Market Participation and Poverty

- Smallholders on the Ugandan Maize Market

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Master Thesis 2009-03-16
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Abstract

Food grain markets are special in the sense that farmers will, likely, be consumers of the crops they produce. This study examines smallholder market participation on the Ugandan maize market, and, furthermore, explores possible connections to rural poverty. A probit model of market participation is employed, and I work with data from a household survey conducted between 1999 and 2000. A number of variables, like literacy, hired labor, specialization, land holdings and access to storage facilities were correlated with a higher probability of market participation. Ownership of livestock was considerably more important to the poor farmers while there are also indications of asset thresholds regarding land and farming assets.

Key words: Market participation, Poverty, Uganda, Maize, UNHS 1999/00, Asset threshold, Probit model.

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1. Introduction

Despite the encouraging advances in other parts of the world poverty continues to be a matter of grave concern in Sub-Saharan Africa. Rural areas are often disproportionally ill-fated, and farmers lacking sufficient means to overcome the costs of entering the market may, with few alternative sources of income, be potentially stuck in a poverty trap (Barrett, 2008: p. 300). A growing strand of literature suggest that trade policy, e.g. reducing tariffs and abolishing subsidies, will not be enough to trigger rural development (Cadot et al., 2005: p. 1; Barrett, 2008: p. 300; Dyer et al., 2006: p. 279). Participation in well-functioning markets will naturally spur economic growth by an efficient allocation of resources and the exploitation of comparative advantages. There is a potentially important relationship between market participation and poverty in markets for food grains, i.e. staples, since these goods make up a considerable proportion of the consumption in a poor household. The aim of this study will be to examine the factors correlated with market participation in the Ugandan maize market. This poses at least two questions - which factors are important to market participation, and how is this connected to rural poverty?

It is probably safe to suggest that variables like land, assets and capital, which will enhance production possibilities, should be important factors to market participation. Costs are another central aspect. Entry can be quite costly in a setting with, one can expect, imperfect institutions, poor infrastructural quality and sometimes large distances to the market place. Technically the market should mean an effective way for the household to transform its resources and ability into other goods and services. All else equal, a higher standard of (material) living should be attainable vis-à-vis subsistence farming. This study will look for differences in market participation between poor and non-poor farmers, and, furthermore, examine the possibility that poor farmers might face proportionally big constraints to market participation. Imperfect access to credit, for example, is often hold to be a central stumbling stone to economic development.

This study contributes to a thin but growing literature on market participation in food grain markets. Rural poverty and local food markets in developing countries are, on the back of recent price hikes, becoming increasingly important topics for future research. The rest of the study is organized as follows. A theory of household market participation is put forth in section 2, which also surveys some of the previous literature on the subject. Section 3 lays out the empirical framework and presents the data while the results are discussed in section 4. The final section concludes.

2. Theoretical considerations and previous studies

Most studies on the subject employ similar theoretical models, where the household, as both producer and consumer, decides upon market participation as a means to maximize utility (see for example Barret, 2008; Heltberg and Tarp, 2002; Goetz, 1992; Key et al., 2000). Various trade related costs will work to distort prices on the market, and, consequently, some farmers will opt not to participate. This is a key mechanism of market participation in developing countries, and the transaction costs referred to are often defined as costs induced by transportation to the market, imperfect information, searching for partners, screening and supervision, negotiation, and so on (de Janvry et al., 1991: pp. 1401; Key et al., 2000: pp. 245). It is in the light of these costs, together with assets, skills and endowments that households decide upon the perceived profitability of entering the market.

A model of household market participation

Formally, consider a household that generates income from crop farming, where each crop, $i = 1, \dots, I$, is produced with a specific technology, $f^i(A^i, B)$. Privately held assets, like land, labor and capital, are captured by the vector A, while B reflects public goods and services, like transport infrastructure, rule of law, property rights, extension services, etc. It is obvious that access to land is a prerequisite for crop production, and more of it should increase the production capacity. Legal ownership should, all else equal, have a positive impact on the effort put into the production (Ray, 1998: pp. 445). Capital is of course important to purchase inputs, acquire storage facilities and undertake investments in new technology (Barrett, 2008: p. 309). Institutions, as rules and norms that structure human behavior, will serve to facilitate transactions in the market place (North, 1989). By the existence of well defined property rights and contract enforcement procedures, for example, improved possibilities to own land and hire labor will naturally improve incentives and increase production capacity (Ray, 1998: pp. 403). The household will maximize its utility by choosing a consumption bundle of agricultural commodities, y^i, and other goods, x.

Now, the transaction costs facing a particular household, $t^i(A^i, B, C, D)$, should depend on a number of factors. The first two, assets and public goods, have already been mentioned while C denotes household earnings from other sources. D reflects the endowment of human capital which should influence search costs and negotiating skills (Barrett, 2008: p. 302). It is popularly stated that transaction costs drive a wedge between the consumer and producer

prices, reflected by $p_c^i = p^l + t^i(.)$ and $p_p^i = p^l - t^i(.)$ respectively. Here, p^i is the price facing the household, which depends on the local market price, p^l, and transaction cost. This obviously has consequences for the optimization problem facing the household:

$$Max\ U(y^i, x)$$

subject to the budget constraint,

$$p^x x + \sum_{i=1}^{I} \boldsymbol{p_c^i} y^i = \sum_{i=1}^{I} \boldsymbol{p_p^i} f^i(A^i, B) + C$$

It is clear that higher transaction costs will tighten the constraint, by raising the value of the left hand side and decrease it on the right, until it is viable to opt out of the market (for goods where the household both is a consumer and producer). It is also possible, even highly likely in an open economy, that international prices affect the local market price, p^l. Barrett (2008: p. 302) holds that the transmission of price signals from the border will depend on the quality of public goods and services and the aggregate output in the local market. That is, transaction costs will be lower on large and spatially integrated markets.

Subsistence farming is also a means to mitigate risk, e.g. volatile prices and non-availability, in food markets. In this sense it might be a means of compensating for imperfectly functioning insurance and credit markets. A reduction of marketing risks, by improved infrastructure, for example, and increasing household resources should provide better incentives for market participation (von Braun et al., 1994: pp. 20). Furthermore, the share of food in total expenditure is large for small households, making them vulnerable to fluctuations in prices. Normally the prices for staple foods are considerably higher in the lean period than around harvest time, and thus market participation may seem unattractive to farmers with small production surpluses (Heltberg and Tarp, 2002: p. 107).

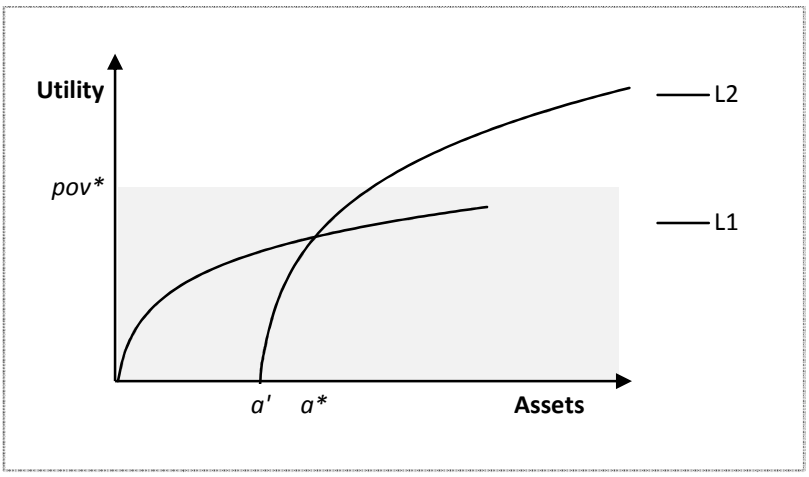
By reiterating the core themes of this section, the existence of transaction costs coupled with the (dis)ability to overcome them, we can form a better understanding of the widespread practices of subsistence farming in developing countries. Risk coping behavior, in part dependent on some of the variables inflicting increasing transaction costs, further adds to the understanding of this issue.

Poverty

Poverty is widespread in many regions of Sub-Saharan Africa. The national headcount ratio averaged 45 percent in 2000 (Chen and Ravallion, 2004: p. 152), but considerably higher rates are found in rural areas among small scale farmers (Ray, 1998: p. 259; Smith and Todaro, 2006: p. 225). While it should be appreciated that poverty is a multifaceted concept comprised by a number of factors, like a person's capability to command basic levels of food, health and education, the approach in this study shall be a simple, money metric one.[1] This is lead by empirical considerations, i.e. to make easier a straightforward and focused analysis.

Subsistence farming and poverty are tightly connected, sometimes in a catch 22-like manner - a farmer could use markets as a way out of deprivation while at the same time he may lack the means to do so simply because of his poverty. This makes it difficult to disentangle causes and effects, and, indeed, hadn't this been the case poverty would not be so persistent and far reaching. It is possible that the poor farmers are more constrained by some factors, such as access to credit, than their non-poor counterparts. Carter and Barrett (2004: pp. 187) argue that there might be some minimum level of asset endowments required to accumulate wealth and capital. This is reasonable. To a very poor farmer most resources will be devoted to fulfill present consumption needs, and since financial markets will most probably be shut to him and there will be no room for saving or investing in new technology.

Figure 1: A poverty trap.



Source: Carter and Barrett, 2004.

[1] A money metric poverty line, often calibrated against the behavior of the poorest half of a population, primarily captures the ability of an individual to command a minimum level of calories. But more about this further down.

Consider figure 1 above. L1 and L2 are two different production technologies, and assets may be land, labor, capital etc. A household reaching point a^* is likely to switch to L2, taking advantage of the locally increasing returns to scale, thus making higher incomes possible (Ibid.). Technically the farmer can switch to L2 already at a' by investing the required start-up capital, like buying an ox or seeds of improved quality. This is, however, unlikely since it would most certainly mean an untenable, though temporary, decrease in utility.

It is important to reiterate that poverty isn't a one-dimensional concept. There is no automatic relationship between production, income and poverty. This is merely an easy way of explaining the issue of poverty traps. It is an extension of the theories put forth in the last section, with (i) high transaction costs facing the poor farmer, and (ii) a minimum level of assets required to overcome the low-level equilibrium, i.e. the poverty trap. It will be of interest to investigate the probability of market participation for different level of assets, like land. For example, Boughton et al. (2007: p. 31) found that only after a certain threshold in cultivated areas did participation among maize farmers in Mozambique increase considerably.

Previous studies

In general, the literature on participation in food grain markets is quite thin, especially for developing countries. Table 1 below summarizes some of the existing empirical works. In a study of Uganda's crop markets, Larson and Deininger (2001) attributes a low level of market participation to the large costs associated with it. This can make food grain market participation a risky, and to poor households unattractive, business. They emphasize the importance of relative prices, and judging by the results of their tobit estimates a 10 percent increase in market price should induce a 2 percent increase in the amount of the crop sold.

Goetz (1992), Heltberg and Tarp (2001) and Boughton et al. (2007) all employ some kind of a selection model, and the last two use models very similar to the approach in this study. With an early contribution to this field of research, Goetz highlights transaction costs as a central obstacle to market participation in grain markets. Selling households were also found to be proportionally well endowed with productive resources. Heltberg and Tarp explore differences between poor and nonpoor farmers. They find that the probability of participation in food markets increases with household expenditure while they reject any substantial differences regarding marginal effects between the two subgroups. The last study, by Boughton et al., emphasizes the lack of sufficient assets, like land, as a constraint on poor

farmers. They also argue that livestock may reduce the risk of food insecurity since it can be sold in order to buy food.

Two studies, Renkow et al. (2003) and Cadot et al. (2005), did advance to quantify transaction costs. The former study jointly estimates demand, supply and transaction costs. Fixed costs associated with market participation are, loosely put, examined as the difference between autarky prices and the possible prices a subsistence household would have received in the market. Cadot et al. examine entry costs as the difference between a households expected profit on the market and in subsistence, where, for example, the difference for a farmer in subsistence would be the opportunity cost of not being in the market. If some special household characteristic defines market participation, they argue, the entry costs can be evaluated for the farmer being exactly on the margin between subsistence and market participation.

Table 1: Literature overview.

Study and country	**Crop**	**Dep. variable**†	**Conclusion(s)**
Larson and Deininger (2001), Uganda.	Many	Share of output taken to the market.	High transaction costs and low participation in Ugandan food markets.
Goetz (1992), Senegal.	Grain	Volume, conditional on participation (0, 1) as net seller or net buyer.	Unobserved variables, like risk preferences, affect both the decision and how much to sell. Transaction costs and productive resources are important to market participation.
Heltberg and Tarp (2001), Mozambique.	Many	Volume, conditional on participation (0, 1).	Technology and transport infrastructure are important determinants (of market participation), while the probability to participate also increases with household expenditure (i.e. being non-poor).
Cadot et al. (2005), Madagascar.	Many	Participation (0, 1) and profits.	Large entry (sunk) costs, somewhere between 124 and 153 percent of annual production, make it very difficult to move out of subsistence farming.
Boughton et al. (2007), Mozambique.	Maize	Volume, conditional on participation (0, 1).	Productive assets, like land and livestock, are correlated with market participation. Also, there are thresholds within the distributions of these assets, acting like a poverty trap on the maize producers.
Renkow et al. (2003), Kenya.	Maize	Trans. costs, demand and supply (of maize).	Semisubsistence farmers are faced by fixed transaction costs in the region of 15 percent of an ad valorem tax equivalence.

† Note that many designs, like a selection model (Heltberg and Tarp, 2001; Boughton et al., 2003) or a system of equations (Cadot et al., 2005; Renkow et al., 2003), will have more than one dependent variable. The probability to participate in the market is often included in one way or another.

Generally speaking, large transaction costs seem to be at the heart of the problem (of non-participation in food markets). They are caused, for example, by imperfect financial markets and poor infrastructure. Productive assets, like land and livestock, appear to be closely associated with market participation. Barrett (2008) presents an overview of the literature on smallholder participation in East-African food grain markets. To reiterate what has been pointed out above, Barrett argues that sufficient access to productive assets, financial markets and technology are, coupled with infrastructural improvements, key elements to an improved situation for many farmers in rural Africa.

3. Empirical framework

Now the theories need to be mapped into a testable empirical model. A complete list of the variables, with explanations and descriptive statistics, can be found in the appendix, tables A1 and A2 respectively. The endowment of land is captured by total area used in production, whilst two variables - household ownership of livestock and credit facilities in the community - proxy for capital availability. The former can, somewhat crassly put, be regarded as money in the bank, while the latter is thought to capture access to the credit market. The value of inputs (e.g. fertilizers), agricultural assets (e.g. tools) and a dummy for hired labor will be employed to capture production potential. A variable measuring the number of visits by extension agents is employed to pick up possible adoptions of new technology. Furthermore, dummies for access to storage facilities, which may allow a farmer to take advantage of price changes, and off-farm income, will also be included. All of the above variables are, in one form or another, very common in studies of market participation (see the studies surveyed in the previous section)

Next, measuring the transaction costs is a little trickier. In part because they are not directly observable, like, say, the money paid for inputs last year or the area cultivated this season. The empirical specification also depends, quite naturally, on the focus of the study and the data at hand. If for example transaction costs are not of primary interest in the study, a fixed-effects panel could isolate, but not quantify, many such effects. Transaction costs often enter empirical models as various measures of distances - to markets, tarred roads, a post office etc. For example, Renkow et al. (2004: p. 359) use distances to the nearest permanent market, tarmac roads and a seed dealer, respectively. Heltberg and Tarp (2002: p. 114) employ distances to the province capital and a railway station, while Cadot et al. (2005: p. 18) utilize an index of infrastructural quality. I will use the distance to a general market and the nearest phone, respectively, as two such measures[2]. Here the latter is used to capture the average quality of infrastructure.

Average maize yield in the local community hopefully captures some effects of aggregate output, like the degree of spatial integration, while it may also touch upon available information and previous investments in new technology (Heltberg and Tarp, 2002: p. 114). Furthermore, the perceived risks facing a farmer will most likely affect his behavior, and the average level of maize yields may also reflect effects of the climate. Dummies are included for areas prone to floods, droughts and civil strife in previous years.

[2] A number of different variations of this measure have been tried - without significant changes of the results.

Individual household characteristics are measured by three variables. Age and literacy of the household head will be proxies for human capital while the dependency ratio, constructed from the equivalence scales described in next section, may also affect the choices of the household (see for example Goetz, 1992, and Boughton et al., 2007). Finally, it is important to somehow consider that farmers may grow maize with different intensity, e.g. with a sole focus on it or more as a complement. A household´s degree of diversification will therefore be interesting, and it is measured by a Herfindahl index and the proportion of maize in total production.[3] Three additional dummies are included, measuring, respectively, if farming is the predominant activity, if the household has other enterprises and whether the household also grows cash crops.

A measure of poverty

We do of course also need some measure of poverty. Expenditure on actual consumption is often preferred, as a measure, over income. This is because the latter requires knowledge about returns to assets and, furthermore, home consumption will need to be incorporated properly (Deaton, 1997: p. 29). When constructing a poverty line for Uganda, Appleton (2001: pp. 90) defines the food requirements as the daily cost of obtaining 3,000 calories from a typical food basket of the poor.[4] Non-food requirements are then estimated as the spending on non-food particulars by a household whose total consumption is just enough to attain the basket of 3,000 calories. The poverty line thus consists of two parts - the costs of obtaining (very) basic daily food and non-food requirements. Equivalence scales are used to account for children in the family, where, for example, a 5 year old boy is assigned 60 percent of the food requirements of an adult male (Ibid: p. 117).

By resembling Appleton (2001) as close as possible, this study uses the same equivalence scales and similar components when constructing a measure of household expenditure. A poverty dummy is then created on the basis of the poverty line(s), which are adjusted by consumer price indices for Uganda.[5] I do actually, by the recommendation of Appleton (2003), use regional poverty lines to account for regional variation in prices and people´s diets.

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[3] The Hefindahl index, $H = \sum s_n^2$, measures the degree of concentration, and s_n is the share of a household´s total production devoted to crop n.

[4] 3,000 calories is, according to WHO (1985), the daily energy requirements of a male subsistence farmer. The poverty measure used to define the poor man's food basket comes from earlier studies with similar methodology (Appleton, 2001: p. 90).

[5] Consumer price indices are taken from Penn World Tables (Heston et al., 2002).

An obvious disadvantage with the measure is that it doesn't capture the dynamics of people moving in and out of poverty (as defined). To fully capture the behavioral impacts of poverty one would rather want to use some measure of vulnerability not so sensitive to fluctuations over time. Pouw (2008) proposes the ranking of food items consumed as an alternative measure, and it is possible that the composition of a food basket doesn't change as quickly as the quantity consumed. One could also, like Carter and Barrett (2004), depart from a measure of assets, or, like Lawson et al. (2003), model the probability of being poor. However, testing different measures in an appropriate way would take quite a lot of time. But we may have to return to this discussion when analyzing the results of the estimations.

The model

The variables described above will be used in a probit model, which, with probabilities ranging between 0 and 1 over a standard normal distribution, emerges as a fitting candidate to model market participation. This model has been used quite a lot in similar studies, often as an initial step in a Heckman selection framework. A logit model would probably yield very similar results while a linear probability model has some obvious shortcomings, like probabilities ranging above 1 and below 0 (Greene, 2003: pp. 665).

Let y_k^* be the (unobserved) probability, conditional on a vector, x, of independent variables, that household k participates on the market. Then $y^* = ax + \varepsilon$ will be the underlying model structuring a discrete, and observable, choice of market participation, $y = 1\ (if\ y^* > 0)$ or $y = 0\ (if\ y^* \leq 0)$. The error term, ε, is normally distributed, and the probability to participate on the market will be $Pr(y = 1|x)$ =..= $\Phi(xa)$ (Greene, 2003: pp. 665). As this is a nonlinear model, the marginal effects will likely vary with the values of x. The values reported are calculated at the sample means of the data, and with a reasonably large sample this approach shouldn't differ substantially from using averages of marginal effects at each observation (Ibid.). Assessing goodness of fit naturally is a little trickier than in an OLS model, and the sample design further limits the opportunities. I am effectively left to test if all slope parameters are jointly different from zero.

Interactions between a poverty dummy and several other variables will be used to illuminate possible differences between poor and non-poor farmers. An alternative method would be to divide the sample into subsamples, which, however, could be problematic since the outcome of the model, i.e. the probability to participate in the market, is believed to be correlated with the variable (expenditure) forming the basis for such a division (Cameron and

Trivedi, 2005: p. 42). The interactions will be specified in the following manner: $y = B_1 + B_2x_1 + \ldots + B_4poverty + B_5pov. \times credit + B_6nonpov. \times credit$. Here, poverty, as already described, is a dummy indicating poverty, while the variable non-poverty indicates the opposite. In the specification above, B_5 and B_6 will show the marginal effect of access to credit for poor and non-poor households respectively.[6]

It can also be instructive to look for the possibility of asset thresholds, identified as a possible poverty trap in section 2, by using a non-parametric kernel regression. A kernel estimator, in short, is a way of smoothing a graph by estimating the joint density (of y and x) for every value of x (Deaton, 1997: pp. 179).[7] It is a way to visually examine the relationship between the predicted probabilities and, say, the amount of land used in the production of maize. Boughton et al. (2007: p. 33) use this method to conclude that modest movements in the lower end of the land-holding distribution is unlikely to affect the probability of market participation.

The material

The data come from a national household survey, UNHS 1999/00, conducted by the Ugandan bureau of statistics (UBOS) between August 1999 and July 2000. It consists of 10,696 households from 1,086 different local communities. All of Uganda except the northern districts of Kitgum, Gulu, Kasese and Bundibugyo are covered, and the design employed is, generally, stratified two-stage sampling. Stratification is basically made along rural/urban divisions, also taking account of farm size (UBOS, 2001: pp. 3). This is usually done to increase the efficiency of estimates, particularly on certain subgroups of the population (Deaton, 1997: p. 49). Sampling weights, principally the inverse of the probability of selection, have been used to correct for the different probabilities of inclusion facing each household.

Each household is visited two times, one after each season, and the farmers are asked to remember the quantities sowed, harvested, sold etc. Answers are unlikely to be completely accurate, given this discrepancy in time, but there shouldn't be too much confusion about a rough measure like participation (or not) in the market. Some of the variables, like land and output, don't connect perfectly between the two seasons. Rather than arbitrarily linking the

[6] See Yip and Tsang (2007) for a discussion about the use of interaction terms. Note that the variable credit will have to be excluded to avoid collinearity.

[7] It is something of the continuous-case counterpart to calculating the mean y-values for every discrete x-value. No assumptions are made about the distributions of the variables.

two seasons together this study focuses solely on the first one. This means that it will not be possible to discern any potential inter-season trend or relationship. The bulk of the interviews were made between November and June, thus only in part overlapping the lean period (more or less between April and August). The timing of the interviews, and choice of season, could have some potential bearing on the results. One suggestion is that prior to, or during, the lean period there would be higher rates of poverty and maybe an increased reluctance among poor farmers to participate in the market.

I use a cross section with 25 variables, totaling 4931 observations. Some variable candidates, like detailed information about land holdings, carried a substantial amount of missing responses. However, less than 1 percent of the observations in the selected sample had more than one missing value across variables. Observations are therefore assumed to be missing at random, and a method of listwise deletion has been preferred to a more cumbersome imputation procedure. This process results in a final sample of 4525 observations. Summary statistics on the variables can be found in the appendix, table A1, while table 2 and 3 below illuminate some characteristics of the Ugandan maize farmers.

Table 2: Descriptive statistics (mean values).

	Land (acres)	Assets (U Sh.)	Dist. to market (km)	Prop. of maize
Poor (34 %)	2,45	11975	10,63	0,32
Non-Poor (66 %)	3,03	16954	10,47	0,29

Table 3: Descriptive statistics (percentages).

	Participation	Cash crops	Other enterprise
Poor (34 %)	36	39	37
Non-Poor (66 %)	38	34	47

First, 34 percent of the maize farmers in Uganda are poor. This by comparison quite low figure will in part be a product of the considerable poverty reductions throughout the 1990s. Furthermore, the proportion of maize farmers is much lower in the poorer, northern region than other parts of the country. Although maize is the most widespread food crop in Uganda there are considerable intra-country differences in the patterns of production and consumption. One could of course suspect some sort of self selection into maize production. This topic, however, isn’t pursued any further in this study.

As can be seen in the first table the poor are considerably worse endowed with land and agricultural assets. The distance to the market is almost identical between the two groups, while the poor farmers are just a little proportion more specialized in maize production. Market participation is, somewhat surprising, quite even among the two groups, while poor farmers actually grew cash crops more often than their non-poor counterparts. Finally, poor farmers were considerably less involved in other business activities, as measured by the dummy for other enterprises.

In summary there appear to be some differences, albeit smaller than expected, between poor and non-poor farmers. One immediate explanation could be the timing of the interviews, as mentioned above. The almost identical rate of market participation within the two groups somewhat dampens expectations about a strong relationship between market participation and poverty.

4. Results and discussion

I begin here by estimating the model, with participation as the dichotomous (1 or 0) dependent variable, including the variables believed to be correlated with the probability to participate in the maize market. The results from specification (1), in table 4 below, indicates that the amount of land used in production is, as expected, significant and positively correlated with market participation. Furthermore, both measures of distances are insignificant. Of the two possibilities, that either are the transaction costs very small or they are not captured properly in the model, the latter is most likely. First, the quality of African roads tends to vary with the season, due to rainfall etc., which is something that a distance variable doesn't pick up properly. Perhaps a dummy variable measuring the time, say, above or below half an hour, taken to the market would be a better alternative. Second, it is likely that the presence of traders at the farm gate will affect the correlation between market participation and distance to the market. Some of the transport costs and uncertainty will then be borne by the gate traders. Unfortunately the information about this was generally not good enough in the survey[8].

Farms that use hired labor and has access to storage facilities has a higher possibility to be in the market, while the amount of inputs and the value of assets don't seem to exert any influence. The insignificance of the last variable, assets used in farm production, is somewhat unexpected. Theory tells us that assets are important to production, and, realistically, to participate in the market. Perhaps there are differences between poor and non-poor farmers not discernable in (1), and the interactions further down might shed some light on this issue. Market participation is also positively correlated with the number of visits from extension agents - be it because this enhanced the adoption of new, improved technologies, or simply because the officials visited farms with an already high degree of participation. Furthermore, households with off-farm income opportunities are less probable to produce for the market. This too seems reasonable.

Next, credit is negatively correlated with market participation. A positive relationship would, all else equal, be expected here. Access to credit should be crucial to develop production possibilities and grow out of a (possible) state of poverty, and, one would think, farmers already in debt would need to use the market in order to pay the debts. Nevertheless,

[8] This variable has been deemed missing on too many observations (307 of 4931). Out of the non-missing observations, agricultural traders were present in 44 percent of the communities. This, however, doesn't mean that they traded primarily in maize (which they probably did not) or that they visited every farmer in the community.

Table 4: Results from the probit model.

Variables	**(1)**	**(2)**
Land	0,0208 (0,0045)*	0,0200 (0,0043)*
Dist. to market	0,0004 (0,0006)	0,0004 (0,0006)
Dist. to phone	0,0003 (0,0004)	0,0003 (0,0004)
Credit (D)	- 0,0336 (0,0204)**	- 0,0351 (0,0205)**
Assets	- 0,0013 (0,0000)	- 0,0014 (0,0000)
Inputs	0,0020 (0,0000)	0,0015 (0,0000)
Storage (D)	0,0363 (0,0191)**	0,0365 (0,0190)**
Labor (D)	0,1039 (0,0212)*	0,0999 (0,0211)*
Livestock (D)	0,0705 (0,0211)*	0,0719 (0,0211)*
Extension	0,0141 (0,0077)**	0,0143 (0,0077)**
Employment (D)	- 0,0515 (0,0216)*	- 0,0524 (0,0216)*
Av. Yield	0,0015 (0,0000)*	0,0016 (0,0000)*
Age	- 0,0032 (0,0006)*	- 0,0033 (0,0006)*
Literacy (D)	0,0450 (0,0195)*	0,0431 (0,0194)*
Dependency	- 0,0113 (0,0044)*	- 0,0096 (0,0044)*
Weather (D)	0,0664 (0,0477)	0,0679 (0,0480)
Civil unrest (D)	- 0,1190 (0,1184)	- 0,1139 (0,1196)
Expenditure	- 0,0068 (0,0000)*	-
Poverty (D)	-	0,0044 (0,0193)
Diversification	- 0,4088 (0,0432)*	- 0,4126 (0,0431)*
Maize proportion	0,7253 (0,0388)*	0,7284 (0,0388)*
Cash crops (D)	0,0634 (0,0195)*	0,0620 (0,0196)*
Primarily farmer (D)	0,0646 (0,0208)*	0,0701 (0,0206)*
Other enterprise (D)	- 0,0461 (0,0187)*	- 0,0044 (0,0187)*
N	4525	4525
Prob. > F	0,0000	0,0000

Note that the marginal effects are evaluated at the mean value of the sample. Standard errors are in parentheses and the dependent variable is participation (1, otherwise 0) as a maize-seller during the first season. * indicates significance at 0,95 - level, and ** at 0,90.

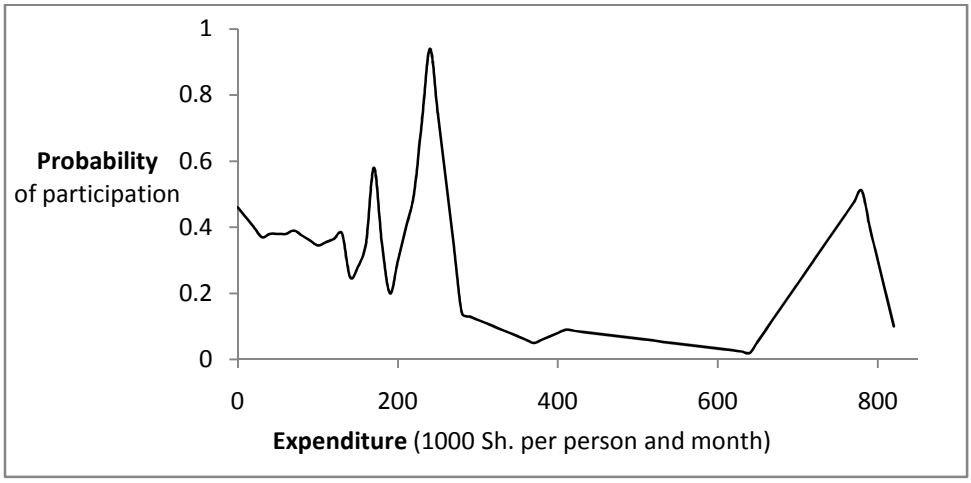
the relationship is negative, and one possibility is that communities running viable credit programs put more emphasis on (and succeed with) creating employment opportunities. And with access to credit proportionally more farmers might be inclined to search for better paid off-farm employment. If this is the case, one would expect the relationship between credit and market participation to be more pronounced for non-poor farmers since they would have better possibilities to look for other occupational activities. Ownership of livestock is positive and significant, possibly indicating greater risk taking behavior (with the animals as insurance) and/or more efficient production with the help of, for example, an ox or a cow. Some aspects of regional differences regarding the quality of land and available technologies should be captured by the community-average yield of maize. This variable is significant and positively correlated with market participation, perhaps in part through the possibility to produce marketable surpluses among farmers living in better-off communities. The dummies for weather and civil unrest were used as control variables, but neither one of them are significant.

Three variables - age, dependency ratio and literacy - are employed to capture household characteristics. Literacy, as an indicator of human capital, proved to be important, as did age, albeit in an opposite, negative relationship with market participation. One possible explanation of the latter, peculiar, result could be that many of the households are engaged in a number of activities, not only maize production. All else equal, skills should increase with age, but this negative relationship could be influenced by younger persons being more inclined, and able, to look for other income opportunities. This reasoning leads us to the variables thought to capture a household´s degree of specialization (in maize production). All of these carry expected signs and are significant at the 0,95 - level. The probability of market participation is, for example, negatively correlated with a household's diversification, measured by the Herfindahl index, but positively correlated with the proportion of maize in total crop production. And being a cash crop farmer further enhances the probability of participation in markets for food crops, perhaps reflecting some form of complementarities or economies of scale, e.g. in the use of facilities or marketing networks.

Finally, regarding monthly expenditure per capita in the household, it seems quite odd that the probability to participate in the market *decreases* with expenditure. Does this finding effectively quash the proposed relationship between market participation and poverty? Not necessarily, since it can be a result of a number of factors. It is possible that I don't measure poverty correctly, as discussed in section 3. Poverty should be connected to market participation in a number of ways - through the endowment of asset, land, income and credit,

etc. - but also due to behavioral differences, like attitude towards risk. While the behavior is, of course, a product of the endowments, one could argue that the model doesn't capture the latter properly. If the one-time snapshot of expenditure proves inaccurate the vulnerability of farmers might not be measured well enough. However, it must be admitted, this line of reasoning seems most fitting to an insignificant relationship between expenditure and participation. And following this line, the poverty dummy, which is directly constructed from the expenditure variable, in specification (2) above is indeed insignificant. Furthermore, look at figure 2 below. Here the predicted values are plotted against expenditure in a Kernel regression. Considering that the bulk of observations are below 200 000 Ugandan shillings, one shouldn't read too much into the far right of the picture. This figure illustrates, if anything, a complex relationship between expenditure and market participation.

Figure 2: Market participation and expenditure.



This Kernel (Epanechikov) regression has bandwidth 0, and the predicted values (the probability of participation) were retained from specification (1) above. The bulk of observations are stacked below 200. Values are in thousands of Ugandan shillings.

A deeper analysis of poverty and market participation seems motivated. This is done by interacting assets, credit, land, livestock and distance with two dummies, indicating poverty and non-poverty respectively. Credit, as seen in table 5, specification (3), on the next page is indeed only significant in the non-poor interaction. This strengthens the suspicion that better-off farmers might be more inclined, and able, to seek other means to earn their income. The negative relationship between market participation and diversification, visible in (1) above, could be an indication that maize farming for home consumption is not something exclusively practiced by the poor. Next, (4) displays a *positive* relationship between distance and market participation. This isn't realistic in itself, but, as previously argued, some form of

Table 5: Interactions with credit, livestock and distance to the market.

Variables	**(3)**	**(4)**	**(5)**
Poverty (D)	- 0,0226 (0,0240)	0,0364 (0,0251)	- 0,0386 (0,0357)
Poverty and credit	0,0167 (0,0345)	-	-
Non-poverty and credit	- 0,0599 (0,0220)*	-	-
Poverty and dist. to market	-	- 0,0017 (0,0015)	-
Non-poverty and dist. to market	-	0,0013 (0,0007)**	-
Poverty and livestock	-	-	0,1126 (0,0371)*
Non-poverty and livestock	-	-	0,0508 (0,0249)*
N	4525	4525	4525
Prob. > F	0,0000	0,0000	0,0000

Note that the marginal effects are evaluated at the mean value of the sample. Standard errors are in parentheses. * indicates significance at 0,95 - level, and ** at 0,90.

Table 6: Interactions with land and assets.

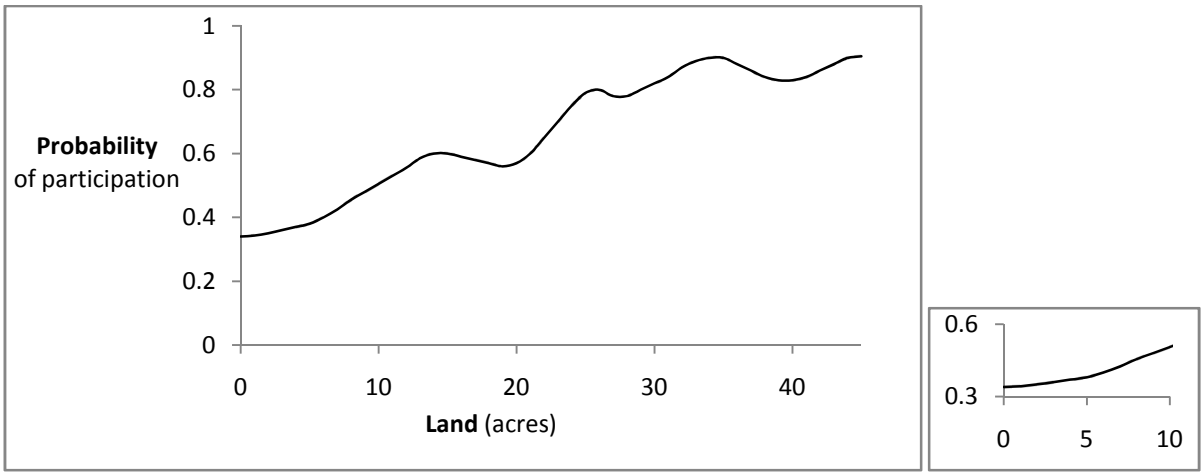
Variables	**(6)**	**(7)**
Poverty (D)	0,0074 (0,0273)	- 0,0067(0,0200)
Poverty and land	0,0192 (0,0076)*	-
Non-poverty and land	0,0204 0,0047)*	-
Assets	-	- 0,0028 (0,0000)
Land	-	0,020 (0,0048)*
Poverty, land and assets	-	0,0027 (0,0000)*
Non-poverty, land and assets	-	- 1,5550 (0,0000)
N	4525	4525
Prob. > F	0,0000	0,0000

Note that the marginal effects are evaluated at the mean value of the sample. Standard errors are in parentheses. * indicates significance at 0,95 - level, and ** at 0,90.

collective transportation to the market could be an explanation. The presence of gate traders has already been suggested and it is also possible that the farmers themselves cooperate, which, if true, could be a more wide-spread practice in remote areas. Whatever the reason might be, this result highlights the importance of a well specified measure of distance in similar studies of market participation.[9] The interactions in (5) indicate that livestock ownership is more important on the margin to people living below the defined poverty line. This supports the suggestion that livestock is used as an alternative way of saving money.

The significant and positive relationship between land holdings and market participation is reinforced in table 6, specification (6). Land seems to be of equal importance to poor and non-poor farmers. Assets were surprisingly insignificant in specification (1), but this time, in specification (7), poverty is interacted with both assets and land. The relationship is indeed positive, albeit the effect is quite small, and significant. This indicates that, given land, a marginal increase in assets has a higher impact (on market participation) to poor than non-poor farmers. This result relates to the discussion about poverty traps and asset thresholds, and the finding indicates that there might be some form of complementary effects between land and assets especially pronounced to poor farmers. In line of this reasoning, compare figure 3, below, with figure 1 in section 2.

Figure 3: Market participation and landholdings.



This is a plotted Kernel (Epanechikov) regression with bandwidth 2. Predicted values (the probability of participation) were retained from specification (1), and the small figure to the right is just the first part of the original plot.

[9] Using distance to an agricultural market, a preferable measure had it not been missing across so many observations, doesn't yield a significant relationship at all.

More than 75 percent of the maize farmers used just 4 acres or less in their production when the survey was conducted. This makes the left part of the graph the most interesting, and it indicates that a small increase in land holding has, at best, only a modest impact on market participation amongst small scale farmers. By this reasoning the existence of some form of threshold in the endowments of land and assets, for example, seems quite reasonable. The dip between 15 and 20 acres is also notable, and it could be that the combination of size and technique isn't optimal for some of the farmers at this level.

5. Concluding remarks

This study has examined participation in the Ugandan maize market. The conceptual framework employed basically puts a farmer's probability to participate, as a seller, positively dependent on productive assets and negatively on transaction costs. The results indicate that farms with the means to hire labor and use storage facilities, with more land and access to assistance of extension agents, with more human capital and ownership of livestock, and with a clear specialization in maize production, have a higher probability to participate in the maize market.

There is not a lot of research made on market participation in food grain markets. Only two of the studies surveyed in section 2 - Boughton et al. (2007) and Heltberg and Tarp (2001) - employ a framework directly comparable to this study. Both of them do, like me, find strong indications of the importance of landholdings, whereas they diverge on the results regarding distance to the market. Boughton et al. (2007) find a similar (to this study), overall non-existing, relationship between distance and participation. As mentioned previously some important aspect might be missing, like the presence of gate traders or collective organization of transportation, and future studies might want to rethink this distance measure.

The connection to poverty is made more explicit in this study than elsewhere. The results indicate that some endowments, like livestock and agricultural assets coupled with land, are more important on the margin to the poorer farmers. Landholdings, as seen in figure 3, seem to increase in importance (to market participation) only at its higher levels, a relationship found by both Boughton et al. (2007) and Heltberg and Tarp (2001). The possibility of some form of asset/land threshold thus seems quite plausible. On the other hand this study finds a negative relationship between household expenditure and market participation. This result does raise some serious questions about the accuracy of the poverty measure, or, more precisely, what this measure really captures. If people move in and out of poverty, i.e. below and above the defined poverty line, over some period, it is a possibility that this measure fails to reflect the real vulnerability of farmers.

The approach taken in this study, i.e. to focus exclusively on market *participation*, constitutes a logical point of departure to a more general understanding of poverty amongst food grain farmers in rural Africa. Next step is to consider sales volumes, particularly in relation to the household´s own consumption. It is probable that the ability to be a net-seller is what really matters to a farmer succeeding to grow out of poverty. But this approach, found for example in Barrett (2008), can still be susceptible to the seasonality problem (discussed

above) if food expenditure varies a great deal over the year. Future research should, in light of the findings in this study and elsewhere, first and foremost look further into the relationship between market participation, sales volumes and poverty amongst food grain farmers. Using a better measure of poverty, or rather vulnerability, will hopefully yield further knowledge about the issues at hand. Greater awareness about this will be important in the search of poverty-reducing measures for Sub-Saharan Africa.

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Appendix

Table A.1: Description of variables.

Variables	Description
Age	Age of the head of the household.
Assets	Value of assets, like ploughs etc., used in agricultural production.
Average yield	Average maize yield in the community.
Cash crop (D)	Household produces cash crops (cotton, coffee, tea and/or tobacco) (dummy).
Civil unrest (D)	The event occurred in the community two times during the last four years (dummy).
Credit (D)	There is a local money lender, a lending cooperative or some micro credit program in the community (dummy).
Dependency	Number of household members. Children and elderly count as some fraction of a + 18 year old male. See Appleton (2001: p. 117) for details.
Dependent variable (D)	The household did sell some part of its maize output the first season (dummy).
Diversification	Herfindahl index, $H = \sum s_n^2$, which measures the degree of concentration on the households internal market, i.e. s_n is the share of a household´s total crop production devoted to crop n. Frequently harvested crops are excluded because of the difficulties involved with an accurate measure of their value.
Dist. to market	Distance (in km) to the nearest market. The sample maximum is used when respondents don't know where the nearest market is.
Dist. to phone	Distance (in km) to the nearest telephone call/box. Sample max. is used when unknown.
Employment (D)	Household has income from employment other than farming.
Extension	Number of visits, last year, of extension agents.
Expenditure	Expenditure on food the last seven days, non-durables (e.g. firewood, soap) the last month and semi-durables (e.g. clothing, education) last year. Home consumption and gifts, valued at market prices, are both included in the food part. Expenditure is calculated per person and month, using the equivalence scales in Appleton (2001: p. 117).
Inputs	The value of (non-labor) inputs, like fertilizers and pesticides.
Farmer (D)	Farming is the main activity of the household (dummy).
Labor (D)	The household used hired labor (dummy).
Land	Total area (in acres) planted.
Literacy (D)	The head of the household can both read and write (dummy).

Table A1 continued.

Livestock (D)	The household owns livestock, like chicken, oxen etc.
Maize proportion	The proportion of maize, based on value, of total (crop) production. Frequently harvested crops excluded.
Other enterprise (D)	Household has other (than farming) enterprise (dummy).
Participation (D)	Dependent variable. The household sold some fraction of its maize production (dummy).
Poverty (D)	Household expenditure is above the poverty line (defined in Appleton, 2001) (dummy).
Storage (D)	Access to storage facilities (dummy).
Weather (D)	All or many of the households in a community were affected by flood or drought three times during the last six years (dummy).
Interactions	
Poverty and livestock	Poverty * livestock.
Non-poverty and livestock	Non-poverty (dummy, 1 if household is above the poverty line, 0 otherwise) * livestock.
Poverty and land	Poverty * Land.
Non-poverty and land	Non-poverty * land.
Poverty, land and assets	Poverty * land * assets.
Non-poverty, land and assets	Non-poverty * land * assets.
Poverty and dist. to market	Poverty * distance to the nearest market.
Non-poverty and dist. to market	Non-poverty * distance to the nearest market.

Table A.2: Descriptive statistics.

Variables	**Mean**	**Std. Dev.**
Participation (D)	0,19	0,29
Land	2,82	3,03
Dist. to market	10,41	13,73
Dist. to phone	22,23	26,87
Credit (D)	0,39	0,49
Assets	16222	85061
Inputs	25290	68401
Storage (D)	0,37	0,48
Labor (D)	0,33	0,47
Livestock (D)	0,73	0,44
Extension	0,29	1,06
Employment (D)	0,27	0,44
Av. Yield	77753	182051
Age	44,41	15,75
Literacy (D)	0,70	0,46
Dependency	4,55	2,53
Weather (D)	0,05	0,22
Civil unrest (D)	0,01	0,11
Expenditure	31116	30172
Poverty (D)	0,33	0,47
Diversification	0,54	0,21
Maize proportion	0,30	0,26
Cash crops (D)	0,35	0,48
Primarily farmer (D)	0,78	0,41
Other enterprise	0,45	0,50
N = 4525		