].

In terms of policy relevance, our analysis clearly shows that participation and the level of participation may be different decisions and that an estimation of participation intensity on the basis of factors affecting the participation decision, as implied by other approaches, may be liable to error.

The DH model has been extensively applied in several studies (Burton et al., 1996; Newman et al., 2001; Moffat, 2003; Martínez-Espiñeira, 2006; Langyintuo and Mungoma, 2008). However, it has not been much used in the area of market participation. The DH approach implies that farmers make two decisions with regard to their decision to participate in the commercial market. The first decision is whether they will participate. The second decision is about the amount of yam that they

[3] Also known as *Tobit* type I and *Tobit* type II models, respectively (Flood and Gråsjö, 1998, 2001).

will convey into the market, conditional on the first decision. The two decisions are, therefore, whether to participate and how much to participate. The importance of treating the two decisions independently lies in the fact that the factors that affect a decision to participate may be different from those that affect the decision on how much to participate. The DH model allows for the possibility that these two decisions are affected by a different set of variables. The advantage with this approach is that it allows us to understand the characteristics of a class of households that would never participate. Thus, the probability of a household belonging to a particular class depends on a set of household characteristics. The DH model is a parametric generalization of the Tobit model, in which two separate stochastic processes determine the decision to participate and the level of participation. The first equation in the DH model relates to the decision to participate and can be expressed as follows:

$$y_i = 1 \text{ if } y_i^* > 0 \text{ and } 0 \text{ if } y_i^* \leq 0$$

$$y^* = x_i'\alpha + \varepsilon_i$$

Where:

y_1^* is latent participation variable that takes the value of 1 if a household participates and 0 otherwise, x is a vector of household characteristics and α is a vector of parameters;

The second hurdle, which closely resembles the Tobit model, is expressed as:

$$t_i = t_i^* > 0 \text{ and } y_i^* > 0$$

$$t_i = 0 \text{ otherwise}$$

$$t^* = z_i'\beta + u_i$$

Where:

t_i is the observed response on how much yam should be conveyed to market,

z is a vector of the household characteristics and β is a vector of parameters.

The decisions whether or not to participate in market and about how much yam to convey to market can be jointly modelled, if they are made simultaneously by the household; and independently, if they are made separately; or sequentially, if one is made first and affects the other as in the dominance model (Martínez-Espiñeira, 2006). If the independence model applies, the error terms are distributed as follows: $\varepsilon_i \sim N(0, 1)$ and $u_i \sim N(0,\delta^2)$.

If both decisions are made jointly (the Dependent DH) the error term can be defined as $(\varepsilon_i, u_i) \sim BV$ $N(0,Y)$ Where: Y = $\begin{bmatrix} 1 & p\delta \\ p\delta & \delta^2 \end{bmatrix}$

The model is said to be a dependent model if there is a relationship between the decision to participate and the level of participation. This relationship can be expressed as follows:

$$p = \frac{cov\ (\varepsilon_i u_i)}{\sqrt{var\varepsilon_i varu_i}}$$

If $p = 0$ and there is dominance (the zeros are associated only with non-participation, not standard corner solutions) then the model decomposes into a Probit for participation and a standard OLS for *y*. Following Smith (2003) we assume that the error terms and ε_i and u_i are independently and normally distributed and thus we have the following expression:

$$\binom{\varepsilon_i}{u_i} N\left[\binom{0}{0}, \begin{pmatrix} 1 & 0 \\ 0 & \delta^2 \end{pmatrix}\right]$$

And finally, the observed variable in a DH model is $t_i = y_i\ t_i^*$ and the log-likelihood function for the DH model is:

$$LogL = \sum_0 ln\left[1 - \phi(x_i'\alpha)\phi(\tfrac{z_i'\beta}{\delta})\right] + \sum_+ ln\left[\phi(x_i'\alpha)\tfrac{1}{\delta}\emptyset(\tfrac{t_i - z_i'\beta}{\delta})\right]$$

Thus in this study we estimate the decision to participate and the level of participation using a DH model.

In order to check for multicollinearity in the model, variance inflation factor (VIF) for categorical variables were estimated (Fox and Monette, 1992). According to Maddala (1992), VIF can be defined as:

$$VIF\,(X_i) = 1/(1 - R_i^2)\ \text{With}\ (1 - R_i^2) = TOL\,(X_i)$$

Where:

R_i^2 is the squared multiple correlation coefficient between Xi and the other explanatory variables;

TOL is Tolerance. The larger the value of VIF, the more troublesome it is.

To avoid the problem of multicollinearity, it was essential to exclude the variables with the TOL of less than 0.20 or a VIF of 5 and above (O'Brien, 2007).

Similarly, there might also be an association between dummy variables. In order to test multicollinearity problem between discrete variables, contingency coefficient (CC) which is χ^2, chi-square based measure of the relation between two categorical variables (proposed by Pearson, the originator of the Chi-square test) was computed. The values of contingency coefficient range between 0 and 1, with zero indicating no association between the variables and values close to 1 indicating a high degree of association. If the value of contingency coefficient is greater than 0.75, the variable is said to be collinear. The contingency coefficient can be defined as:

$$CC = [\chi^2 / (n + \chi^2)]^{1/2}$$

Where:

CC = Contingency coefficient, n= sample size, χ^2 = Chi-square value.

Empirical specification

We use a DH model. These decisions are made in a sequential manner and can be subject to two very different decision-making processes. Therefore, we use a set of explanatory variables. The choice of the variables used in this study is largely based on work by Lapar et al. (2003), Bellemare and Barrett (2006), Alene et al. (2008), and Xu et al. (2009), who extensively reviewed factors that influence farmers to participate in marketing. The set of independent variables potentially expected to influence market participation are grouped into the following classes: household characteristics, physical assets, social capital, transaction costs, livelihood development services, and regional variables.

Households' background characteristics are captured by age, education, household size, and number of female in the household. The relationship with age is expected to be negative depending on the levels of development. Younger farmers are expected to be progressive, more open to new ideas, and to understand better the benefits of agricultural commercialization. In addition, younger farmers also have higher levels of education and more contacts worldwide. In most cases, older farmers view farming as a way of life rather than as a business and have a strong emotional or almost biological connection with farming and the land. Intellectual capital as captured by education is

expected to play a positive role in influencing market participation. The level of education gives an indication of the household's ability to process information and causes some farmers to have better access than others to understanding and interpreting information. However, the expectation may be reversed when there are competing and more remunerative employment opportunities available in the area requiring skills that are enhanced by more education (Lapar et al., 2003). Household size is included as a proxy for the availability of family labor. Household size may be relevant for attending group meetings while number of female in the household for attending market days and transporting yam, emphasizing higher probability of market participation. Therefore a household with a large number of members is expected to produce a larger marketable output. Lapar et al. (2003) hypothesized that the propensity to participate in the market economy declines with lower numbers of household members.

Physical assets are captured through the storage facilities farmers own. Owning a storage facility is expected to exert a positive impact on both the likelihood that participation will occur and the proportion of sales that will be undertaken once the decision to participate has been made. This hypothesis is supported by Heierli and Gass (2001) who argue that the acquisition and ownership of productive assets can catalyze a family to participate in economic activities.

Again, households using motorized equipment to market are likely to convey their agricultural product easily and on time to the market before it loses value. It is therefore hypothesized that such households are more likely to participate in commercialization and will have a larger quantity of yam to transport to market.

Access to farm land is a necessary condition for market participation. This variable is measured by the size of the farm land that the household operates and is likely to be important. The larger the size of land a household uses, the higher the production levels are likely to be, and the higher the probability of market participation. However, large farms may face high transaction costs and a lack of economies of scale, leading to a lowering of the additional benefits of participation.

Non-farm activities mostly consist of non-farm employment usually available in nearby towns. Off-farm income may lead to risk-reduction in a household's decision-making and, with it, an increased propensity to undertake activities with a higher level of risk, notably selling crops or producing for the market.

Membership in yam producer and marketing groups/cooperatives is another construct of transaction costs as applied in the study. Membership has been linked to a variety of outcomes which can improve smallholders' market power and ensure a more equitable distribution of benefits (Key and Runsten, 1999) and it is through networks that information and other resources can be transmitted (Sharp and Smith, 2003). Membership strengthens farmers' bargaining and lobbying power and facilitates coordination and the obtaining of institutional solutions to some problems (Matungul et al., 2001). This variable is expected to have a positive impact on market participation. However, membership could be a limiting factor as an indication of other preoccupations that are taking members away from commercialization. This could generate unsuccessful group action (Markelova et al., 2009; Poulton et al., 2010).

Transaction costs are hypothesized to impede market participation because they impose added cost burdens on the efficient conduct of market entry activities. The following factors were used to capture the transaction costs variable: distance from residence to farm, access to market information, and price factor.

Distance from residence to farm is a proxy for the time and cost of transportation. The proximity reflects how far farmers have to travel to reach the farm. Thus, the further away a household is from the farm, the higher the transaction costs of obtaining a farm outlet (Key et al., 2000; Croppestedt et al., 2003; Holloway et al., 2005; Bellemare and Barrett, 2006). A long distance from residence to farm is expected to influence market participation negatively. Another variable used as a proxy for transaction costs is access to information on output markets and prices. Marketing efficiency is hindered by delay and difficulty in obtaining information which increases transaction costs by raising search and bargaining costs. Therefore access to market information becomes crucial in capturing the information relevant to predict market participation. Small-scale farmers are often not aware of prices and market opportunities for their yam and find it difficult to participate in alternative markets. Access to such information is hypothesized to influence market participation positively.

The price factor influences market participation positively as pointed out by Alene et al. (2008) and Cunningham et al. (2008). The output price is an incentive to sellers to supply more in the market. The final construct of transaction costs applied in the study is the country dummy that is included in the analyses to capture differences that might arise due to diversity in human, economic, and ecological conditions among households located in both countries.

2. Data and results

The household survey was carried out between May and September 2012. Using a carefully designed and tested questionnaire, we conducted structured, household-level interviews with yam growers in communities classified as yam-growing areas with a high potential. A multistage, random sampling procedure was adopted to get the total sample size of 1400 households from both Nigeria and Ghana which were selected with equal probability from each community. The sampling frame including all households in the surveyed communities was developed by extension agents in collaboration with community heads as a source list and the last stage involved a random selection of farm households through a random number generator. The data collected valuable information on several variables including socio-economic, farm-related, institutional, and technological factors.

The extent of market participation was captured by the proportion of quantity of yam produced that ended up being sold for each household. For all the households across Nigeria and Ghana, about 55% of the yam production was marketed, with zero as the lowest registered and almost the total production (99.92%) as the highest percentage marketed (Table 1). This is reflective of the importance of yam as a main source of income in the region. The average age of the farmers was 50 years, an indication that most of them are still economically active with strength and ability to carry out agricultural activities. Availability of labor for farming (especially family labor) was indicated by the large size of households (10). Illiteracy was frequent in both countries, as most farmers did not complete six years of primary education. The farmers cultivate small plots of land with an average size of about 2.5 ha. Access to non-farm credit was extremely low as a sizeable proportion of the respondents claimed that they had never had access to loan facilities from any formal or informal institutions. The yields obtained from the farms vary from farmer to farmer but are low on average (about 9 t/ha).

< Table 1 >

The econometric estimation results of output market participation among households using the DH of Cragg (1971) are discussed in this section. Correlates are hypothesized of yam market participation (whether a household sold yam) and extent of participation (the proportion of yam sold) are hypothesized variables focused on existent literature of interest which will inform conclusions for this. The estimation was done separately for each of Nigeria and Ghana before being pooled together. Based on relevant statistical tests as evidenced by the values of Wald chi^2

and Log Likelihood as well as signs and magnitude of the estimates, the pooled regression made better statistical sense and was therefore used in explaining market participation decisions. The Probit results on the decision to participate in markets and truncated regression analysis results on the extent of market participation for the three regressions are presented (Table 2).

Age was negative and insignificant in influencing market participation but significant in affecting the extent of participation, meaning that more of the younger people participated in yam marketing. The rationale behind this is that younger people tend to be energetic and risk takers. Similarly, no of females was negative but insignificant in influencing decision and extent of market participation. Education was negative and significantly related to decision to participate in yam market. This implies that more the education, the less the willingness to sell yam by farming households. The tendency could be attributed to improved understanding of storage and possession of better storage facilities by seemingly educated yam farmers.

Farm size was positively and significantly associated with a higher probability of participating in the yam market. In addition, farm size positively and significantly influenced marketed volumes for yam. This is in agreement with the *a priori* expectation that farmers with large farms produce beyond what they use for home consumption. An increase in farm size naturally implies an increase in output. These results indicate the constraints that farmers who happen to have farms of smaller sizes face in getting access to markets due perhaps to their inability to produce a marketable surplus. The result also showed that the yield of yam was positively and significantly related to the probability of participating in marketing activities. The higher the yam yields the greater the tendency for the farmers to sell yam. After the decision to participate in the market has been made, yield has a significant influence on the proportion of yam sold. Increased productivity results in a larger marketed surplus of yam which could drive the commercialization of other crops as it has the potential to release some forest and other resources tied up in subsistence farming.

Membership of a yam producer and marketing group/cooperative society was positively associated with the extent of participation in the yam market. After the decision to participate has been made, membership has a significant influence on the share allocated for sale. These results underscore the importance of social capital in the volume of yam sold by the poor smallholder farmers.

Contrary to expectations, the price for yam was negatively, albeit insignificantly, associated with the decision to sell. This is in agreement with the findings of Mathenge et al. (2010). A possible explanation for this unexpected behavior in the sign of price could be connected with the status of the households as net buyers of food crops. A high price could stimulate farmers to keep as much

yam as possible on the farm to prevent significant spending on the food crop. Moreover, resource-poor households do participate in the market immediately after harvest when the prices are low and purchase at other times when prices are high. Another reason is the fluctuation in prices occasioned by a lack of storage facilities and high perishability of yam crop.

The country variable is significantly and positively associated with both market participation and the extent of participation. This underscores the associated socioeconomic and population-related factors that are more available and evident in Nigeria and cumulate in higher demand for the yam crop there.

< Table 2 >

3. Conclusion and policy implications

Participation in agricultural markets could be the main weapon against hunger to lift millions of poor farmers out of poverty traps. Unfortunately, most of the potential beneficiaries are constrained by several factors in their quest to participate in the yam market. This study, thus, clarified the underpinning drivers of market participation among small-scale yam farmers in the yam area. Socio-economic characteristics were described, such as age, educational status, household and farm sizes, membership in a yam producer and marketing group/cooperative, number of female in the household, ownership of a yam storage facility, means of transport used to market, distance from residence to farm, and country dummy. The results show farmers were still in their economically active years with large households. Most of them did not finish primary education. The mean proportion of 55% of the production was marketed across Nigeria and Ghana. Yam was the main source of income for most smallholder farmers in the region. Market participation was becoming crucial to motivate the farmers in increasing their farms' output, hence enabling them to earn more income. The DH estimation reveals that market participation is governed by two independent decisions: the decision to participate in the market and the decision on the extent of participation. The estimation results show that these two separate decisions are determined by different sets of factors. Non-price constraints played a significant role in determining decisions on market participation. Education of household head, farm size, yam yield, and country variable were found to influence the decision to participate; age of the household head, membership of a yam producer and marketing group/cooperative, yam yield, distance from farm to residence, means of transport used from residence to market and country variable influenced the extent of participation. Policies that reduce transactions costs and induce farmers to commercialize could be critical alternatives to policies based on price to promote a marketed surplus and the commercialization of agriculture by yam farmers and thereby alleviate poverty.

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Tables

Table 1: Descriptive statistics

Variables	Symbol	Obs.	Mean	Std. Dev.
Dependents				
Yam market participation (=1 if the household sold yam; 0 otherwise)		1400	0.97	0.17
Proportion of yam sold		1400	55.32	25.76
Independents				
Age of the household head (years)	AGE	1400	50.09	14.29
Education status (=1 if the head has 6 years of schooling or more; 0 otherwise)	EDUCS	1400	0.46	0.50
Number of female in the household	NFEM	1400	4.51	2.62
Household size (number)	HSIZE	1400	10.02	5.61
Total farm size (ha)	TFSIZE	1400	2.51	1.16
Yam yield (kg/ha)	YYIELD	1379	8932	12203
Average price at which each unit of yam is sold ($/kg)	PRICE	1400	0.49	0.44
Off-farm income (in $US)	OFF-INC	1400	413.88	1358.33
Access to output markets and prices (=1 if household has access; 0 otherwise)	AOMP	1400	0.11	0.32
Membership of yam producer and marketing group/cooperative (=1 if a member; 0 otherwise)	MBER	1400	0.03	0.17
Yam storage facility ownership (=1 if household has a storage room, yam barn, or raised huts; 0 otherwise)	YSFO	1400	0.54	0.50
Means of transport used from residence to market (=1 if use motorized equipment; 0 otherwise)	MTUM	1400	0.57	0.50
Distance from residence to farm (in minutes of walking time)	DISTF	1391	43.53	44.42
Country (=1 for Nigeria and 0 for Ghana)	CTRY	1400	0.57	0.50

Table 2: Estimates of Double-Hurdle Model of Determinants of yam market participation decision and degree of participation

	NIGERIA		GHANA		POOL	
Variable	**Coefficient**	**Z- value**	**Coefficient**	**Z- value**	**Coefficient**	**Z- value**
			First Hurdle			
AGE	-0.00034	-0.04	-0.01205	-1.59	-0.00711	-1.38
NFEM	-0.09968	-1.57	-0.02261	-0.29	-0.06819	-1.38
EDUCS	-0.24161	-0.96	-0.32342	-1.33	-0.29410**	-1.72
HSIZE	0.02231	0.61	0.03174	0.68	0.03487	1.17
TFSIZE	0.08444	0.84	0.26693***	2.67	0.17629***	2.54
PRICE	-0.16912	-0.69	-0.37952	-1.45	-0.24941	-1.42
MBER	3.32360	0.02	-0.31452	-0.55	0.13125	0.28
DISTF	0.00026	0.09	0.00083	0.33	0.00110	0.58
MTUM	0.01745	0.07	-0.36826**	-1.73	-0.19923	-1.28
YYIELD	0.00003**	1.76	0.00004**	1.67	0.00003***	2.36
OFF-INC	3.77e-07	0.07	0.00022	0.89	6.59e-06	0.17
AOMP	0.05079	0.12	0.00882	0.03	0.00447	0.02
CTRY	-	-	-	-	0.40899***	2.30
CONSTANT	2.14636***	3.57	1.77728***	3.19	1.79255***	4.65
			Second Hurdle			
AGE	-0.17008***	-2.67	-0.11565	-1.49	-0.13937***	-2.81
NFEM	-0.03096	-0.07	-0.76202	-1.21	-0.32086	-0.89
EDUCS	-0.86820	-0.47	2.02278	0.77	0.26102	0.17
HSIZE	0.05943	0.29	0.34455	1.17	0.16943	0.99
TFSIZE	0.87674	1.14	0.90772	0.89	0.76689	1.24
MBER	7.39265**	1.73	6.80771	0.85	8.15127***	2.11
DISTF	0.03053	1.46	-0.06612***	-2.87	-0.01889	-1.23
MTUM	-1.27318	-0.69	-4.18795**	-1.90	-2.43567**	-1.71
YYIELD	0.00068***	9.04	0.00031***	3.94	0.00049***	8.93
OFF-INC	9.94e-06	0.82	-0.00025	-1.52	7.12e-06	0.57
AOMP	-2.94375	-0.94	0.70747	0.23	-0.37325	-0.17
YSFO	-4.97950***	-2.47	2.26733	0.87	-2.51182	-1.55
CTRY	-	-	-	-	6.37639***	3.52
CONSTANT	62.0677***	12.83	57.97048***	10.65	56.33972***	16.15