

Egerton University



TEGEMEO INSTITUTE OF AGRICULTURAL
POLICY AND DEVELOPMENT

Market Participation among Poor Rural Households in Kenya

John Olwande and Mary Mathenge

Tegemeo Institute, Egerton University.
P.O Box 20498-00200, Nairobi.
Tel: (02) 2717818
Email: egerton@tegemeo.org

October 2010

Executive Summary

Poverty in Africa has been found to be predominantly a rural phenomenon. About 75 percent of the world's poor are believed to work and live in rural areas, and it is estimated that, by the year 2020, 60 percent of the poor will still be rural. Meeting the challenge of reducing poverty and improving rural incomes in Africa will require some form of transformation out of the semi-subsistence production systems that currently characterize much of rural Africa to a more commercialized agriculture.

Increased market participation by the poor has been found to be important as a means of breaking from the traditional semi-subsistence farming. It has been argued that market-oriented production can achieve welfare gains through specialization and comparative advantage, economies of scale and regular interaction and exchange of ideas. Unfortunately, the poor who need this kind of welfare boost may be constrained by several factors in their quest to participate in the market for their goods and services.

This study aimed at assessing the extent of market participation among poor smallholder farmers in Kenya with a view to identifying constraints to market participation among and potential market opportunities for the poor. We use a three-year panel data set collected in 2000, 2004 and 2007 and across various agro-ecological zones of Kenya under the Tegemeo Agricultural Policy Research and Analysis (TAPRA) project. The data analysis mainly focuses on the characteristics of the poor households and their participation in different input and output markets. Critical questions under the study relate to the levels of participation in markets by the poor, key constraints to output market participation by the poor and the relationship between market participation and transition out of poverty. The study also looks at the factors that affect the likelihood and intensity of participation in different output markets among the poor.

The study defines poor households as those below the poverty line as generated by the Kenya National Bureau of Statistics (KNBS). Descriptive results show that the proportion of poor households decreased from 42% to 37% between 2000 and 2007, a scenario that is well consistent with the general reduction in the national poverty figures reported across that period. The study further reveals that the proportion of poor households is highest in the

Western and Coastal Lowlands and Western Highlands and lowest in the Central Highlands, and that 47% of the poor are in the agriculturally low potential areas, mainly the Lowlands.

In terms of socio-economic characteristics, the study reveals that the poor households are headed by persons with low literacy levels and are larger in size than the non-poor households. Dependency level is also higher in the poor relative to the non-poor households. The poor's income levels are about five times lower than those of the non-poor households. Combined, the farm (both crops and livestock) is the most important livelihood source for the households; it contributes to over 68% and over 66% to the poor and non-poor households' income respectively. After agriculture, the poor rely more on businesses and informal labour activities, which is essentially the informal rural sector, while their non-poor counterparts rely more on income from formal employment sector. Developing agriculture and the informal rural sector would be key intervention areas for helping the poor out of poverty. The poor households own smaller land sizes and are less endowed with assets, suggesting that their agricultural productive capacity is very low. A higher proportion of non-poor than poor households used credit; about 68% versus 41% in 2007, suggesting more limited access to credit by the poor households. Also, a higher proportion of non-poor than poor households had membership in groups, indicating less collective action among the poor than non-poor households.

Results on market participation across selected commodity groups (maize, vegetables, fruits and dairy) show that poor households have significantly lower production volumes and lower market participation compared to their non-poor counterparts. The poor also lag behind in adoption of productivity enhancing inputs such as fertilizers and improved seeds. The low adoption levels of technology coupled with low literacy levels, small land sizes, low asset endowment and low access to credit limit the capacity of the poor to produce surpluses for the market. Yet, among the households that exited poverty there are tremendous increase in market participation for the various commodities. Among the households that descended into poverty, market participation either declined or increased marginally. These results point to a strong relationship between market participation and exiting poverty, and indicate the role that access to productive assets, which improves a household's capacity to produce marketable surplus, can play in poverty reduction.

In terms of market concentration, results show that the top 20% of the selling households account for over 70% of the marketed volume for maize, vegetables and fruits and about 60%

of the marketed volume of milk, suggesting that the commodity markets are generally very highly concentrated and majority of the smallholders are essentially subsistent. Improving production levels for these households is therefore critical, and need to be considered alongside any measures that are aimed at reducing transaction costs that hinder access to markets.

In terms of factors that could enhance market participation for the poor, we find that land size play a significant role. This suggests that any hope for the poor to make any meaningful gains from agriculture lies in improving productivity of their land as well as improving their access to land. The results also show that membership in farmer organizations/groups is positively associated with increased market participation. Collective action is important in facilitating access to information and, in some instances, credit. Both credit and information are critical in accessing market opportunities. Therefore, increasing social capital among the poor can be of great value in enhancing the households' access to markets.

Acknowledgements

Support for this research was provided by the Tegemeo Agricultural Policy Research and Analysis (TAPRA) project between Tegemeo Institute/Egerton University and the Department of Agricultural Economics, Michigan State University. Financial support for this project was provided by the Kenya Mission of the United States Agency for International Development. We acknowledge the support of research assistants, particularly Mercy Mutua, and all members of Tegemeo Institute in the course of this study. We also acknowledge Margaret Beaver of Michigan State University for her role in improving the quality of the survey data entry and cleaning over the past years.

DRAFT

Table of Contents

Executive Summary	i
Acknowledgements	iv
Table of Contents	v
List of Tables	vi
List of Figures	vi
1. Introduction.....	1
1.1 The Promise of Improving Smallholder Participation in Markets	1
1.2 Challenges in Improving Market Participation by Smallholders.....	2
1.3 Objectives and Focus of the Study.....	5
1.4 Organization of the Paper	5
2. Conceptual Approach, Analytical Methods and Estimation.....	5
2.1 Conceptual Approach	5
2.2 Analytical Methods	9
2.2.1 Descriptive Analysis	9
2.2.2 Econometric Model	9
2.2.2.1 Model Specification.....	9
2.2.2.2 Variable Descriptions	12
2.2.2.3 Estimation	14
2.2.3 Input and Output Categories	15
3. Data and Sample	15
4. Results and Discussion	16
4.1. Descriptive Analysis Results	16
4.1.1. Socio-economic Characteristics of the Households	16
4.1.1.1 Demographic Characteristics	17
4.1.1.2 Economic Characteristics.....	19
4.1.2. Market Participation	22
4.1.2.1 Input Markets	22
4.1.2.2 Output Markets.....	24
4.1.2.3 Output Market Participation and Poverty Dynamics.....	28
4.2 Econometric Results.....	31
5. Key Findings and Conclusion.....	35
References	37
Annexes	42

List of Tables

Table 1: Distribution of Sampled Districts by Agro-Regional Zones	16
Table 2: Percent of Poor Households.....	17
Table 3: Proportion of Households by Education Category, Age of Household Head, Household Size and Dependency Ratio	18
Table 4: Household Mean Annual Income and Shares of Income Components.....	19
Table 5: Proportion of Households Using and Intensity of Use of Fertilizer and Improved Maize Varieties.....	24
Table 6: Percent of Households Producing Various Enterprises, Volume of Production and Percent Contribution to Total Value of Crop Production	25
Table 7: Proportion (%) of Households that Marketed Various Crops, Sales Volume and Proportion of Marketed Production.....	26
Table 8: Distribution of Marketed Volumes of Various Commodities across the Sample.....	28
Table 9: Participation in Crops Markets by Poverty Status	30
Table 10: Correlates of Decision to Participate and Extent of Participation in Maize, Vegetables, Fruits and Milk Markets.....	32

List of Figures

Figure 1: Mean Household Land Size.....	20
Figure 2: Mean Value of Household Assets.....	21
Figure 3: Proportion (%) of Households Using Credit and Belonging to Groups.....	22

1. Introduction

1.1 The Promise of Improving Smallholder Participation in Markets

Rural poverty levels remain high in Africa and the East Africa region. The World Bank (2008) showed that the number of rural poor in Africa increased over the period between 1992 and 2002 to reach over 210 million people. Most of Africa's poor reside in rural areas -- 70% of its poor -- and this is expected to dominate urban poverty for several more decades. The rural populations depend on small scale agriculture for food and income. Smallholder agriculture remains the major engine of rural growth and livelihood improvement for any pathway that can lift large numbers of the rural poor out of poverty (Hazell, 2005). Meeting the challenge of improving rural incomes in Africa will require some form of transformation out of the semi-subsistence, low-input, low-productivity farming systems that currently characterize much of rural Africa (Govereh et al., 1999)

Data at the global level also indicate that through investments, rural poverty rates can decline. Between 1992 and 2002, the percentage of the rural population in poverty reduced from 37 to 29, with virtually all of this taking place in East Asia. Nonetheless, there are examples of significant agricultural productivity and income growth as a result of increased linkages to markets in Africa. In Kenya, there are many examples of smallholder farming successes in which households have diversified from staple food subsistence production into more market oriented and higher value commodities. Evidence shows that in Kenya, there are approximately 300,000 smallholders growing tea, 500,000 coffee growers, hundreds of thousands are producing horticultural crops and nearly 2 million have dairy production systems (Place et al., 2006).

This shift towards more commercialization has also been found to contribute positively to agricultural income. A study on the effects of smallholder commercialization on rural Kenyan food production and welfare in South Nyanza District, found that farmers participating in the sugarcane scheme enjoyed significantly higher agricultural incomes than their neighbours who did not participate. Much of the difference in income was related to agricultural sales, with most but not all of these sales being related to sugarcane (Kennedy and Cogill, 1987). A study by Strasberg (1997) on smallholder integration into cash cropping schemes in Mozambique demonstrates that smallholder cash cropping schemes can have a positive effect on smallholder welfare. Related studies on input use have also shown a positive relationship

between cash cropping and input intensification on food crops within households (Kelly et al., 1996; (Govere et al., 1999); Freeman and Omiti, 2003; Mathenge and Tschirley, 2008).

Agricultural commercialization refers to the shift from subsistence production to an increasingly complex production and consumption system based on the market (Goletti, 2005). Apart from marketing of agricultural outputs, it includes product choice and input use decisions based on the principles of profit maximization (Pingali and Rosegrant, 1995). Jaleta (2009) argues that commercialization strengthens linkages between input and output sides of a market. Demand for modern technologies promotes the input side of production and facilitates the development and advancement of technological innovations. In turn, the use of modern technologies can result in higher productivity and production entering markets. From the other side, output market growth can often drive input market linkages as the cash generated from sales can be used as investment funds.

Commercialization of agriculture benefits the poor by increasing agricultural labour productivity which in turn generates employment in low-capital smallholder agricultural production. Both the households that are commercializing their production and hired laborers receive direct income benefits (von Braun, 1995). However, von Braun (1995) also cautions that, while commercialization by itself rarely has adverse consequences on household welfare, commercialization combined with failures of institutions, policies, or markets can be damaging. Moreover, other studies have found that commercialization may have adverse effects on certain household members, such as women and children, when the allocation of income is not done equitably.

1.2 Challenges in Improving Market Participation by Smallholders

While there is general agreement that improving market access and commercialization of smallholders will help induce greater investment, productivity, and income, there remains several challenges in making progress:

- (1) Which output markets and types of commodities, if any, can enable large numbers of smallholders to improve their incomes?
- (2) Which markets and commodities, if any, can provide significant opportunities for the poor?

(3) How can access to these output markets be improved? What are the key constraints for poor smallholders' access to the markets and what interventions are important for market participation to be improved?

While there are some interventions that have broad effects to improve smallholder market participation (e.g. communications and roads), other types of investments may depend on the types of markets and commodities pursued, e.g. whether export oriented or not, whether with perishable commodities or not. Thus the answers to (1) and (2) are important to uncover before the full identification of investment options can be made.

In terms of the first challenge, several recent studies have reached different conclusions. On the one hand, there is ample evidence to suggest that the sheer magnitude of domestic staple food markets is far greater than those for exported commodities or for higher value commodities (e.g. Hazell (2005), Diao et al., 2007). The implication is that domestic staple food markets have the potential to involve a much larger number of smallholder farmers than other commodity markets, both domestic and export for most countries in sub-Saharan Africa. Other studies stress the importance of ties between a particular sector and the overall economy through, for instance, labour market and other multiplier effects such as induced investment in input use and technological change, which may make certain high value crops such as horticulture a promising growth strategy despite their current small base (Diao and Dorosh, 2007). However, some studies provide evidence on the increasingly stringent health standards on agricultural imports into developed countries, potentially hampering access by smallholders (Asfaw, 2007; Okello *et al.*, 2008).

Yet, other evidence suggests that currently smallholders do not often participate much in staple food markets and their overall market share is very low (Jayne et al., 2005). Jayne et al. (2005) found that the top 2% of commercial farmers sold about 50% of observed marketed maize in Kenya, Mozambique and Zambia. Ellis (2005) also shows that farmers in semi-arid areas of Africa have very low proportions of output marketed. Further complicating the picture is evidence of growing participation of smallholders in horticulture, dairy, tree crops, and the like and a shifting away from staple food production as farm sizes shrink (see evidence on Kenya by Jayne et al. (2005)). This is due to the low prices received for staple foods and farmers' desires to increase their returns. Thus there appears to be divergent trends on the demand and supply side: demand trends which may be creating greater opportunities for staple foods in domestic markets and supply trends which suggest an interest of farmers to

diversify away from lower value staple food crops. Thus, the way forward is muddled and requires careful examination on a case by case basis (i.e. in specific countries and regions within countries).

In terms of studies of market participation and the poor, very few studies have been done. Jayne et al. (2005) and Jayne et al. (2004) investigated relationships between land holdings, market participation, and incomes. They found that most smallholders did not sell cereals and in fact were net buyers of cereals. The size of land holding was also found to be highly correlated with income, including crop income and livestock income. This shows that the land-poor are not benefitting from markets nearly as much as those with more resources. Yet, an interesting finding is that even the land poor households count on crop production for a sizeable amount of their household income (where crop income is defined as net value of production) meaning that they do not largely turn their backs on agriculture and seek predominantly off-farm livelihoods.

In terms of understanding the constraints to market participation and the types of interventions that can overcome these constraints, a number of studies have been done. On the constraints, a more in-depth review is given in Chapter 2, but here it is useful to acknowledge that constraints can exist at different levels and cover a range of types. Barrett (2008) stresses the importance of distinguishing location level constraints that tend to influence participation at a meso or community scale from household level constraints that influence participation across households within a given location. Among the types of constraints, others have differentiated between transactions costs, risks, and resources (e.g. skills, land, capital) which all may manifest themselves at a meso or household level (e.g. Bijman et al., 2007, Poulton et al., 2005).

One key point is that interventions may be different for different types of commodity market chains. For example, investments required in vegetables or fruits are different from those in cereals, due to differences in perishability, potential for value adding, and standards, inter alia. Identifying which agricultural commodities offer the best opportunities for sales, income, and poverty alleviation is thus a critical step in the process of making wise investments.

1.3 Objectives and Focus of the Study

The main objective of this study is to assess trends in output market participation among and explore potential output market opportunities for the poor agricultural households, and further to identify factors that enhance their participation in output markets. Specific questions we aim to address in our study are listed below:

- What are the levels of participation in output markets by the poor?
- What are the key constraints to output market participation by the poor?
- Is market participation important in helping the poor transition out of poverty?
- What factors explain the degree of commercial orientation by the poor?

The various ways in which these questions are addressed, including definitions of market participation, are addressed in Section 2.

1.4 Organization of the Paper

Section 2 presents the conceptual approach, analytical methods and estimation. Description of specific variables used in the analysis is also presented. Sections 3 and 4 cover, respectively, an overview of the dataset used and results of descriptive and econometric analyses. Finally, Section 5 provides a key findings and conclusion.

2. Conceptual Approach, Analytical Methods and Estimation

2.1 Conceptual Approach

Market-oriented production can achieve welfare gains through gains from specialization and comparative advantage, gains from larger-scale production due to fixed or sunk cost, and finally gains from regular interaction, exchange of ideas and technological change (Barrett, 2008). Market-oriented production can be described by the decision to participate in the market as well as the intensity of participation as measured by the share of sales in production (output supply) and/ or input demand; both of these decisions are also referred to as '*commercialization*' in this report.

The factors that determine commercialization of smallholder agriculture can be categorized as external and internal. External factors are beyond the smallholder's control like population growth and demographic change, technological change and introduction of new commodities, development of infrastructure and market institutions, development of the non-farm sector

and the broader economy, rising labour opportunity costs, macroeconomic, trade and sectoral policies affecting prices and other driving forces (Pingali and Rosegrant, 1995). In addition, development of input and output markets, institutions such as property rights and land tenure, market regulations, cultural and social factors affecting consumption preferences, production and market opportunities and constraints, agro-climatic conditions, and production and market related risks are other external factors that could affect the commercialization process (Pender and Alemu, 2007). For example, nearness to urban centres play an influential role in commercialization and mechanization of agriculture in the hinterland by creating demand for different agricultural products including cereals and vegetables, and by supplying necessary inputs, including fertilizers and machines (Thapa and Nepali, 2009). Household specific factors, i.e. internal determinants, include resource endowments such as land and other natural capital, labour, physical capital, human capital and social capital. (Jaleta, *et al*, 2009). On the importance of resource endowments for market participation, Jayne et al. (2005) showed that the top 2% of households sold 50% of the maize in Kenya, Zambia and Mozambique, which could be attributed to better endowment with land resources. Another 20-30% of households sold smaller amounts and had less land available (*ibid.*).

Commercialization is to a large extent influenced by transaction costs, which include information, negotiation and enforcement costs. Another way to categorize these costs would be to differentiate between tangible transaction costs such as transport, communication, and legal costs and intangible transaction costs due to uncertainty and moral hazard. Due to increasing globalization of food production and market systems, new transaction costs grow relevant such as those for meeting product quality standards (Pingali et al., 2005). Overall, transaction costs have a deterring effect on market participation. The prevalence of higher market transaction costs also limits household involvement in cash crop production by discouraging participation in food markets and prompting them to give priority to subsistence food production (Fafchamps 1992; Key et al. 2000; Pingali et al. 2005). As a result, agricultural resources are diverted away from their potential use in cash crop production that would generate higher household income.

In addition to the factors listed above, fixed and/ or sunk cost of investment, coordination problems from public goods provision, liquidity constraints at household to government level result in the existence of multiple market participation equilibria ranging from autarchic to fully commercialised rural households (Barrett and Swallow, 2006; cited in Barrett, 2008).

Much of the framework of this study depends on the non-separable household model developed by Barrett (2008), which aims at analyzing household response to price and policy interventions and allows for household-level and market-level transactions costs. This model as well as findings from other models is used to derive hypotheses for our study. The next paragraphs briefly summarize major conclusions from this model.

Non-separable household model

In this model, a household maximizes utility subject to a cash budget as well as non-tradables' availability constraint, with household specific crop prices being determined by the household's net market position. The model differentiates two layers of transaction costs: household specific transaction costs as well as crop and location-specific transaction costs. These determine or are determined by integration of an individual household in the market as well as the integration of the local market in the regional/ national/ global market. Integration of local markets in the greater economy has impact on price transmission, which is also impacted by the competition amongst intermediaries, which results in locally differentiated price bands. Transaction costs create a wedge, which result in price bands (market prices plus/minus transaction costs), which result in kinked demand and supply functions with diminished price responsiveness (see also Key et al., 2000). The empirical application mostly concentrates on the food grain market in East and Southern Africa (Barrett, 2008).

Household specific transaction costs are determined by private assets and productive endowments (Barrett, 2008) as well as, age, gender and education (Pingali, Meijer, Khwaja, 2005). Household specific transaction costs interact with the poverty status of a household and may vary between the poor and non-poor. Crop specific transaction costs are determined by crop characteristics such as perishability and its requirements such as cooling facilities (Pingali et al, 2005). Location specific transactions costs include costs of commerce given by remoteness of the location and its infrastructure (Barrett, 2008).

Extended application

The model does not explicitly differentiate between fixed and variable transaction costs, but we do use variables that would proxy for each type separately. Fixed transaction costs are highly household or commodity-specific, non-variant with the volume of transaction, and basically deter smallholder entry into markets such as owning a pickup truck and local

membership in an agricultural or transport association. Proportional transaction costs, as the name indicates, are proportional to the volume under transaction such as crop transport costs and distance to the market (Key et al., 2000). The former have been shown to be a determinant of market entry, while the latter are linked to the intensity of participation (Heltberg and Tarp, 2001). For example, fixed transaction costs estimated to be 15.5% of the price band in maize-producing semi-subsistence households is one of the major deterrents to market participation (Renkow et al. 2004).

Since the Barrett model mostly concentrates on price and policy effects, *other types of intervention such as increased vertical (e.g. through contract farming¹) or horizontal (e.g. collective action of farmer associations) integration* are indirectly analysed and could possibly be more formally put into this framework.

The model also does not explicitly factor in idiosyncratic as well as covariate *risk* that rural households face, and consequently risk management and coping strategies. Agricultural production commercialized at a household level is subject to risk and the household's attitude towards risk (Fafchamps, 1992; Dercon, 1996) matters. The more risky the marketing environment a household is engaged in, the less a household will be involved in agricultural practices that support market orientation (Fafchamps, 1992; Govereh et al., 1999). Furthermore, unreliable and costly food markets and fluctuations in market prices put the relatively market-oriented resource allocation decisions of semi-subsistence households at stake due to less reliability of food markets to guarantee household food security (Govereh et al., 1999). Fafchamps (1992) also shows that a household's decision to commercialize depends on the sum of consumption and income effects of market shocks.

Rural household normally *diversify* into a range of farm, non-farm and off-farm activities (Ellis, 2000) and consequently are integrated into the market through participation in multiple input markets as well as multiple output markets. Overall, increased market orientation moves rural households from subsistence production to profit and (cash) income oriented decision making which can result in increased specialization of production (Pingali et al., 2005). Along this process, a rural household decides on the enterprise mix including non-

¹ Across many developing countries, contract farming has been found to play an important role in the commercialization of smallholder agriculture through the provision of an assured market, high prices, critical inputs, knowledge of new agricultural technologies for farmers, and as a driver of rural development strategy (Elepu and Nalukenge, 2007).

agricultural income generation, market participation as well as the level of participation.² Households may choose to pursue non-agricultural income generation and then continue with producing staple foods with low market participation (Pingali et al., 2005). Hence any analysis needs to control for other livelihoods strategies and look at overall household commercialization.

Welfare effects of price changes vary by crop, household and location and are influenced by linkages between markets and technologies. Households will respond heterogeneously to opportunities for market participation based on their individual characteristics and resource endowments including liquidity constraints (Stephens and Barrett, 2009), even though market access conditions and other external factors may be similar. In addition, the enterprise portfolio choice also depends on factors within the production function framework (input, service and labour). Overall, analysing and projecting an aggregated supply response is difficult also due to differentiated factor and output market response, e.g. land and labour market response (Dyer et al., 2006; cited in Barrett, 2008; Key, et al., 2000)

2.2 Analytical Methods

2.2.1 Descriptive Analysis

Descriptive methods of analysis are used to generate frequencies, proportions and means to show trends and patterns in input and output market participation over time. The analysis has been disaggregated by poverty status of the household for comparison purposes.

2.2.2 Econometric Model

2.2.2.1 Model Specification

In this study, we estimate output supply functions to determine factors that enable small scale farmers to participate in the respective output markets. We explore factors that determine whether a household sells all or some of their farm production in the market.

Various studies on small holder market participation have mainly modelled both/either output and/or input market decisions as a two-step decision process. This is based on the assumption that households make two separate decisions; one involves the decision to participate in the

² Bellemare and Barrett (2006) analysed whether the market participation – intensity of participation is simultaneous or sequential with more evidence towards the latter.

market or not and secondly the level of participation. These studies have used either the sample selection model of Heckman (1979) (Makhura, et al., 2001; Boughton, et al., 2007; Alene et al., 2008) or the two tier/ hurdle models (Omiti, et al., 2009).

The sample selection model is ideally used to deal with non-random samples as a result of survey design, non-response on survey questions, sample attrition or the specific attributes of the variable being analyzed. The sample selection model of Heckman (1979) was based on wage offer functions given that some wage data was missing due to the outcome of another variable – labour force participation³. In this case, usually known as *incidental truncation*, it is important to account for the non-random nature of the sample using a selection model. It would be erroneous to equate these missing observations to zero as would be the case under corner solution outcomes⁴ (discussed later). The Heckman type models deal with such a sample selection problem by computing a selection term from the first equation (selection model) and including it as a regressor to correct for self selection in the second stage regression involving observations from the selected sample. In other words, as indicated by Wooldridge (2002), the selection bias is viewed as an omitted variable in the selected sample which is corrected by this procedure.

The two tier/hurdle models are a type of corner solution outcome (sometimes referred to as censored regression model). These models define an initial discrete probability of participation model. Conditional on participation ($y > 0$), a second decision is made on the intensity of participation. Originally, such models were estimated using the Tobit model that accounts for the clustering of zeros due to non-participation. However, a major limitation with the Tobit model is that it assumes that the same set of parameters and variables determine both the probability of market participation and the level of transactions. A two-step model however relaxes these assumptions by allowing different mechanisms to determine the discrete probability of participation and the level of participation. These models allow for a separation between the initial decision to participate ($y > 0$ vs $y = 0$) and the decision of how much y given ($y > 0$). In this case, it is assumed that some right

³ Not possible to collect wage data on all persons of working age since some were not working at the time of the survey.

⁴ See details of this discussion in Wooldridge (2002) pp 562-3.

hand side variables may affect differently the decision to participate at all and the decision on the level of participation.

The first step in a two-tier model involves a Probit estimation while the second stage can take different functional distributions. The simplest two step model for a corner solution outcome assumes that conditional on $y > 0$, $y|x$ follows a lognormal distribution (second stage).

$$P(y = 0 | x) = 1 - \Phi(x\alpha) \quad (2.1)$$

$$\text{Log}(y) | (x, y > 0) \sim \text{Normal}(x\beta, \delta) \quad (2.2)$$

A most commonly used two tier model is the double hurdle of Craig (1971). In this model, the second stage is defined by a truncated normal distribution instead of the lognormal distribution described above. The main advantage of the truncated normal distribution over the lognormal is that it nests the usual Tobit Model thus allowing us to test the restrictions implied by the Tobit hypothesis against the two step model (Wooldridge, 2002, pp 536-38). The double hurdle model can thus be denoted by:

$$P(y = 0 | x) = 1 - \Phi(x\alpha) \quad (2.3)$$

$$\text{Log}(y|x, \theta) = 1(y = 0) \ln \left[\Phi \left(\frac{x\beta}{\sigma} \right) \right] + 1(y > 0) \left\{ \ln \left[\frac{\phi(x\beta)}{\phi(\frac{x\beta}{\sigma})} \right] + \ln \left[\frac{1}{\sigma\sqrt{2\pi}} \exp \left(-\frac{1}{2\sigma^2} (y - x\delta)^2 \right) \right] \right\} \quad (2.4)$$

Tobit hypothesis

$$\beta = \delta/\sigma \rightarrow \text{Tobit}$$

$$\beta \neq \delta/\sigma \rightarrow \text{Double Hurdle}$$

The main issue between a sample selection model and a corner solution model is data observability. For corner solution problems, all data is observed and non-participation implies that some economic agents have made the optimal choice of a corner solution i.e. $y = 0$.

Examples here include charity contribution, labour supply decisions, expenditure on research

and the like. According to Wooldridge (2002) pp 520-21, it is important to avoid emphasizing on the latent variable y^* when dealing with corner solution problems since our variable of interest, y is observed.

In sample selection problems, and more precisely in cases of incidental truncation, some part of the dependent variable is not observed as a result of the outcome of another variable. In this case, it is erroneous to infer a zero for non-participation and any estimation based on the selected sample would be biased unless we account for those agents who never participated or whose data is missing through the correction term as described above.

From the above discussion and given the nature of the problem in this study, we adopt the two step method advanced by Craig (1971), usually known as the double hurdle model to model output market participation decisions. In this, we assume that non participation is a purely economic decision by households not to participate in the market.

The estimated double hurdle model for market supply thus takes the following specification:

$$P(Y_1 = 1) = P(Q_s > 0) = X_1\alpha + \varepsilon \quad (\text{market participation model}) \quad (2.5)$$

$$Q_s = Z_1\beta + \mu \quad (\text{intensity model}) \quad (2.6)$$

Equation 2.5 defines the market participation model where Y_1 takes the value of one if a household made any positive sales to the market and zero if no sales were made. Q_s is the proportion of quantity sold (or alternatively might represent the quantity sold or value sold) and X_1 and Z_1 define factors that affect the discrete probability of participation and intensity of participation respectively.

2.2.2.2 Variable Descriptions

Factors that may influence a household's participation in output markets are grouped into five categories: demographic characteristics and human capital; physical resource endowments; distances to markets and information; membership in groups; output prices; and agricultural potential. These factors are discussed below, where direct and indirect indicators for transaction costs are printed in bold.

Demographic characteristics and human capital: Included under this category are gender, age, education of household head and dependency ratio.⁵ Gender of household head is expected to capture differences in market orientation between males and females with males expected to have a higher propensity to participate in markets than females. Age of household head is an indicator of experience in farming. It is expected that higher age, and therefore, more experience in farming will improve orientation to market participation. On the other hand, experience can also be expected to be negatively associated with market participation, as older household heads (up to a certain maximum) tend to have more dependents and hence more subsistence production activities (Ehui, et al, 2009). The conventional age squared variable is added. Human capital is represented by formal education of household head. Education enhances the skill and ability to better utilize market information, which may reduce marketing costs and make it more profitable to participate in the market. Higher dependency ratio is expected to lower the propensity of a household to participate in markets. Household size may explain a household's family labour supply for production activities. This measure, however, assumes that all household members are actively involved in family labour provision. Dependency ratio, which takes care of the level of burden active household members bear, is, therefore, used in this analysis. It is expected that a higher dependency ratio will result in a household consuming a higher proportion of its produce and hence leaving lower proportions for sale. All of these variables can be considered as indicators of household specific transaction costs.

Physical resource endowments: Included in this category are per capita land size, **ownership of transport equipment** and **ownership of communication equipment**. Both of the latter are further proxies for household specific transaction costs. Land may have indirect positive impacts on market participation by enabling farmers to generate production surpluses, overcome credit constraints, where land can be used as collateral for credit, and allow them to adopt improved technologies that increase productivity. Ownership of communication equipment such as telephone, radio and television is expected to have a positive impact on the decision to participate in markets. Ownership of transport equipment such as bicycles, motorcycles and vehicles is expected to have a positive impact on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to the market.

⁵ A household's dependency ratio is calculated by dividing the number of individuals under 15 years of age plus the number of individuals over 64 years of age by the number of individuals from 15 to 64 years.

Distances to service and infrastructure: **Distances to tarmac road and extension service** are included to capture the role of travel costs in influencing market participation. It is expected that longer distances increase travel time and travel costs, which impact negatively on market participation. These are location specific and to a lesser extent household specific measures of transaction costs.

Membership in groups: **Participation in farmer groups increases** a household's access to information important to production and marketing decisions. Many farmer groups also engage in group marketing as well as credit provision for their members. It is expected that membership in groups will positively impact on market participation. This may be a measure of household specific as well as location specific transaction costs.

Output prices: District median prices for various crops and milk are used. For crops grouped in one category, the simple average of the district median prices for the individual crops is used. District median prices were constructed from the actual prices reported by the households that sold produce. Prices are indirect indicators of location specific transaction costs, reflecting cost of commerce and integration of the local market in the national/ regional market. Prices could also constitute indirect measures of crop specific transaction costs. For instance, crop characteristics such as perishability might make prices of such crops to fluctuate differently from those of storable crops. Higher output price acts as an incentive to sell. Output price is, therefore, expected to have a positive impact on market participation.

Agro-regional zone dummies were included in the analyses to account for differences in agricultural potential across the zones. The Lowlands have the least agricultural potential. Western transitional, Western highlands and Marginal rain shadow can be said to be medium potential while Central highlands and High potential maize zone have the highest agricultural potential. It is expected that market participation would be lower in marginal agricultural potential zones.

To account for variations across the survey years of 2000, 2004 and 2007, year dummies were included using 2000 as the comparison year.

2.2.2.3 Estimation

As discussed earlier, the output supply functions are estimated using the double hurdle model of Craig (1971) involving a Probit model for the first stage and truncated normal regression

for the second stage. The two stages of the double hurdle are estimated separately based on the assumption that the respective error terms (ε and μ ; η and ν) are not correlated.

2.2.3 Input and Output Categories

Participation in input markets is included in the descriptive analyses only. Inputs included in the descriptive analyses are inorganic fertilizers and improved maize varieties. Use of improved maize varieties has been analyzed given the importance of maize as main staple crop and investments that have gone into development of improved maize seed varieties in Kenya in the recent past. Apart from these inputs trends in access to credit has also been analysed.

Participation in maize, vegetables, fruits and milk (cow milk) markets is included in both descriptive and econometric analyses. Maize is the main staple crop in Kenya widely grown in virtually all agricultural regions of the country. The category for vegetables includes kales (*sukuma wiki*), onions, cabbages, tomatoes and cowpeas leaves while in the fruits category are avocados, mangoes and pawpaw among others. Maize is not perishable and can be stored for future consumption or marketing. Vegetables, fruits and milk, on the other hand, are highly perishable and must be consumed or sold off a few hours or days after harvesting/production. This makes market access for vegetables, fruits and milk critical for the producing households.

3. Data and Sample

The data for this study was drawn from the Tegemeo Agricultural Policy Research and Analysis (TAPRA) panel data set collected by Tegemeo Institute of Egerton University with support from the United States Agency for International Development (USAID). The TAPRA dataset was collected over a ten year period (1997-2007) and was obtained through rural household surveys covering 24 administrative districts, 39 divisions and 120 villages using structured questionnaires. The data was classified into 8 agro-regional zones based on existing agro-ecological zones and population density⁶. Detailed information on land use, crop production, livestock and livestock products, off-farm activities, demographic characteristics, consumption, food security and asset endowment were collected.

⁶Refer to Argwings-Kodhek (1997) for a detailed discussion on the sample design

This current study is based on 1,275 households and covers the 1999/00, 2003/04 and 2006/07 cropping years (hereafter referred to as 2000, 2004 and 2007, respectively). The distribution of the sampled districts and interviewed households across various agro-regional zones is presented in Table 1. The agro-regional zones represent differing agricultural potential with the Lowlands having the lowest potential, Western transitional and Marginal rain shadow represent medium potential while the Highlands and the High potential maize zone have the highest agricultural potential.

Table 1: Distribution of Sampled Districts by Agro-Regional Zones

Agro-regional zone	Districts	No. of households
Coastal Lowlands	Kilifi, Kwale	75
Eastern Lowlands	Machakos, Mwingi, Makueni, Kitui, Taita-Taveta	145
Western Lowlands	Kisumu, Siaya	153
Western Transitional	Bungoma (lower elevation), Kakamega (lower elevation)	148
Western Highlands	Vihiga, Kisii	129
Central Highlands	Nyeri, Muranga, Meru	242
High-Potential Maize Zone	Kakamega (upper elevation), Bungoma (upper elevation) Trans Nzoia, Uasin Gishu, Bomet, Nakuru, Narok	346
Marginal Rain Shadow	Laikipia	37
Overall sample		1275

4. Results and Discussion

Descriptive analyses on the characteristics of the poor households and their use of inputs and participation in output markets are presented and discussed in this section. Results of the econometric estimation of output market participation are also presented and discussed.

4.1. Descriptive Analysis Results

4.1.1. Socio-economic Characteristics of the Households

This sub-section presents a discussion on socio-economic characteristics the poor households. Characteristics of the non-poor households are included for comparison purposes. The level of household income per adult equivalent was used as the basis for defining a household as poor or non-poor. Household income comprised of crop income (gross value of crop production less input costs); livestock income (gross value of livestock products plus sales of live animals less purchases of live animals plus input costs); salaries for all household members; business income for all household members; income from informal labour employment for all household members; and remittances and share dividends received by all

household members. To account for differences in the size of households, adult equivalents (see Annex 1) categorization was used to get household annual income per adult equivalent, which was converted into monthly values by dividing by 12. The resulting monthly income per adult equivalent for each household in each of the three years was compared with nominal poverty threshold for that year: Ksh 1,347/month in 2000; Ksh 1,490/month in 2004; and Ksh 1,598/month in 2007. The nominal poverty lines for the respective years were computed by linear extrapolation of the Kenya rural poverty lines for 1997 (Ksh 1,239) and 2006 (Ksh 1,562) as provided by the Kenya National Bureau of Statistics. A household is defined as poor in a particular year if its monthly income per adult equivalent is below the poverty threshold and non poor if its income per adult equivalent was at par with or above the poverty threshold for that year.

On the basis of this, it is observed that the proportion of poor households declined from 42% to 38% between 2000 and 2007 (Table 2). This declining trend in poverty is generally consistent with that observed at the national level over the same time period. Regional differences, however, exist in the distribution of poverty. It is observed that the proportion of poor households is highest in the Western and Coastal Lowlands and Western Highlands and lowest in the Central Highlands. Western and Coastal Lowlands are among the regions with low agricultural potential.

Table 2: Percent of Poor Households

Zone	2000		2004		2007	
	No. of hh	%	No. of hh	%	No. of hh	%
Coastal Lowlands	45	60.0	48	64.0	39	52.0
Eastern Lowlands	60	41.4	42	29.0	57	39.3
Western Lowlands	118	77.1	103	67.3	89	58.2
Western Transitional	55	37.2	77	52.0	68	45.9
High Potential Maize Zone	128	37.0	129	37.3	119	34.4
Western Highlands	69	53.5	84	65.1	66	51.2
Central Highlands	45	18.6	41	16.9	32	13.2
Marginal Rain Shadow	19	51.4	7	18.9	9	24.3
Overall Sample	539	42.3	531	41.6	479	37.6

The characteristics of the poor households are grouped into two: demographic and economic characteristics.

4.1.1.1 Demographic Characteristics

The demographic characteristics considered are education and age of household head and household size and dependency ratio. Dependency ration was computed as the ratio of the

number of household members aged below 15 years and those aged above 64 years to the number of household members aged from 15 to 64 years.

The proportion of household heads under each of the broad education categories is presented in Table 3. In the overall, over 70% of the households were headed by persons with at least primary level of education. Approximately 20% of the household heads had secondary education while only slightly over 5% of the heads had post-secondary education. The proportion of household heads with no formal education averaged 20% across the three years. Among the poor and non-poor households, a closely similar distribution in education as with the overall sample is observed. However, a higher proportion of the poor has no formal education while a lower proportion has secondary education compared to the proportions among the non-poor households. This reveals the clear disadvantage that the poor household heads have with respect to education.

Table 3: Proportion of Households by Education Category, Age of Household Head, Household Size and Dependency Ratio

	Year	Income poor	Income non-poor	Overall sample
Education level (% of hhs)				
No education	2000	27.3	13.9	19.5
	2004	26.4	16.1	20.4
	2007	25.9	16.1	19.8
Primary education	2000	57.7	50.1	53.3
	2004	56.3	48.8	51.9
	2007	57.0	50.5	52.9
Secondary education	2000	13.7	27.0	21.4
	2004	15.4	23.7	20.2
	2007	15.0	23.6	20.4
Post secondary	2000	1.3	9.0	5.7
	2004	1.9	11.4	7.5
	2007	2.1	9.8	6.9
Age (Years)	2000	55.0	52.7	53.7
	2004	57.1	56.0	56.5
	2007	58.9	58.5	58.7
Size (No. of residents)	2000	7.2	6.2	6.6
	2004	6.8	5.5	6.0
	2007	6.8	5.2	5.8
Dependency ratio	2000	0.9	0.8	0.8
	2004	0.9	0.7	0.8
	2007	0.8	0.7	0.8

The mean age of household head increased between 2000 and 2007 (Table 3), the sample being a panel. The heads' ages for the poor and non-poor households show no significant difference. In the overall, the mean household size declined from seven to six between 2000

and 2007. The mean size of poor households is larger than that of the non-poor across all the years. Dependency is also higher in the poor than non-poor households.

4.1.1.2 Economic Characteristics

Household Income

In the overall, the annual household income per adult equivalent increased from Ksh. 23,462 in 2000 to Ksh. 47,584 in 2007 (Table 4), a trend that is also observed among both the poor and non-poor households. However, the poor's income levels are significantly lower than those for the non-poor households; the non-poor's income levels are about five times those of the poor. This indicates that the poor really cannot productively engage in farming activities given the limitations they are likely to face in acquiring productivity enhancing inputs.

Table 4: Household Mean Annual Income and Shares of Income Components

	Year	Income poor	Income non-poor	Overall sample
Total income (Ksh)	2000	55,200	236,039	159,590
	2004	60,035	249,532	170,612
	2007	72,922	262,029	190,984
Income per adult equivalent (Ksh)	2000	7,389	35,171	23,426
	2004	10,784	59,934	39,464
	2007	13,423	68,140	47,584
Shares of income components (%)				
Crop	2000	49.5	48.7	49.0
	2004	47.5	42.8	44.7
	2007	46.5	44.8	45.4
Livestock	2000	18.8	18.1	18.4
	2004	20.6	20.3	20.4
	2007	17.7	19.6	18.9
Businesses & Informal labour	2000	18.5	14.6	16.1
	2004	16.0	14.8	15.3
	2007	22.5	16.6	18.6
Salaries and & Remittance	2000	13.2	18.7	16.5
	2004	15.8	22.1	19.7
	2007	13.3	18.9	17.0

The pattern in the share of income components shows that crop enterprises generally account for the largest share in household income, but has declined from 49% to 45% between 2000 and 2007. The share of business and informal labour activities has gone up by about three percentage points during the same period. A similar trend is also observed between the poor and non-poor households. However, the contribution of crops to household income is higher (46-49%) among the poor households compared to the non-poor households (43-49%). The share of businesses and informal labour activities is also higher among the poor than non-

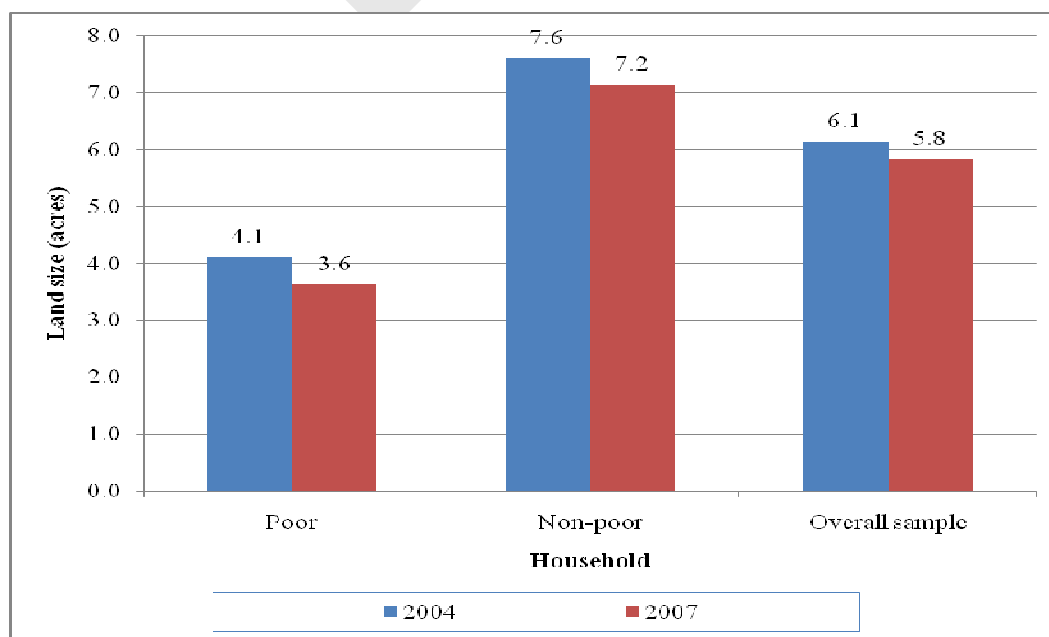
poor households, and has increased more among the poor households. The share of salaries and remittance, in the contrary, is higher among the non-poor households.

Combined, the farm (both crops and livestock) is the most important livelihood source for the households; it contributes to over 68% and over 66% to the poor and non-poor households' income respectively. After agriculture, the poor rely more on businesses and informal labour activities, which is essentially the informal rural sector, while their non-poor counterparts rely more on income from formal employment sector. Developing agriculture and the informal rural sector would be key intervention areas for helping the poor out of poverty.

Household Land Size

On average, the sampled households owned six acres of land (Figure 1). The poor households owned smaller land sizes than their non-poor counterparts. It should also be noted that household land size generally declined between 2004 and 2007, indicating increasing pressure on land among the agricultural households, perhaps as a result of frequent subdivision. These results suggest that the income poor households also double as being land poorer relative to their non-poor counterparts. With smaller land sizes, the only hope for the poor households to make any meaningful gains from agriculture lies in improving productivity of their land and having assured market for their produce.

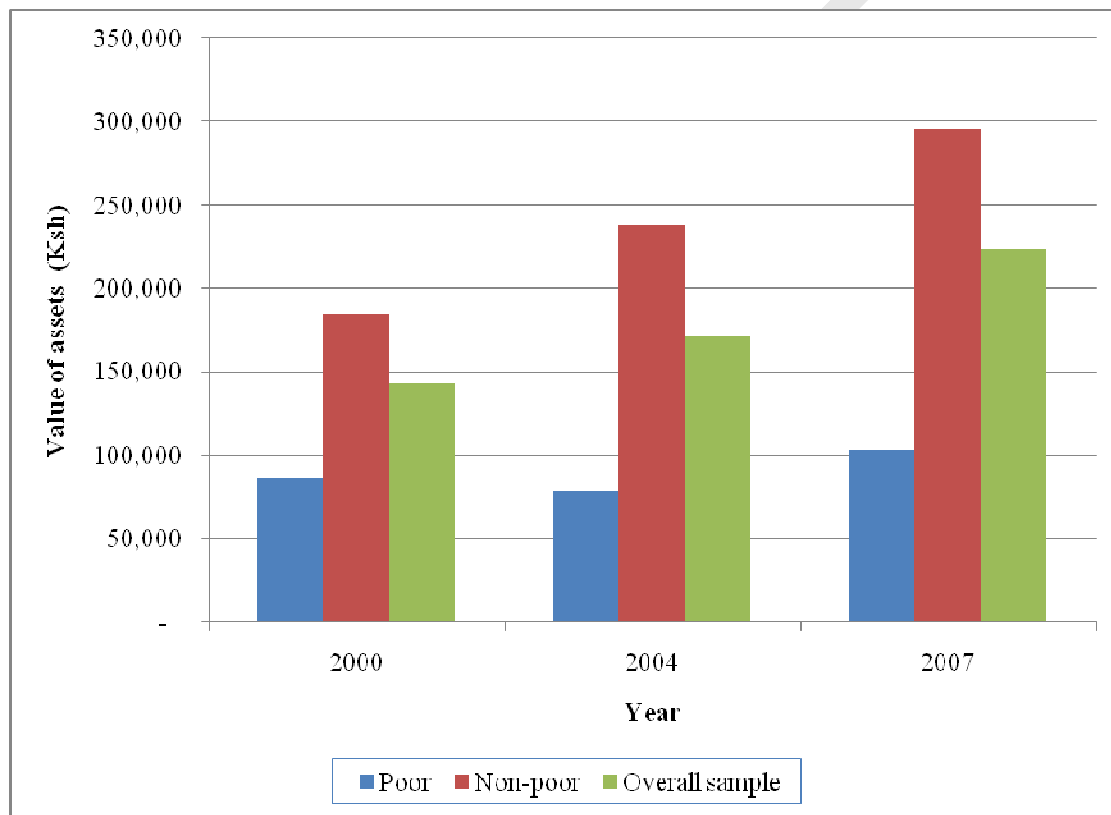
Figure 1: Mean Household Land Size



Household Assets

The mean value of household assets is presented in Figure 2. Three observations are made. First, the value of household assets generally increased between 2000 and 2007 for all households, implying that households allocate some of their incomes to accumulating assets, given that household income also increased during this period. Secondly, the increase in asset values between 2000 and 2007 is lower for the poor than non-poor households. Lastly, mean asset value for the poor is significantly lower than for the non-poor households.

Figure 2: Mean Value of Household Assets



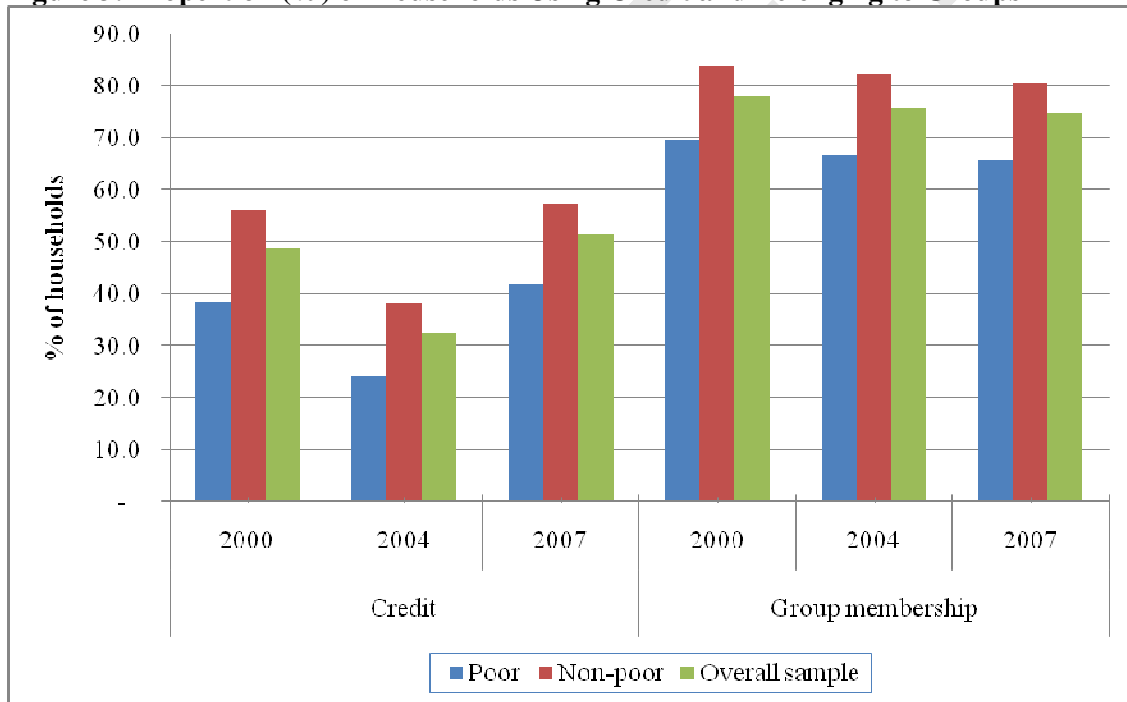
Use of Credit and Membership in Groups

Availability of reliable and affordable credit to farmers is of critical importance in strategies aimed at improving their production and marketing capacity. Collective action by farmers can allow stronger bargaining power in the market for inputs and outputs and thus contribute to achieving economies of scale. It also provides a platform for sharing information that may be helpful in production and marketing activities by the farmers. Trends in the proportion of households that used credit and the proportion with membership in farmer organizations/groups are presented in Figure 3. In the overall, the proportion of households

that used credit decreased between 2000 and 2004, and then rose in 2007 to reach just over 50%. This trend is mirrored among both the poor and non-poor households. However, a higher proportion of non-poor than poor households used credit; about 68% versus 41% in 2007. This gap may suggest more limited access to credit by the poor households. A study by Kibaara (2006) found that few credit providers were willing to lend to agriculture, and that supply of agricultural credit was skewed towards the high potential agricultural regions served by mainly commodity based credit providers and cooperatives.

In the overall, the proportion of households belonging to farmer organizations/groups remained over 70% between 2000 and 2007. Across all the years, a higher proportion of non-poor than poor households had membership in groups, suggesting less collective action among the poor than non-poor households.

Figure 3: Proportion (%) of Households Using Credit and Belonging to Groups



4.1.2. Market Participation

4.1.2.1 Input Markets

Farmers use fertilizer as a source of essential plant nutrients added to the soil to replenish the soil reserve for better and proper crop performance. Due to the diminishing land-holdings, many farmers continue to cultivate the same piece of land every year and in some cases grow

the same crops. As a result, most of the soils have been experiencing declining fertility status over the years and very few areas can still support crop production without supplementary nutrients through addition of fertilizers. In addition to fertilizer, seed is also another important production inputs that greatly affects productivity, and therefore, production and market participation. Maize is the dominant staple crop in Kenya and has attracted a lot of investment in development and multiplication of high yielding varieties. For instance, between 2001 and 2006, 94 new varieties of improved maize were released by the Ministry of Agriculture (Nyoro et al, 2006).

There are several interrelated components within the decision environment in which farmers operate that influence their adoption of these productivity enhancing technologies. Feder et al (1985) identify some of the constraints to the adoption of agricultural technologies as lack of credit, limited access to information, aversion to risk, inadequate farm size, insufficient human capital, tenure arrangements and absence of adequate farm equipment as key constraints to rapid adoption of innovations in less developed countries. In the overall, the proportion of households that used fertilizer increased between 2000 and 2007; from 70% to 76% (Table 5). Fertilizer use intensity⁷, in the contrary, declined during the period. This trend was also observed among both the poor and non-poor households. However, a higher proportion of non-poor than poor households across all the years used fertilizer and in a more intensive way. This may imply that poor households still lag behind in productivity gains possible with increased fertilizer use. But the fact that fertilizer adoption has been increasing even amongst the poor could be an indication of increased awareness of the benefits of using fertilizer among the smallholder farmers. It could also be a deliberate response by smallholder farmers to increasingly deteriorating soil fertility for the purpose of attaining reasonable productivity levels. This pattern could also be an indicator of increased availability of commercial fertilizer in local markets near the farmers.

In the overall, the proportion of households adopting improved maize varieties and the proportion of maize area planted with improved varieties increased between 2000 and 2007. A higher proportion of non-poor than poor households adopted improved maize varieties across the three years. The non-poor households also planted a larger proportion of maize area with improved varieties. The low adoption rates of improved maize varieties among the

⁷ Fertilizer use intensity is defined as kg of fertilizer applied per acre of cultivated land by households that used fertilizer.

poor may have implications on production levels of maize, which in turn can affect participation in maize market as seen later in the report. There is need for more concerted efforts to increase the use of improved varieties to raise agricultural productivity among small holder farmers in general, but with specific emphasis on the poor. The challenge would be to develop seed production and delivery systems that encourage wider use of improved seeds for crops important to the households in terms of food security and income generation.

Table 5: Proportion of Households Using and Intensity of Use of Fertilizer and Improved Maize Varieties

Input	Year	Poor	Non-poor	Overall sample
Fertilizer				
Adoption (% of hhs)	2000	51.0	83.6	69.8
	2004	60.5	80.1	71.9
	2007	63.7	83.4	76.0
Use rate (Kg/acre)	2000	47	83	72
	2004	53	71	65
	2007	44	72	63
Improved maize seed				
Adoption (% of hhs)	2000	55.7	79.5	69.4
	2004	56.7	78.2	69.2
	2007	62.4	81.3	74.2
Use rate (% of acres planted)	2000	50.5	74.5	64.4
	2004	51.6	71.9	63.4
	2007	55.1	74.5	67.2

4.1.2.2 Output Markets

Kenya's agro-ecological conditions are varied and this dictates the kinds of agricultural enterprises in which farmers engage as well as performance of the enterprises. However, maize, vegetables, fruits and dairy are enterprises that are widely spread in many agro-ecologies of Kenya. The proportion of the sampled households engaged in these enterprises, volume of production and the importance of each of the crops enterprises in the households' total value of crop production across the three years are presented in Table 6. In the overall, maize is produced by over 95% of the households across the three years, indicating the importance of the enterprise to the majority of Kenyan rural households. Vegetables are produced by over 85% and fruits by over 80% of the sample households. Approximately 68% of the sample households engage in dairy production. Between the poor and non-poor households, the proportion of households engaged in maize, vegetables and fruits enterprises does not show significant variation. For dairy, it is observed that just over half of the poor households compared to over 77% of the non-poor households are engaged in the enterprise.

Table 6: Percent of Households Producing Various Enterprises, Volume of Production and Percent Contribution to Total Value of Crop Production

Commodity	Year	% producing			Volume (kg) of production			% contribution to total value of crop production		
		Poor	Non-poor	Overall sample	Poor	Non-poor	Overall sample	Poor	Non-poor	Overall sample
Maize	2000	94.4	97.1	96.0	776	2,691	1,895	33.6	27.0	29.8
	2004	97.6	98.8	98.3	935	2,405	1,797	36.1	29.3	32.1
	2007	98.1	98.2	98.2	1,244	2,453	1,999	40.9	30.0	34.1
Vegetables	2000	81.8	92.4	87.9	425	1,700	1,198	11.0	12.0	11.6
	2004	94.7	97.4	96.3	549	1,635	1,190	13.5	12.7	13.0
	2007	92.9	93.5	93.3	481	1,353	1,027	12.0	11.6	11.8
Fruits	2000	73.8	80.0	77.4	653	1,247	1,008	11.1	6.6	8.4
	2004	81.4	83.3	82.5	503	1,195	911	9.0	6.7	7.6
	2007	80.0	82.3	81.4	482	757	656	7.7	5.3	6.2
Milk	2000	55.8	78.7	69.0	520	2,055	1,406			
	2004	52.5	80.6	68.9	527	2,510	1,684			
	2007	53.2	77.8	68.5	499	2,220	1,573			

On the volume of production, the overall pattern indicates that poor households compared to their non-poor counterparts produce significantly less of all the three enterprises. The difference in the volume produced between these groups of households may be influenced by differences in resource endowments such as land size and differences in use of productivity enhancing inputs such as fertilizer and improved varieties as observed earlier.

Various crop enterprises have various weights in terms of their contribution to total value of crop production. Among the three crops, maize has been the most important crop enterprise in terms of contribution to total value of crop production across the three years. The share of maize in the total value of crop production has in fact been on the rise. The contribution of vegetables has remained in the neighbourhood of 12%. The weight of fruits in total value of crop production has declined from 8% to 6% between 2000 and 2007. The overall pattern and trend is also observed among the poor and non-poor households. However, two observations are made. Firstly, the contribution of maize to total value of crop production is higher and has increased much faster among the poor than non-poor households, suggesting the more dominant importance of maize among the poor than non-poor households. Secondly, the poor have experienced faster decline in the contribution of fruits than have the non-poor households.

The proportion of households that marketed the various enterprises, mean volume of sales and the extent of sales (measured by the proportion of marketed production) are presented in

Table 7. In the overall, there is a general increase in the proportion of households that marketed the various enterprises across the years. As expected, vegetables, fruits and milk (the perishable commodities) in that order lead in the proportion of households marketing. The proportion of households marketing maize remained below 50%, but increased from 40% to 48% between 2000 and 2007. With respect to poverty, several observations are made. Firstly, a higher proportion of non-poor compared to poor households engaged in marketing of the various enterprises. Secondly, the proportion of poor households marketing maize increased faster than that of the non-poor. This may suggest that maize market is becoming more accessible to the poor. It may also be a reflection of the increased volumes in production (as observed in Table 6), which generated more marketable surplus. Thirdly, participation in marketing of fruits declined among the poor while it increased among the non-poor households. Finally, the proportion of the poor households marketing milk remained between 32% and 33%, just about half the proportion among the non-poor households.

Table 7: Proportion (%) of Households that Marketed Various Crops, Sales Volume and Proportion of Marketed Production

Commodity	Year	% selling			Volume (kg) of sales			% of production sold		
		Poor	Non-poor	Overall sample	Poor	Non-poor	Overall sample	Poor	Non-poor	Overall sample
Maize	2000	28.7	47.8	39.9	175	1,413	900	9.4	22.7	17.2
	2004	33.4	54.8	46.0	257	1,295	866	11.7	26.1	20.2
	2007	37.9	53.5	47.6	319	1,220	882	12.8	24.3	20.0
Vegetables	2000	52.0	68.2	61.9	202	1,206	811	26.3	38.5	33.7
	2004	62.6	71.7	68.0	276	1,066	742	27.3	37.0	33.0
	2007	55.3	69.4	64.1	219	951	677	26.6	39.1	34.4
Fruits	2000	50.4	54.0	52.5	199	527	395	21.5	27.0	24.8
	2004	53.9	58.9	56.8	185	638	452	24.1	28.6	26.8
	2007	48.7	63.4	58.0	215	431	351	25.5	34.7	31.3
Milk	2000	32.1	64.5	50.8	222	1,142	753	17.0	35.6	27.7
	2004	31.6	67.1	52.3	208	1,510	968	16.1	39.3	29.6
	2007	33.0	67.8	54.7	220	1,411	964	17.1	40.1	31.4

In the overall, marketed volumes of the commodities do not show a clear trend between 2000 and 2007, except for vegetables and fruits where there was a marked decline. The mean volumes marketed for all the enterprises are significantly lower among the poor than non-poor households, a scenario that reflects differences in production volumes as observed earlier. The differences in the mean volumes sold between the poor and non-poor households are particularly large for maize and milk. However, the volume of maize marketed increased among the poor and declined among the non-poor households between 2000 and 2007.

The proportion of households marketing various enterprises and the average volume marketed may mask important information about the extent of participation by the households in the markets for the various enterprises. The extent of market participation can also be captured by looking at the proportion of the quantity produced that ended up being sold for each enterprise. For all the enterprises and across all the years, less than 35% of the production was marketed, with maize registering the least (17-20%) and vegetables the highest (33-34%) proportion marketed. Comparing 2000 and 2007, it is observed that in the overall the proportion of marketed production increased for all the four enterprises. Across poverty status, the proportion of marketed production is lower among the poor than non-poor households for all the enterprises. This again is reflective of the differences in production volumes earlier observed. The differences in the proportion of marketed production between the poor and non-poor households are largest for maize and milk. However, a marked increase in the proportion of marketed production is observed in maize and fruits among the poor and in fruits and milk among the non-poor households between 2000 and 2007.

Market concentration, defined as the distribution of the total volume marketed across the sample households, is presented in Table 8. Generally, it is observed that between 59% and 87% of all marketed volumes for the various commodities were sold by top 20% of households across the three years. The bottom 20% of the households sold less than 2.5% of the marketed volumes for the commodities. For maize, over 70% of the marketed volume was sold by top 20% of the households while the bottom 20% sold less than 1.5%. For vegetables and fruits, over 75% and 65% respectively of the marketed volume was sold by top 20% of the households, while the bottom 20% of the households sold less than 1% for vegetables and 2% for fruits. Milk market is the least concentrated, with the top 20% of the sellers accounting for 59-62% and the bottom 20% accounting for about 2% of the marketed volume. These results indicate that agricultural commodity market participation among the smallholder farmers is dominated by a minority of households; majority of the smallholder farmers are locked in subsistence production.

Table 8: Distribution of Marketed Volumes of Various Commodities across the Sample

Commodity	Year	Lowest 20%	20%	20%	20%	Highest 20%	Total
Maize	2000	0.5	2.8	4.3	13.3	79.1	100.0
	2004	1.3	3.3	8.5	15.3	71.7	100.0
	2007	1.4	4.3	7.4	14.8	72.1	100.0
Vegetables	2000	0.6	1.9	5.1	14.4	78.0	100.0
	2004	0.6	2.1	5.6	15.1	76.5	100.0
	2007	0.8	3.1	6.0	12.8	77.3	100.0
Fruits	2000	0.9	2.7	6.4	13.6	76.4	100.0
	2004	0.9	3.1	6.1	12.6	77.3	100.0
	2007	1.7	4.8	10.0	17.6	65.9	100.0
Milk	2000	2.2	5.9	9.8	20.0	62.2	100.0
	2004	1.8	6.6	10.8	19.8	61.0	100.0
	2007	2.4	6.0	11.8	20.5	59.3	100.0

4.1.2.3 Output Market Participation and Poverty Dynamics

Based on the previous definition of poverty, households were classified into various categories based on their income poverty status in order to explore the relationship between market participation and poverty dynamics. The households that remained in poverty in the three years are categorized as ‘always poor’ while those whose income levels remained above the poverty line in all the three survey years are classified as ‘always non-poor’. The households that ‘exited’ poverty are those that were poor in 2000 or in both 2000 and 2004 then rose above the poverty line in 2007. On the other hand, households that were not poor in 2000 or in both 2000 and 2004 but became poor in 2007 are classified as having ‘descended’ into poverty. The ‘oscillators’ are those households that moved in and out of poverty or vice versa in the three survey years. The interest here is to explore trends in output market participation by the households that exited poverty to provide a snapshot of the role market participation could play in poverty reduction.

Changes in participation in the commodity markets among the households categorised by poverty status is presented in Tables 9. Changes in participation are computed as the difference in the participation statistics between 2007 and 2000. A positive difference means an increase and a negative difference means a decline in participation. It is observed that among the households that exited poverty there are tremendous and largest increases in both the percent selling and the marketed proportion, compared to the other categories of households. The increase in the marketed proportion among these households is particularly huge for fruits and milk. Among the households that descended into poverty, the percent selling declined for vegetables, fruits and milk and marginally increased for maize. The

marketed proportions also declined for all the commodities except fruits where marginal increase is observed. These results point to a strong relationship between market participation and exiting poverty, and indicate the role that expanded access to markets among small holder farmers can play in poverty reduction.

DRAFT

Table 9: Participation in Output Markets by Poverty Status

Poverty status	Crop	% producing			% selling			% of production sold		
		2000	2007	Change (2007-2000)	2000	2007	Change (2007-2000)	2000	2007	Change (2007-2000)
All households	Maize	96.2	98.4	2.2	39.9	47.6	7.7	17.2	20.0	2.8
	Vegetables	88.3	93.6	5.4	61.9	64.1	2.2	33.7	34.4	0.7
	Fruits	85.1	89.7	4.6	52.5	58.0	5.4	24.8	31.3	6.5
	Milk	69.0	68.5	-0.5	73.6	79.9	6.2	40.2	45.9	5.7
Always poor	Maize	94.9	98.7	3.8	30.4	32.5	2.1	9.3	10.1	0.8
	Vegetables	83.4	94.5	11.1	51.8	52.3	0.5	26.6	22.8	-3.8
	Fruits	81.7	89.4	7.8	48.0	47.7	-0.3	19.5	24.1	4.6
	Milk	50.2	49.4	-0.8	47.9	53.0	5.1	24.0	26.0	2.0
Always non poor	Maize	97.4	98.5	1.1	51.0	60.0	9.0	25.2	28.7	3.5
	Vegetables	94.3	94.3	0.0	72.3	69.7	-2.6	41.1	42.1	1.1
	Fruits	88.1	89.5	1.4	52.8	62.4	9.6	26.9	34.3	7.4
	Milk	84.2	84.6	0.4	85.9	91.2	5.3	48.1	54.1	6.0
Exited	Maize	93.8	97.8	4.0	25.6	42.8	17.2	9.1	18.0	8.9
	Vegetables	80.9	92.9	12.0	51.1	66.5	15.4	26.1	33.7	7.5
	Fruits	80.6	91.5	10.9	48.8	66.3	17.5	20.6	36.1	15.5
	Milk	61.7	66.1	4.4	60.7	82.0	21.3	32.7	48.7	16.0
Descended	Maize	98.8	97.0	-1.8	42.7	44.1	1.4	18.8	16.6	-2.2
	Vegetables	91.0	92.2	1.2	59.2	59.1	-0.1	34.9	30.9	-4.1
	Fruits	86.4	85.7	-0.7	55.1	51.6	-3.5	26.5	28.1	1.5
	Milk	66.5	58.1	-8.4	75.7	71.1	-4.5	39.6	38.3	-1.4
Oscillated	Maize	95.2	99.5	4.3	38.5	45.5	6.9	15.2	16.6	1.4
	Vegetables	86.2	93.1	6.9	61.1	66.9	5.7	30.3	34.2	3.9
	Fruits	86.3	91.4	5.1	58.9	55.6	-3.3	28.8	30.1	1.3
	Milk	67.0	66.0	-1.1	73.0	74.2	1.2	40.1	41.6	1.4

4.2 Econometric Results

In this section, we discuss econometric estimation results of output market participation among the poor households. Correlates of market participation (whether a household sold) and extent of participation (the proportion of produce sold) are discussed for maize, vegetables, fruits and milk. The discussion focuses on only the variables of interest (gender of household head, land size, membership in farmer groups, ownership of transport and communication equipment, distance variables, output and prices and agricultural potential), which will inform conclusions for this. The probit results on the decision to participate in markets and truncated regression analysis results on the extent of market participation are presented in Tables 10. Gender of the household head neither significantly influences the decision to participate nor the extent of participation in any of the commodity markets among the poor.

Larger per capita land size is significantly associated with a higher probability of participating in fruits market. In addition, per capita land size also positively and significantly influences marketed volumes for fruits and maize. These results indicate the constraints the poor, majority of who happen to have smaller land sizes, face in accessing markets perhaps due to their inability to produce marketable surplus.

Membership in farmer organizations/groups is positively and significantly associated with a higher probability of participating in maize, vegetables and milk markets. After the decision to participate in the market has been made, membership in group does not have significant influence on the volume sold except for vegetables. These results underscore the importance of social capital in accessing markets by the poor smallholder farmers.

Ownership of communication equipment such as radio, television and/or phone is positively and significantly associated with a greater likelihood of participating in vegetables, fruits and milk markets. It also has a positive and significant influence on the amount sold for maize. Ownership of transport equipment is significantly associated with the decision to sell maize. It, however, has no significant influence on the decision about how much to sell of any of the commodities.

Table 10: Correlates of Decision to Participate and Extent of Participation in Maize, Vegetables, Fruits and Milk Markets

Variable	Correlates of decision to participate			Correlates of extent of participation			
	Maize	Vegetables	Fruits	Maize	Vegetables	Fruits	Milk
Gender of household head (1=male)	-0.08 (0.84)	0.12 (1.30)	-0.08 (0.81)	-0.04 (1.38)	0.02 (0.58)	-0.02 (0.96)	0.01 (0.61)
Household head age (years)	-0.02 (1.18)	0.00 (0.15)	0.02 (1.02)	-0.00 (0.32)	-0.01 (1.59)	-0.00 (0.21)	0.00 (0.33)
Household head age squared	0.00 (0.90)	-0.00 (0.39)	-0.00 (0.91)	0.00 (0.31)	0.00 (1.28)	0.00 (0.30)	-0.00 (0.40)
Education of household head (1=no education)	-0.06 (0.58)	-0.17* (1.83)	-0.24** (2.39)	0.00 (0.03)	-0.05* (1.65)	-0.02 (0.84)	0.01 (0.54)
Education of household head (1=secondary education)	0.14 (1.34)	0.06 (0.59)	-0.05 (0.43)	0.02 (0.64)	-0.04 (1.24)	-0.01 (0.19)	0.02 (0.85)
Education of household head (1=post-secondary education)	-0.06 (0.23)	-0.55** (2.15)	0.11 (0.39)	0.20*** (2.62)	0.05 (0.66)	0.02 (0.22)	0.04 (0.75)
Dependency ratio	-0.09* (1.90)	-0.07 (1.39)	0.04 (1.00)	-0.02 (1.34)	-0.03* (1.78)	0.00 (0.32)	-0.01 (0.56)
Per capita land size (acres)	0.00 (0.12)	-0.02 (0.55)	0.11** (2.35)	0.03** (2.33)	-0.00 (0.07)	0.02* (1.80)	0.01 (1.43)
Membership in farmer group (1=yes)	0.23*** (2.78)	0.27*** (3.39)	0.11 (1.30)	0.01 (0.42)	0.05** (2.08)	0.03 (1.07)	-0.00 (0.02)
Ownership of communication equipment (1=yes)	0.06 (0.60)	0.19* (1.95)	0.27*** (2.70)	0.09** (2.24)	0.03 (1.04)	0.05 (1.59)	-0.01 (0.32)
Ownership of transport equipment (1=yes)	0.14* (1.66)	0.07 (0.91)	-0.06 (0.67)	0.04 (1.39)	0.02 (0.81)	-0.00 (0.12)	-0.02 (0.87)
Distance to tarmac road (km)	0.01** (2.51)	-0.01* (1.75)	0.00 (0.41)	-0.00 (0.26)	0.00 (1.13)	-0.00*** (2.72)	-0.00* (1.88)
Distance to extension service (km)	-0.00 (0.22)	0.00 (0.51)	-0.00 (0.04)	-0.00 (0.04)	0.00 (1.27)	0.00 (0.87)	-0.00 (0.84)
Commodity price (ksh/kg)	-0.01 (0.31)	0.01* (1.69)	-0.02 (1.06)	0.03*** (3.00)	-0.00 (1.30)	-0.02*** (3.33)	0.00 (0.36)
Coastal Lowlands dummy	-0.39 (1.64)	-0.19 (0.98)	-0.27 (1.39)	0.05 (0.40)	0.10 (1.41)	-0.04 (0.64)	0.15 (1.21)

Variable	Correlates of decision to participate				Correlates of extent of participation			
	Maize	Vegetables	Fruits	Milk	Maize	Vegetables	Fruits	Milk
Eastern Lowlands dummy	0.17 (0.86)	0.14 (0.81)	0.28* (1.66)	-0.92*** (3.38)	-0.00 (0.05)	0.07 (1.15)	-0.01 (0.13)	0.00 (0.04)
Western Lowlands dummy	0.06 (0.34)	0.46*** (2.82)	-0.06 (0.38)	-1.42*** (5.85)	-0.04 (0.52)	0.15*** (2.66)	0.03 (0.67)	-0.01 (0.34)
Western Transitional dummy	0.60*** (3.24)	0.81*** (4.70)	-0.14 (0.80)	-0.15 (0.62)	0.08 (1.02)	0.13*** (2.31)	-0.03 (0.56)	0.04 (1.06)
High Potential Maize Zone dummy	1.16*** (6.77)	0.48*** (3.08)	-0.20 (1.22)	-0.32 (1.47)	0.22*** (3.15)	0.10* (1.92)	0.07 (1.50)	0.02 (0.50)
Western Highlands dummy	0.54*** (3.18)	0.88*** (5.44)	0.07 (0.46)	-0.92*** (3.93)	-0.11 (1.47)	0.12*** (2.25)	-0.03 (0.57)	0.01 (0.26)
Marginal Rain Shadow dummy	0.03 (0.09)	0.42 (1.37)	-0.05 (0.12)	0.31 (0.86)	0.08 (0.65)	0.24*** (2.63)	-0.09 (0.81)	0.11*** (2.09)
Year of survey (1=2004)	0.08 (0.91)	0.24*** (2.67)	0.07 (0.77)	0.08 (0.70)	0.04 (1.40)	-0.08*** (2.90)	0.02 (0.93)	-0.01 (0.70)
Year of survey (1=2007)	0.23** (2.06)	0.02 (0.19)	-0.07 (0.74)	0.08 (0.67)	0.06 (1.46)	-0.01 (0.41)	0.11*** (3.95)	-0.01 (0.24)
Constant	-0.40 (0.59)	-0.71 (1.22)	-0.75 (1.20)	1.47* (1.74)	-0.19 (0.79)	0.63*** (3.50)	0.49*** (2.61)	0.48*** (3.30)
Observations	1493	1387	1212	835	496	790	620	499

Absolute value of z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Distance to tarmac road, which is an indicator of travel time and cost to the market, shows mixed results both in the model for decision to participate in the markets and in the extent of participation. It is significantly and positively associated with the decision to participate in maize markets and negatively – as expected – and significantly associated with the decision to participate in vegetables and milk markets. This puzzling result can be explained by the characteristics of the commodities, where perishability may possibly be influencing farmers to specialize depending on the relative advantages of their location. After decision to sell has been made, distance to tarmac negatively and significantly influences the amount sold for fruits and milk.

Contrary to expectations, prices for maize and fruits are negatively, albeit insignificantly, associated with the decision to sell. For vegetables and milk, prices have a positive and significant association with the decision to sell, as expected. The influence of prices on the amount sold is significant and positive for maize but significant negative for fruits. A possible explanation for the unexpected behavior of price on market participation could be that many of the households are actually net buyers of food crops and a high price may encourage them to keep as much on the farm as possible to avoid making significant expenditures to buy more food

In comparison to poor households in Central Highlands, poor households in the Western Transitional, High Potential Maize Zone and Western Highlands have a significantly higher propensity to participate in maize and vegetable markets. Also poor households in the Western Lowlands have a higher likelihood of participating in vegetable markets compared to their poor counterparts in the Central Highlands. Poor households in the Eastern and Western Lowlands and Western Highlands compared to their counterparts in the Central Highlands have a lower likelihood of selling milk. These results suggest that Western Lowlands, Transitional and Highland zones may be productive in vegetables such that their production levels allow for marketable surplus. Efforts in improving the production of vegetables in these regions may be desirable in enhancing greater market participation by the poor households. The amount of maize sold is significantly higher in the High Potential Maize Zone than in the Central Highlands. On the other hand, the poor in Western Lowlands, Transitional and Highland zones, Marginal Rain Shadow and High Potential Maize Zone compared to their counterparts in the Central Highlands sell significantly larger volume of vegetables. For milk, the poor in the

Marginal Rain Shadow compared to those in the Central Highlands sell significantly larger volume.

5. Key Findings and Conclusion

It has been argued that market-oriented production can achieve welfare gains through comparative advantage, economies of scale and regular interaction and exchange of ideas. Unfortunately, some groups, who in particular would benefit from this kind of welfare boost, may be constrained by several factors in their quest to participate in the market for their goods and services. This study set out to assess the extent of market participation by the poor smallholder farmers in Kenya with a view to identifying constraints to market participation among and potential market opportunities for this group of households.

The results from the study reveal differences in market participation across selected commodity groups among the poor and non-poor households. Compared to their non-poor counterparts, the poor households have generally lower market participation for the selected enterprises. Some of the characteristics of the poor households that could partly explain this low market participation include the following:

- Low literacy levels, which could impact on their managerial ability on the farm.
- Small land sizes, indicating that they are not only income poor but also land poor. This constrains them in producing marketable surplus
- Low asset values, indicating that they also experience asset poverty, which compromise their agricultural productive capacity, and consequently limit their ability to exploit available market opportunities
- Low access to credit, which may limit their ability to access inputs to improve their production
- Low levels of adoption of productivity enhancing inputs such as fertilizers and improved seeds, which limits their ability to produce surpluses for the market as observed in the low volumes they produce and sell

There are tremendous increases in market participation for the various commodities among the households that exited poverty. Among the households that descended into poverty, market

participation either declined or increased marginally. These results point to a strong relationship between market participation and exiting poverty, and indicate the role that expanded access to markets among small holder farmers can play in poverty reduction.

Results also show that the commodity markets are generally very highly concentrated; the top 20% of the selling households account for over 70% of the marketed volume for maize, vegetables and fruits and about 60% of the marketed volume of milk. This indicates that majority of the smallholders are essentially subsistent and any sales they make are very negligible in volumes to derive any substantial market benefits. Improving production through raising productivity levels need to be considered alongside any measures that are aimed at reducing transaction costs that hinder access to markets by these farmers.

In terms of factors that could enhance market participation for the poor, we find that land size play a significant role, indicating that innovations that enhance the poor's access to land can be instrumental in raising their ability to exploit market opportunities. However, with diminishing household land sizes, it would be more prudent to focus on improving the productivity of land. The results also show that membership in farmer organizations/groups is positively associated with increased market participation. Collective action is important in facilitating access to information and, where the groups deal in financial services, credit. Both credit and information are critical in accessing market opportunities. Therefore, increasing social capital for the poor can be of great value in enhancing the households' access to markets.

References

- Ahikire, J., (Undated). Gender and Poverty in Uganda Today. Department of Women's Studies Makerere University, Kampala Uganda. Available at <http://www.fiuc.org/iaup/sap/>
- Alene, A.D., Manyong, V.M., Omany, G., Mignouna, H.D., Bokanga, M., Odhiambo, G., 2008. Smallholder market participation under transaction costs: Maize supply and fertilizer demand in Kenya. *Food Policy* 33: 318-328.
- Asfaw, S. 2007. Does EurepGAP standard marginalize poor farmers? – Evidence from Kenya. *Agriculture and Rural Development*, 2/2007: 45-47.
- Ayieko, M. W. and Tschirley, L.T. (2006). Enhancing access and utilization of quality seed for food security in Kenya. Tegemeo Institute Working Paper No. 27/2006. Tegemeo Institute of Agricultural Policy and Development, Nairobi.
- Barrett, C.B. (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy* 33: 299-317.
- Barrett, C.B., Swallow, B.M., 2006. Fractal poverty traps. *World Development* 34 (1), 1–15.
- Bellemare, M.F. and Barrett, C.B. (2006). An ordered Tobit model of market participation: evidence from Kenya and Ethiopia. *American Journal of Agricultural Economics* 88(2): 324-337.
- Bijman, J. G. Ton, G. Meijerink (2007). Empowering Small holder Farmers in Markets: National and International Policy Initiatives. WUR: Wageningen.
- Binswanger H.P. and von Braun J. 1991. Technological change and commercialization in agriculture: The effect on the poor. *The World Bank Research Observer* 6(1):57–80.
- Boughton, D., D. Mather, C. Barrett, R. Benfica, D. Abdula, D. Tschirley, B. Cungura. 2007. Market Participation by Rural Households in a Low-Income country: An Asset-Based Approach Applied to Mozambique. *Faith and Economics*, 50:64-101.
- Chamberlin, J. 2007. Defining smallholder agriculture in Ghana: Who are smallholders, what do they do and how are they linked with markets? Prepared as part of the Ghana Strategy Support Program and submitted for consideration as an IFPRI Discussion Paper. Available at <http://www.ifpri.org/publication/defining-smallholder-agriculture-ghana>
- de Janvry A., Fafchamps M. and Sadoulet, E. 1991. Peasant household behaviour with missing markets: Some paradoxes explained. *The Economic Journal* 101(409): 1400–1417.

- Deininger, K., Okidi, J. (2001). Rural Households: Incomes, Productivity, and Non-farm Enterprises. In Reinikka, R., Collier, P. (Eds.), *Uganda's recovery: the role of farms, firms, and government*, Washington, DC: The World Bank.
- Dercon S. 1996. Risk, crop choice and savings: Evidence from Tanzania. *Economic Development and Cultural Change* 44(3), 485–513.
- Diao, X. and Dorosh, P. (2007). Demand Constraints on Agricultural Growth in East and Southern Africa: A General Equilibrium Analysis. *Development Policy Review*, 25 (3): 275-292.
- Diao, X., Dorosh, P., and S. Rahman. 2007. Market Opportunities for African Agriculture A General Equilibrium Examination of Demand-Side Constraints on Agricultural Growth in East and Southern Africa. Research Report 154, International Food Policy Research Institute, Washington DC.
- Dyer, G.A., Boucher, S., Taylor, J.E., 2006. Subsistence response to market shocks. *American Journal of Agricultural Economics* 88 (2), 279–291.
- Ehui, S., Benin, S. and Paulos, Z (2009), Policy Options for Improving Market Participation and Sales of Smallholder Livestock Producers: A case study of Ethiopia. *Draft prepared for presentation at the 27th Conference of the International Association of Agricultural Economists (IAAE), 16-22 August 2009, Beijing, China.*
- Elepu, G. and Nalukenge, I. 2007. Contract Farming, Smallholders and the Commercialization of Agriculture in Uganda: The Case of Sorghum, Sunflower, Rice, and Poultry Contract Schemes, Uganda Programme for Trade Opportunities and Policy (UPTOP)
- Ellis, F. (2005). *Rural livelihoods and diversity in developing countries*. Oxford University Press, Oxford.
- Fafchamps M. 1992. Cash crop production, food price volatility, and rural market integration in the third world. *American Journal of Agricultural Economics* 74(1), 90–99.
- Feder, G., Just, R. and Zilberman, D. (1985). Adoption of Agricultural Innovations in Developing Countries: A Survey. *Economic Development and Cultural Change* 33(2):225-298.
- Freeman, H. and Omiti, J. 2003. “Fertilizer Use in Semi-Arid areas of Kenya: Analysis of Smallholder Farmers’ Adoption Behavior under Liberalized Markets.” *Nutrient Cycling in Agroecosystem*, 66: 23-31.
- Gabre-Madhin E, Barret C.B. and Dorosh P. 2003. Technological change and price effects in agriculture: Conceptual and comparative perspectives. MTID Discussion Paper No. 62, IFPRI, Washington, DC, USA.

- Goletti, Francesco. 2005. *Agricultural Commercialization, Value Chains and Poverty Reduction*. Making Markets World Better for the Poor Discussion Paper No.7. Hanoi: Asian Development Bank.
- Govere J, Jayne T.S and Nyoro J. 1999. Smallholder commercialization, interlinked markets and food crop productivity: Cross-country evidence in eastern and southern Africa. Available at http://www.aec.msu.edu/fs2/ag_transformation/atw_govere.pdf
- Hazell, P. (2005). Is there a future for small farmers? *Agricultural Economics*, 32(1s), 93-101.
- Heckman, J. J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (1): 153-161.
- Heltberg, R. and Tarp, F. (2001). Agricultural supply response and poverty in Mozambique. UNU-WIDER, Helsinki.
- Jaleta, M., Gebremedhin, B. and Hoekstra, D. (2009). Smallholder commercialization: Processes, determinants and impact. ILRI Discussion paper No. 18.
- Jayne TS, Yamano T and Nyoro J. (2004). Interlinked credit and farm intensification: Evidence from Kenya. *Agricultural Economics* 31:209–218.
- Jayne, T.S, Yamano, T. and Nyoro, J. (2004). Interlinked credit and farm intensification: Evidence from Kenya. *Agricultural Economics* 31:209–218.
- Jayne, T.S., D. Mather and E. Mghenyi (2005). Smallholder farming in difficult circumstances: Policy issues for Africa. MSU International Development Working Paper No. 86, 2006. Department of Agricultural Economics and the Department of Economics, Michigan State University, East Lansing, Michigan 48824-1039, U.S.A.
- Kelly, V., Diagona, B., Reardon, T., Gaye, M. and Crawford, E. 1996. "Cash Crop and Food Grain Productivity in Senegal: Historical View, New Survey Evidence and Policy Implications." MSU International Development Working Paper Series, No. 20.
- Kennedy, E.T. and Cogill, B. (1987). Income and nutritional effects of the commercialization of agriculture in southwestern Kenya. International Food Policy Research Institute, Washington.
- Key N, Sadoulet E. and de Janvry A. 2000. Transaction costs and agricultural household supply response. *American Journal of Agricultural Economics* 82(2), 245–259.
- Kibaara, B. (2006). Rural Financial Services in Kenya: What is Working and Why? Tegemeo Institute Working Paper No. 025, 2006. Tegemeo Institute of Agricultural Policy and Development, Nairobi.

- Makhura, M. N., J. Kirsten, C. Delgado. 2001. Transaction Costs and Smallholder Participation in the Maize Market in the Northern Province of South Africa. *Seventh Eastern and Southern Africa Regional Maize Conference*
- March, C., Smyth, I. and Mukhopadhyay, M. (1999). A guide to Gender Analysis Frameworks. Oxford: Oxfam GB.
- Mathenge and Tschirley (2008): Off-farm work and Farm Production Decisions: Evidence from Maize-Producing Households in Rural Kenya, 2008, Tegemeo Working Paper series No 33/2008, Tegemeo Institute/Egerton University
- Muyanga, M. and Jayne, T.S. (2006). Agricultural Extension in Kenya: Practice and Policy Lessons. Tegemeo Institute Working Paper No. 026, 2006. Tegemeo Institute of Agricultural Policy and Development, Nairobi.
- Nepal, R., Thapa, G.B. (2009), "Determinants of Agricultural Commercialization and Mechanization in the Hinterland of a City in Nepal", *Applied Geography*, Vol. 29, pp. 377-389
- Nepali, R. and Thapa, G.B. 2009. Determinants of agricultural commercialization and mechanization in the hinterland of a city in Nepal. *Applied Geography* (29) 377-389
- Nyoro, J., Ayieko, M. And Songa, J. (2006). Program for Africa's Seed Systems Country report: Kenya. Unpublished report.
- Nyoro, J., Ayieko, M. and Songa, J. 2009. Program for Africa's Seed Systems, Country report: Kenya. Unpublished report.
- Okello, J., Narrod, C., and D. Roy. 2008. Smallholder Compliance with International Food Safety Standards is not a Fantasy: Evidence from African Green Bean Producers. Fresh Perspectives: Agrifood standards and pro-poor growth in Africa. Agrifoodstandards.net.
- Omiti, J. M., D. J. Otieno, T. O. Nyanamba, E. McCullough. 2009. Factors Influencing the Intensity of Market Participation by Smallholder Farmers: A Case Study of Rural and Peri-urban areas of Kenya. *Affare* 3 (1): 57-82.
- Pender J and Alemu D. 2007. Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia. Discussion Paper No. 75. IFPRI, Washington, DC, USA.
- Pingali LP. & Rosegrant M.W. 1995. Agricultural commercialization and diversification: Process and policies. *Food Policy* 20(3), 171-185.
- Pingali P, Khwaja Y and Meijer M. 2005. Commercializing small farmers: Reducing transaction costs. FAO/ESA Working Paper No. 05-08. FAO, Rome, Italy.

- Place, F., J. Pender, S. Ehui (2006). Key Issues for the Sustainable Development of Smallholder Agriculture in the East African Highlands, In Pender, J., F. Place, and S. Ehui, eds. *Strategies for land management in the East African highlands*. Washington, D.C.: International Food Policy Research Institute
- Poulton, C., J. Kydd, and A. Dorward. 2006. Overcoming market constraints on pro-poor agricultural growth in Sub-Saharan Africa. *Development Policy Review* 24 (3): 243–277.
- Quisumbing, A.R., Brown, L.R., Haddad, L., and Meizen-Dick, R. (1998). The Importance of Gender Issues for Environmentally and Socially Sustainable Rural Development. In: E. Lutz (Ed.), *Agriculture and the Environment: Perspectives on Sustainable Rural Development*. Washington, D.C: The World Bank.
- Renkow, M., Hallstrom, D.G., Karanja, D.D., 2004. Rural infrastructure, transactions costs and market participation in Kenya. *Journal of Development Economics* 73 (3), 349–367.
- Stephens, E.C. and Barrett, C.B. (2009). Incomplete credit markets and commodity marketing behaviour. Pitzer College and Cornell University.
- Strasberg, P.J. et al 1999. Effects of Agricultural Commercialization on Food crop input use and productivity in Kenya. MSU International Development, Working Paper No. 71.
- Strasberg, Paul J. 1997. Smallholder Cash Cropping, Food-Cropping and Food Security in Northern Mozambique. Ph.D. dissertation, Michigan State University.
- Suri, T., Dave, T., Irungu, C., Gitau, R., and Kariuki, D (2007). Poverty, Inequality and Income Dynamics in Kenya, 1997-2007. Tegemeo Institute of Agricultural Policy and Development, Nairobi.
- Tipraqsa, P. and Schreinemachers, P. (2009) Agricultural commercialization of Karen Hill tribes in northern Thailand. *Agricultural Economics* 40 (1): 43-53
- von Braun, J. (1995). Agricultural commercialization: impacts on income and nutrition and implications for policy, *Food Policy* (20), 187-202.
- Wooldridge, J. 2002. *Econometric Analysis of Cross-Section and Panel Data*. Massachusetts: The MIT Press.
- World Bank (2008). “Agriculture for Development”. *World Development Report 2008*. Washington: World Bank.

Annexes

Annex 1: Conversion Factors for Computing Adult Equivalents

AGE	MALES	FEMALES
Under 1 year	0.33	0.33
1 - 1.99	0.46	0.46
2 - 2.99	0.54	0.54
3 - 4.99	0.62	0.62
5 - 6.99	0.74	0.70
7 - 9.99	0.84	0.72
10 - 11.99	0.88	0.78
12 - 13.99	0.96	0.84
14 - 15.99	1.06	0.86
16 - 17.99	1.14	0.86
18 - 29.99	1.04	0.80
30 - 59.99	1.00	0.82
60 and Over	0.84	0.74

As per the World Health Organization (Jayne and Argwings-Kodhek 1997)