Determinants of Smallholder African Indigenous Leafy Vegetables Farmers' Market Participation Behaviour in Nyamira County, Kenya

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Abstract

Participation in commercial agriculture holds key prospects for unravelling pertinent opportunities necessary for providing better incomes and sustainable livelihoods for small-scale farmers. Therefore, market participation has the potential to increase farmers' rural incomes and employment opportunities, especially if farmers concentrate on production and marketing of indigenous crops requiring low inputs such as African indigenous leafy vegetables (AILV). This study examined factors that influenced smallholders' market participation behaviour. Data was obtained through a household survey using structured questionnaires administered to 254 respondents picked for the study through a multistage sampling procedure. An ordered probit model was used to determine factors influencing smallholders' market participation as either net buyers, net sellers or autarchies. Findings revealed that marketing experience, land ownership, households' food self-sufficiency, contractual marketing, access to credit and extension services significantly influenced the regimes in which smallholders participated in markets. It is not enough that farmers merely participated in markets, rather they should participate in markets profitably as net sellers. Identifying the specific challenges and requirements that are unique for each market regime (net sellers, autarkic and net buyers) through proper targeting and screening of farmers is necessary. Here, equipping extension workers with the ability to address the specific needs of each group is recommended. Further, the study advocates for group marketing to increase farmers' bargaining power during negotiations, in addition to reducing transportation costs by transporting produce in groups. Improving the state of the roads linking producers to markets is also important in reducing the cost of transporting produce, as well as the cost of searching for markets.

Keywords: Autarkic, Net buyer, Net seller, Ordered Probit, Smallholder, Nyamira, Kenya

1.0 Introduction

About 30,000 edible plants are found throughout the world, 7,000 of which are grown or collected as food (Natarajan, 2002). According to Smith and Eyzaguirre (2007), about 3,000 species of these plants have been commercialized, with only about 20 consumed on large scale. African Indigenous Leafy Vegetables (AILVs) are increasingly recognized as possible contributors of both micronutrients and bioactive compounds to the diets of populations in Africa. The African continent is rich of vegetable species including amaranths which are among the most popular leafy vegetables within the continent (Maundu *et al*., 2009). AILVs are especially important to women who are involved in all aspects of the supply chain and dominate both intermediary and retail activities; thus providing them with an important income generating opportunity (Weinberger *et al*., 2011). The AILVs market promises to keep growing, and with the rapidly expanding population of Kenya, a consequential increase in demand is projected to take place.

Studies by Barrett (2009) and Kirsten (2010) allude to market access, as one of the critical factors influencing the performance of smallholder agriculture in developing countries. Access to new and better-paying markets for agricultural products is thus vital in enhancing and diversifying the livelihoods of poor subsistence or semi-subsistence farmers (Barrett, 2009). However, market access remains a major constraint in commercialization of agriculture (Poulton *et al*., 2007; Wambugu *et al*., 2009);

A quick summation of figures reported in the Kenya Horticultural Performance report of 2012 reveals a market value of close to Ksh. 675.89 million of AILVs marketed in Nyamira County, thus highlighting the important contribution AILVs play in the county and the potential they can have in poverty alleviation among poor households (USAID and HCDA, 2012). These figures are explicit that large volumes of AILVs are marketed in the county depicting substantial market participation. However there is still large urban demand and unmet market potential.

According to Bellemare and Barrett (2006), studies that have researched on market participation exist, yet the literature on the subject remains thin, especially in developing country settings where significant frictions make this question most salient. The question of whether households make marketing decisions either sequentially or simultaneously is not explicit in the sense that it raises two implicit questions: first, does the household decide whether to be a net buyer, autarkic, or a net seller,

and then decide how much to buy or sell only once it gets to market and discovers additional market information, conditional on having chosen not to be autarkic?; or second, does the household head make both decisions before leaving for the market? (Bellemare and Barrett, 2006).

Farmers in Nyamira have ventured into production of AILV due to the high market value associated with it. This is attributable to growing consumer awareness of their nutritional and health benefits. Though farmers engage in the markets, it is unclear why their overall participation as net sellers remains low. It also remains unknown why farmers operating under homogenous conditions, exhibit different market behaviours. This study therefore aimed to fill the existing knowledge gap by giving empirical evidence on the determinants of market participation behaviour.

2.0 Methodology

The study was conducted in Nyamira County located in the western region of Kenya. It covers an area of 899.3 km2 and lies between latitudes 0º 30' and 0º 45' South and 34º 45' and 35º 00' East. The altitude ranges from 1,250 - 2,100 metres above sea level. Temperatures range from a mean annual minimum of 10.1°C at night to a mean maximum of 28.7°C during the day, with rainfall amounts of between 1,200 mm and 2,100 mm per annum experienced. The target population of the study consisted of smallholder farmers in Nyamira County. The sampling unit of the study was made up of smallholder AILVs farmers. Multi-stage sampling procedure was used to arrive at the surveyed sample of 254 farmers.

2.1 Methods of Data Analysis

STATA computer program was used to analyse data. The choice of the estimation technique is normally dictated by the dependent variable. This study opted to approach market participation as being measured by categories of an ordinal nature, in this case; net sellers, autarchies and net buyer typologies/regimes/categories. Following Bellemare and Barrett (2006) and Muricho *et al*. (2015), this section employed the ordered probit model to implement the market participation problem. The motivation for the model comes from the prospective sequencing and jointness (simultaneity) of the household's marketing decisions. In the presence of non-zero censoring points, regions between zero and the censoring points may have zero density, for household's net sales (sales minus purchases) volume. This implies that one can partition the continuous market participation outcome into three distinct categories: net buyer (households whose net sales are negative), autarkic (households whose net sales are equal to zero) and net seller (households whose net sales are positive) households.

According to Tisdell and Svizzero (2001), a large body of literature recognizes that linear regression is inappropriate when the dependent variable is categorical, especially if it is qualitative. Following Greene (2000) and Marenya *et al*. (2015), the appropriate theoretical model in such a situation is the ordered probit model because market participation can be naturally ordered, for this case, into three categories with the lowest category being net buyers of AILV. This model has been widely used as a methodological framework for analyzing ordered data since the pioneering work of McKelvey and Zovoina (1975). The link between the observed categories and the latent outcome index is thus assumed to be of the ordered probit type and is a nonlinear model, thus the effect of the explanatory variables can be measured in terms of marginal effects. Explicitly the market participation equation was modelled as follows. The specific regressors (*Xi*'s) are presented in Table 1.

$$Y = \beta_O + \beta_1 X_{1i} + ... + \beta_n X_{ni}$$

Because these three market categories are logically ordered, and since it is informative to distinguish between net buyers and net sellers rather than just lump them together as market participants, an ordered probit participation decision was estimated. This approach also allows for non-zero censoring points at the first stage, that is, the thresholds below and above which a household will find it worthwhile to be a net buyer or a net seller, respectively, as in Key *et al*. (2000) and Holloway *et al*. (2005). The decision to participate in the AILV market as a net seller, an autarkic or a net buyer is thus "trichotomous" in nature. Households are assumed to participate in a market regime that maximizes their expected utility over their planning horizon. Consider the following latent model M^*_{ji} which describes the ith household's behaviour of participating in market regime j ($j = 0, 1$ and 2):

$$M^*_{ji} = \beta_j X_{ji} + \varepsilon_{ji}$$

Where M denotes the latent dependent variables which can be represented by the level of expected benefit and/or utility derived from participating in market regime j, *X*s are a vector of covariates influencing the jth market participation regime and *β*'s are associated vector of parameters, and ε are the unobserved factors influencing market participation. The household's utility from participating in a given market regime is not observable but the decision to participate is observable. This means that a household will operate in the regime in which they derive the highest utility.

$$\begin{cases} 1 & if & M^*_{ji} > 0 \\ 0 & otherwise \end{cases}$$

The parameters βj were estimated using coefficients of the ordered probit that allows for multiple ordered values (net sellers, autarkic and net buyers).

Table 1: Variables Used and Expected Outcomes in the Ordered Probit Model.

Variable(X)	Description	Measurement	Expected Sign
Agehh	Age of the household head	Number of years	$\pm$
Edcnhh	Education level of the household head	Number of years	+
Housyz	Household size	Number of members	$\pm$
Exprnc	Experience in marketing	Numbe of years	+
Gendhh	Gender of the household head	0 = Female; 1 = Male	$\pm$
Landown	Land ownership (title deed)	0 = No; 1 = Yes	+
Foodsuff	Households' food self sufficiency	0 = No; 1 = Yes	+
Groupmemb	Group membership	0 = No; 1 = Yes	+
Contract	Contractual marketing	0 =No; 1 = Yes	+
Nonfarm	Participation in non-farm activities	0 =No; 1 = Yes	$\pm$
Trans	Ownership of transport equipment	0 =No; 1 = Yes	+
Credit	Access to credit	0 =No; 1 = Yes	+
Mrktinfo	Access to market information	0 =No; 1 = Yes	+
Distfrmrkt	Distance from farm to market	Kilometers	-
Farmsyz	Farm size	Acres	+
Extension	Number of extension contacts	Number of visits	+

3.0 Results and Discussions

The ordered probit model of discrete market participation yielded intuitive results. The non-zero censoring points were of negative signs, with the lower censoring threshold at -2.25 (AILV net purchases) and the upper threshold at -1.79 (AILV net sales), each statistically significantly different from zero. These estimates suggested that purchases or sales of less than 1 kilogram were generally uneconomical, given the monetary and non-monetary costs of market participation in the study area. This, according to Bellemare and Barret (2006), could be explained by people's willingness to enter the market for smaller volume sales than purchases, likely reflecting the fact that sales of AILV are essentially means by which households meet immediate cash needs related to payment of school fees, food purchases and ceremonial or emergency health expenses.

The goodness-of-fit measured by the Prob > Chi^2 = 0.000 showed that the choice of explanatory variables included in the ordered probit model explained the variation in decisions to participate in the market by typology. The likelihood ratio tests indicated that the slope coefficients were significantly different from zero for participation decisions. The pseudo-R square of 0.2228 was above the statistical threshold of 20% demonstrating that the explanatory variables described about 22.28% of the covariates considered in the model.

Results of the Ordered Probit Regression for Market Participation Behaviour.

Variable	Coefficient	Standard Error	z	P > |z|
Age of the HHH	-0.016	0.013	-1.18	0.240
Education level of the HHH	0.006	0.035	0.17	0.864
Household size	0.007	0.067	0.10	0.921
Experience in marketing	0.071**	0.029	2.50	0.013
Gender of the HHH	0.021	0.264	0.08	0.937
Land ownership	0.810**	0.314	2.58	0.010
Food self sufficiency	1.005**	0.442	2.27	0.023
Group membership	-0.714	0.455	-1.57	0.116
Contractual marketing	1.395**	0.667	2.09	0.036
Access of non-farm income	-0.254	0.296	-0.86	0.390
Ownership of transport	0.327	0.372	0.88	0.379
Access to credit	0.849***	0.280	3.04	0.002
Access to market information	-0.248	0.268	-0.93	0.355
Distance from farm to market	0.014	0.046	0.31	0.759
Farm size	-0.117	0.081	-1.45	0.148
Number of extension contacts	-0.133**	0.062	-2.15	0.032
Ancillary Parameters				
/cut1	-2.248	0.821		
/cut2	-1.789	0.815		

Number of Observations = 254; LR Chi^2 (16) = 60.43; Prob > Chi^2 = 0.0000; Pseudo R^2 = 0.2228
Log likelihood = -105.4122; z and P > |z| correspond to the test of the underlying coefficient being 0

Note: ***: significant at 1% level; **: significant at 5% level.

The number of years smallholders participated in AILV marketing (Experience) positively influenced the likelihood of households being net sellers at 5% significance level, *ceteris paribus*. Older household heads could therefore take advantage of their experience to obtain superior yields, hence better income, thus likely moving them towards net sellers' position in the market. In addition to developing strong networks with buyers, the experience a farmer had likely reflected higher bargaining

power. Abay (2007) found evidence that an increase in farmers' experience caused an increases in tomatoes supplied to the market in Fogere, South Gonder.

Land ownership positively influenced the likelihood of farmers participating in markets as net sellers, all else held constant. This variable was found to be statistically different at 5% significance level. Possibly, smallholders possessing larger land sizes were more likely to increase the proportion of land under AILV production. This could translate to higher yields, increasing the probability of producing surpluses that are sold off to the market thus moving them towards becoming net sellers. Branson and Norvell (1983) discovered that expanding the land area under crop production increased the volume of marketable produce.

Households' food self-sufficiency positively influenced the likelihood of households being net sellers at 5% significance level, keeping the effects of other variables constant. The non-zero censoring points of the ordered probit model suggested that it is probable that households engaged in AILV marketing to meet immediate family needs such as food. It could be that smallholders started off as subsistence producers of AILV, but once their households became food sufficient, they entered AILV markets to sell off remaining portions of produced AILV, likely moving them towards becoming net sellers. Lukanu *et al*. (2004) verified that households' food availability is one among the factors that affects farmers' decision to commercially produce.

Contractual marketing had a positive influence on the likelihood of households participating in markets as net sellers at 5% significance level. In the uncertain world of farming, fluctuating market conditions, especially price and the promise of making sales is a thorny issue to farmers. Contracts between buyers of AILV and producers therefore guarantee smallholders ready markets, thus income. This could further have motivated farmers to perpetually move towards being net sellers, as ready markets guaranteed them income from farming AILV. Jari and Fraser (2009) found an increase in formal market participation made possible by contractual agreements amongst smallholders and emerging farmers in the Kat river valley, South Africa.

Access to credit was positive and significantly different at 1% significance level, ceteris paribus. Credit gives smallholders cash resources that they could invest in marketing activities such as value addition to improve incomes, or even invest in transportation to further off lucrative markets which, otherwise, are inaccessible. In the pursuit of better incomes, credit boosts that improve on AILV marketing would likely have pushed farmers towards becoming net sellers. Mutai *et al*. (2013) corroborated that participation in sweet potato markets in Vihiga County, Kenya was influenced by credit access. Credit also facilitates the introduction of innovative technologies and ensures input and output marketing arrangements (Reddy, 1998).

The number of visits by extension workers negatively influenced the likelihood of smallholders being net sellers at 5% significance level. This was intriguing since access to extension service, through extension officers, was expected to play an imperative role in empowering farmers with marketing information and ability, thus increasing the likelihood of households becoming net sellers. It could be that extension officers were more conversant with information relating to traditionally grown crops such as maize and beans and not on AILV. Lack of sufficient information condemns smallholders to become autarkic and net buyers of AILV. AILV have only started receiving attention in the contemporary years as high value nutritional crops, thus fuelling their recent demand. This finding contravenes that of Mutai *et al*. (2013) who found a positive impact of extension services on market participation.

4.0 Conclusion and Recommendation

Results of this study showed the importance of marketing experience (+), land ownership (+), households' food self-sufficiency (+), contractual marketing (+), access to credit (+) and extension visits (-) in influencing the regimes in which small holders participated in markets. Based on these study findings, it is recommended that agriculture extension systems should be AILV crop-specific, market driven, decentralized and farmer-led in order to improve productivity and profitability. The development of innovative extension systems by the government is therefore needed. While indeed extension services are present, the nature of information disseminated by officers should not focus on the traditional cash and food crops such as maize and beans. AILV, which have gained attention contemporarily, should be incorporated into the extension services offered by government workers. Institutional innovations that facilitate offering of affordable loans with low interest rates to farmers should be a priority area for stakeholders. Technical support in the form of market linkages should be enhanced; where farmers of AILV are contracted and linked to supermarkets, informal markets, individual vendors, as well as food processing and preparation joints for sustainable utilization of AILV, thus minimizing losses. Smallholder farmers should form production and marketing clusters to enhance their power to bargain for better prices, as well as collectively transport their produce to markets thus minimizing transportation costs. Improving the condition of rural feeder roads that link to main roads, as well as improving the main roads linking to urban market centres is also of paramount importance if high transportation costs are to be checked.

5.0 Acknowledgement

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