Factors influencing the intensity of market participation by smallholder farmers: A case study of rural and peri-urban areas of Kenya

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Abstract

Participation in commercial agriculture holds considerable potential for unlocking suitable opportunity sets necessary for providing better incomes and sustainable livelihoods for small-scale farmers. This study examined factors that influence the intensity of market participation among smallholder farmers in Kenya. Data was obtained through a rapid rural appraisal and a household survey. A truncated regression model was applied in the analysis. Results showed that farmers in peri-urban areas sold higher proportions of their output than those in rural areas. Distance from farm to point of sale is a major constraint to the intensity of market participation. Better output price and market information are key incentives for increased sales. These findings demonstrate the urgent need to strengthen market information delivery systems, upgrade roads in both rural and peri-urban areas, encourage market integration initiatives, and establish more retail outlets with improved market facilities in the remote rural villages in order to promote production and trade in high value commodities by rural farmers.

Keywords: Smallholder farmers; Intensity; Market participation; Kenya

Le fait de participer à l'agriculture commerciale peut considérablement aider les petits fermiers à mettre en place un contexte propice, capable de générer de meilleurs revenus ainsi que des moyens d'existence durables. Cette étude examine les facteurs qui influencent l'intensité de la participation au marché des petits fermiers au Kenya. Les données ont été obtenues grâce à une

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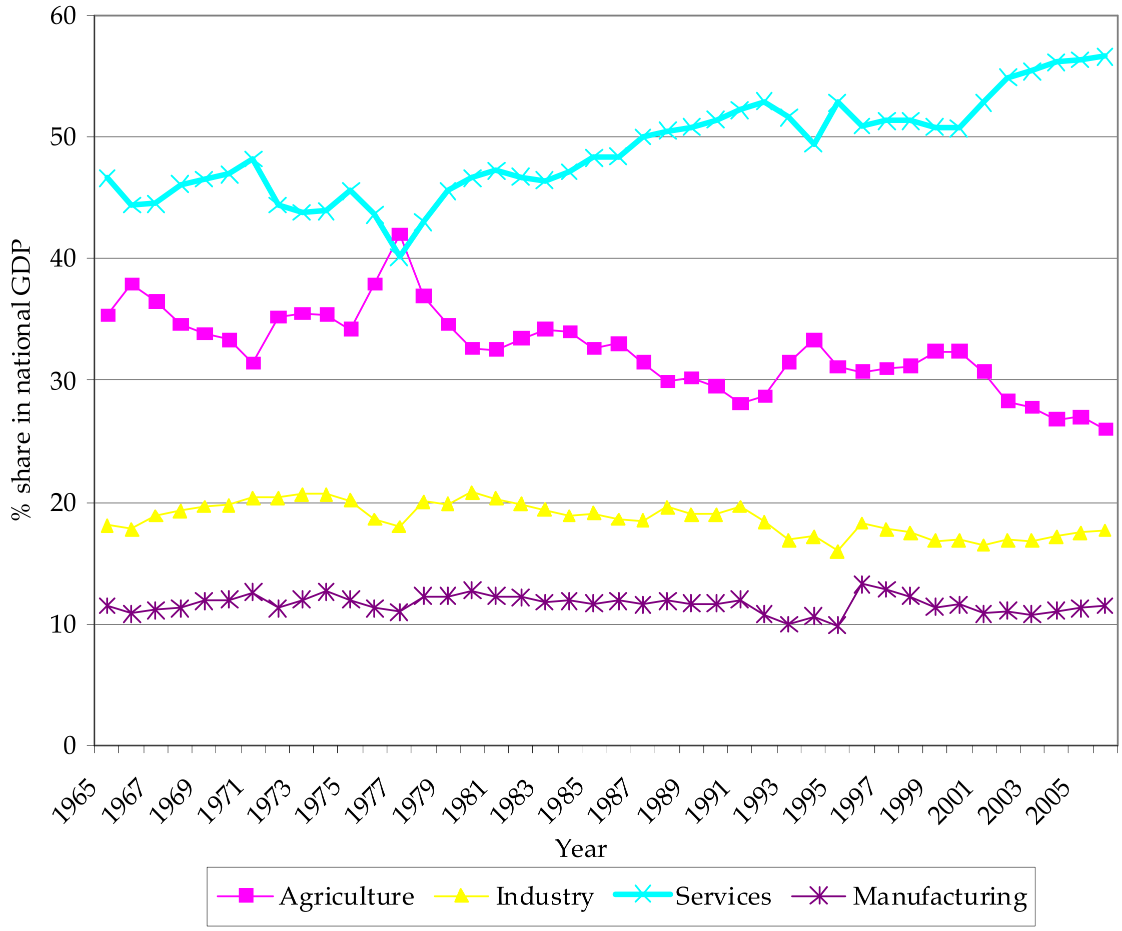
évaluation rurale rapide et un sondage auprès des ménages. Pour cette analyse, on a utilisé un modèle de régression tronqué. Les résultats ont montré que les fermiers des zones périurbaines avaient vendu une plus grande proportion de leurs produits que ceux des zones rurales. La distance entre la ferme et le point de vente représente un handicap majeur, freinant l'intensité de la participation au marché. Un meilleur prix à la production et une information du marché sont les motivations clés si l'on désire une augmentation des ventes. Ces conclusions prouvent qu'il existe un besoin urgent de renforcer les systèmes de dissémination de l'information concernant les marchés, d'améliorer le système routier dans les zones périurbaines et rurales, d'encourager les initiatives d'intégration au marché, et d'établir dans les villages des zones reculées, plus de points de vente avec facilités de marché améliorées afin de promouvoir la production et permettre aux fermiers des zones rurales de vendre des produits plus lucratifs.

Mots clés : *Petits fermiers ; Intensité ; Participation au marché ; Kenya*

1. Introduction

Agriculture continues to be a strategic sector in the development of most low-income nations. It employs about 40% of the active labor force globally. In sub-Saharan Africa, Asia and the Pacific, the agriculture-dependent population is over 60%, while in Latin America and high-income economies the proportions are estimated at 18% and 4%, respectively (World Bank, 2006). Close to two thirds of the natural wealth in low-income countries is embodied in crop and pasture land. In Kenya, agriculture supports the livelihoods of about 80% of the rural population (about 85% of them being small-scale farmers). Only 22% of land in Kenya is arable (though another 40% has potential for irrigated agriculture). The agricultural sector employs 70% of the national labor force through forward and backward industrial linkages, thus providing food and incomes to individuals and households. Small-scale agriculture in Kenya is characterized by landholdings of less than five acres and no more than 20 ruminant animals (mainly cattle, sheep and goats) and a few chickens per farm household. Crop-livestock production systems on small-scale farms often entail very little use of purchased inputs and limited application of modern technology.

As is the case in other East African countries that depend on agriculture, the share of Kenya's agriculture in the gross domestic product (GDP) has been declining over time, while that of the services sector has been gradually increasing. Agriculture's contribution to GDP dropped from 42% in 1977 to 26% in 2006, while the services sector's share rose from 40% to 56% during the same period (Figure 1).



Source: World Bank, 2007

Figure 1: Sectoral contribution to national GDP in Kenya, 1965–2006

The industrial and manufacturing sectors have also witnessed fluctuating performance over time, partly because the cost of doing business in the East African Community (EAC) is higher than in other comparable countries such as Brazil, Ghana, Guatemala and Vietnam (EABC, 2006). The country's total GDP rose from US$8,591 million in 1990 to US$19,292 million in 2006, while the aggregate population is slightly over 36 million (RoK, 2007).

This study highlights factors that explain smallholder farmers' intensity of participation in commercial agriculture in rural and peri-urban areas of Kenya. The findings are expected to inform priority setting in resource allocation policy for improved agriculture development, not only in these areas but also in other similar countries.

Three important subsectors (maize, horticulture and dairy) are considered in the analysis. Maize is a staple food in Kenya – consumed in various forms by 96% of the population. It is produced on 49% of the arable land. Maize production is characterized by high smallholder participation, and its development in an integrated manner with other high-value agro-enterprises is posited to have considerable positive impact on rural incomes, poverty reduction and food security.

Horticulture (especially vegetables) is an important source of income for the smallholders, who account for over 70% of its total production (McCulloch & Ota, 2002). It has higher returns than most other cash crops and is suitable for production on the currently declining farm sizes in varying agro-ecological zones (Minot & Ngigi, 2003). It continues to be one of the key growth-enhancing economic sectors, contributing about 23% of total export earnings for the country (CBS, 2006). The main horticultural crops grown by smallholder farmers for both subsistence and commercial purposes in Kenya are cabbages, tomatoes, kales (*Sukuma wiki*) and onions.

The dairy subsector contributes a significant share of income and food for the majority of the population. It supports more than 650,000 smallholder farmers and an increasing number of small-scale entrepreneurs in the milk marketing system. Annual national milk production has risen steadily from 2.8 billion liters in 2002 (Muriuki et al., 2003) to more than 3.2 billion liters by mid 2007: Kenya is currently the leading milk producer in the EAC. Consumer demand for milk is estimated to be growing at 3.6% per year, largely due to the increase in population, improvement in purchasing power and increasing market penetration into (previously) non-milk-consuming areas. This growing demand offers scope for wealth creation among small-scale farmers and poor remote households in Kenya. Indeed, effective participation in the production of milk for emerging lucrative markets is considered a supply-response to the potential for increments in household wealth among farmers in developing countries over time (Burke et al., 2007).

2. Rationale for commercial agriculture

Agricultural commercialization involves the transition from subsistence farming to increased market-oriented production. It is commonly measured as the ratio of percentage value of marketed output to total farm production (Haddad & Bouis, 1990). Market-oriented production entails modernization of systems, which depends heavily on the intensification of production processes, adoption of new technology and farm mechanization. As the marketed share of agricultural output increases, input utilization decisions and output combinations are progressively guided by profit maximization objectives. This process leads to the systematic substitution of non-traded inputs with purchased inputs, the gradual decline of integrated farming systems, and the emergence of specialized high-value farm enterprises (Omiti et al., 2006).

Commercial orientation of smallholder agriculture leads to a gradual decline in real food prices due to increased competition and lower costs in food marketing and processing (Jayne et al., 1995). These changes improve the welfare of smallholder farmers in two ways: for consumers, low food prices increase the purchasing power for food, while for producers a decline in food prices enables the reallocation of limited household incomes to high-value non-food agribusiness sectors and more profitable non-farm enterprises. Promoting investments in agricultural commercialization could reduce poverty but requires great shifts in priority setting in the rural and peri-urban areas of Kenya (Geda et al., 2001). The potential benefits of higher product prices and lower input prices due to commercialization are effectively transmitted to poor households when market access is guaranteed (IFAD, 2001).

While a decline in agriculture's share in the national income is expected as economies grow, such transformation needs to be accompanied by a significant reduction in the total agriculture-dependent population. The main forces that generally drive commercialization include an increased market demand for food arising largely from population growth and demographic change; urbanization; the development of infrastructure and market institutions; the development of the nonfarm sector and broader economy; rising labor opportunity costs; and macroeconomic, trade and sectoral policies affecting these forces (Pingali & Rosegrant, 1995). At the farm level, commercialization is mainly affected by agro-climatic conditions and risks; access to markets and infrastructure; community and household resource and asset endowments; the development of local commodity, input, and factor markets; laws and institutions; and cultural and social factors affecting consumption preferences, production, and market opportunities and constraints (Pender et al., 2006). These factors affect commercialization by altering the conditions of commodity supply and demand, output and input prices, and transaction costs and risks faced by farmers, traders and others in the agricultural production and marketing system (Pender & Alemu, 2007).

Different levels of progress associated with agricultural commercialization have been recorded in various developing and transition economies in Latin America, southeast Asia and sub-Saharan Africa. For instance, advances in biotechnology have transformed the Brazilian agriculture into a more commercially oriented sector, with improved contributions to the country's economy. Demand-driven agriculture supported by institutional incentives and technological improvements, especially the adoption of new high-yielding varieties of food grains (the 'green revolution'), are often cited as significant contributors to economic transition in many Asian countries. Some important lessons that can be drawn from experiences in Latin America and the Asian countries are that:

(i) Emerging urban consumer preferences offer a huge potential for agricultural trade;

(ii) An increase in per capita purchases by rural households of most food items due to strong growth in the rural economy promotes the commercialization of the rural food economy; and

(iii) Increasingly, more low-income rural households adopt affordable and divisible technology packages and experience faster increases in their cash share of food expenditures than other population categories.

In comparable African countries such as Malawi, the process of agricultural commercialization has generally led to an increase in per capita household incomes, although the greatest benefits have been felt by the better-off households (Peters, 1999). Poor households often sell early in the season when the prices are at their lowest, and buy in the deficit season from the markets when prices are highest. Smallholder farmers in Kenya also experience similar price fluctuations. Weak institutional frameworks discourage effective involvement in commercial agriculture. Participation in well-functioning commodity markets causes real food prices to drop, which increases smallholder farmers' purchasing power for food (as consumers) while enabling them to reallocate their scarce household incomes (as producers) to high-value non-food agribusiness sectors and non-farm enterprises. For example, involving the private sector in agricultural investments in Ethiopia is resulting in considerable advances in modernization of cereal grain marketing and the flower export sector (Kherallah et al., 2000). Improving market infrastructure by providing more and better markets and making it easier for farmers to access them is also deemed necessary for increasing the level of commercialization, especially in developing countries (Shilpi & Umali-Deininger, 2008).

3. Methodology

3.1 Study sites

The study focused on one peri-urban district, Kiambu, and one rural district, Kisii. The two districts were chosen on the basis of their different levels of poverty and degrees of commercialization (CBS, 2005). Kiambu District in Central Province was selected mainly because of its proximity to Nairobi, where there is a potentially huge and lucrative urban market for maize meal and dairy and horticultural products. Food production systems in Kiambu are generally more commercialized, considering its comparative advantage in most physical infrastructure (roads, water, electricity, etc.) compared to other parts of the country. Kisii District, about 400 km from Nairobi in southwestern Kenya, has a modest level of commercialization and relatively modest infrastructure. The two districts were chosen through a stakeholder consultative workshop from 16 districts that were initially considered to be representative of Kenya's agricultural transformation process. High potential areas such as Uasin Gishu and Trans Nzoia were omitted because they had fewer smallholder maize farms and more large-scale plantations. Comparable districts such as Bungoma, Kakamega and Meru were dropped because of budgetary limitations and logistical constraints. Districts with extreme levels of poverty and bad infrastructure (particularly those in the semi-arid northeastern part of Kenya) were not selected because of their very low levels of agricultural commercialization and absence of all three subsectors this study focuses on: maize, horticulture and dairy.

Kiambu District has four agro-ecological zones: Upper Highlands 70%, Upper Midlands 20%, Lower Highlands 5% and Lower Midlands 5%. The district has reddish brown volcanic soils and natural water supply from springs. The total land area in the district is 1458.3 km^2, of which 97% is arable. About 90% of the arable land is under smallholdings while the rest is under large farms. The altitude ranges from 1500 m to 2591 m above sea level and the average temperature is 26°C. The average annual rainfall is 1239.6 mm, occurring in a bimodal pattern: long rains from April to May and short rains from October to November. The main crops are coffee, tea, horticultural crops, potatoes, bananas, maize and beans. The main livestock activities are dairy farming (under zero grazing systems), poultry, pig, goat and sheep farming, and bee keeping. Over 70% of the dairy cows are Friesian, while the rest are Ayrshire, Guernsey, Jerseys and their crosses (RoK, 2001a). The average population density was 526 persons per km^2 in 1999 (CBS, 2003).

Kisii District has three agro-ecological zones: the Upper Midlands 75%, Lower Highlands 20% and Lower Midlands 5%. The district has a highland equatorial climate, red soils and several permanent rivers and streams that drain into Lake Victoria. The total land area is 1200 km^2. The altitude ranges from 1000 to 1800 m above sea level, with a mean temperature of 22°C. There are two rainfall seasons: long rains from April to June and short rains from September to November, recording an average annual rainfall of 1500 mm. About 78% of the land is arable, and 58% of this is under crops. The major crops cultivated are tea, coffee, pyrethrum, bananas, maize, vegetables, sugarcane, groundnuts, avocados and other fruits. The main livestock kept in the district are cattle, sheep, goats, chicken and donkeys. Over 80% of the cattle in Kisii are local zebu and their crosses, while only 10% of the cattle population is improved dairy herd (RoK, 2001b). The main livestock production systems are extensive grazing and tethering. The average population density was approximately 647 persons per km^2 in 1999 (CBS, 2003). Despite comparable typologies in landholdings and farm enterprise combinations in Kiambu and Kisii districts, differences in poverty incidence, distance to main urban centre (Nairobi), and level of infrastructure are useful delineating factors in assessing agricultural commercial orientation.

3.2 Data and sampling

Primary data from village and household levels are used in this paper. The study employed a purposive multi-stage random sampling technique to arrive at the various units used. In the first stage, a rapid rural appraisal (RRA) survey was conducted in 16 villages (Table 1) that had different levels of market access and market integration. Market access was measured by the state of the roads (bad, average and good) and the proportion of households with access to electricity. It was assumed that households with access to electricity and good roads could undertake basic post-harvest activities such as refrigeration of farm output (such as milk) and could access markets conveniently. The degree of market integration was measured by the distance to the nearest town or urban centre and the main type of market outlet (such as open-air, roadside, supermarket or retail shop) in that centre. After broad technical consultations, villages located within 2 km of the nearest town, and with at least one supermarket or wholesale store or milk cooperative were considered to have high market integration.

For each village type in Table 1, two villages are listed for Kiambu and two for Kisii. These represent all four village types (bad market access and low integration, bad market access and high integration, good market access and low integration, good market access and high integration). In a way, this controlled for fixed effects due to government administration and, to a lesser extent, agro-climate, history and culture. Identification of the farmers in each village was conducted jointly by the research team, the Ministry of Agriculture and Livestock officials (at the district, division and location levels) and the provincial administration (chiefs, assistant chiefs and village elders).

Table 1: Villages sampled in the rapid rural appraisal

Village type	Village name	Sample (n)	Sub-location	Location	Division	District
Bad market access and low integration	Gituamba	30	Gituamba	Kirenga	Lari	Kiambu
	Matimbei	18	Matimbei	Kamburu	Lari	Kiambu
	Obosando	27	Metembe	Kegogi	Marani	Kisii
	Bonyunyu*	21	Charachani	Keera	Nyamaiya	Kisii
Bad market access and high integration	Miumia	16	Miumia	Githunguri	Githunguri	Kiambu
	Ngenia	20	Ngewa	Ngewa	Githunguri	Kiambu
	Kionganyo	28	Kionganyo	Sensi	Marani	Kisii
	Mwogeto	31	Sensi	Sensi	Marani	Kisii
Good market access and low integration	Kamung'aria	26	Tiekunu	Ndeiya	Ndeiya	Kiambu
	Ndiuni	15	Ndiuni	Ndeiya	Ndeiya	Kiambu
	Bomwancha	33	Bomwancha	Bomariba	Suneka	Kisii
	Ititi	24	Gesoni	Bogeka	Mosocho	Kisii
Good market access and high integration	Gachie	25	Gachie	Kihara	Kiambaa	Kiambu
	Kabae	21	Ndumberi	Ndumberi	Kiambaa	Kiambu
	Matongo*	38	Kitaru	Kiangeni	Borabu	Kisii
	Amaiga	36	Kegati	Kegati	Kiogoro	Kisii

Source: Authors' rapid rural appraisal survey data (2007)
* These two villages are in the neighboring Nyamira District, which was separated from the larger Kisii District.

In each village, about 15 to 40 farmers were selected to ensure a fair mix of participants in the RRA survey based on gender, age, socioeconomic background and education level. These farmers were then organized into smaller groups of ten to 15 people for focus group discussions (FGDs). The FGDs delved into agricultural commercialization trends at village level. Structured check-list questionnaires were used to capture information in the FGDs.

In the second stage of the study, a household survey was conducted in the same villages one month after the FGDs. The aim of this survey was to investigate factors that influence the intensity of market participation on a purposive sample of those farmers who sell their output through specific channels. Farmers in the selected villages (where the distribution/location of those who sell farm output had been established in the FGDs) were randomly visited during the household survey. Each farmer was interviewed only on whichever of the three commodities (milk, kales or maize) he or she considered to offer more income than the other two. To avoid response bias, households that had participated in the RRA survey discussions (FGDs) were excluded from the household survey. Similarly, households that were not selling output were also omitted from the household survey. The purposive sample obtained consisted of 71 milk producers, 76 maize farmers and 77 vegetable producers, who were selling different proportions of their output through specific channels. Though small (owing to budget constraints), the sample used is representative of farm output sellers in the villages surveyed, as is the relative importance they attached to those commodities. Household data were collected by trained enumerators using a pre-tested questionnaire.

3.3 Analytical methods

i. Chow test for non-separability of data

Data used in this study were drawn from two districts that have different poverty levels, agricultural potential and other socioeconomic characteristics. However, a more robust test of predictive accuracy was necessary in order to determine whether it was more appropriate to estimate a pooled sample model or separate site-specific models (Johnston & DiNardo, 1997). This study used Chow's seminal test to establish whether data from both districts were significantly different (Chow, 1960). With the null hypothesis that the coefficients are equal across the subsamples (equation 1):

$$H_O : \beta_L - \beta_P = 0 \tag{1}$$

where β is the coefficient estimate, and L and P represent rural and peri-urban areas respectively. To constitute the Chow test, three separate linear regressions were estimated: one model for the pooled data (whole sample from rural and peri-urban areas) and separate regressions for the rural and peri-urban data. Using the residual sum of squares (RSS) for the restricted (whole sample) and unrestricted (subsample) models, an F-test was formulated as follows (equation 2):

$$F^* = \frac{RSS_W - (RSS_L + RSS_P)}{(RSS_L + RSS_P)} * \frac{(T - 2K)}{K} \tag{2}$$

where F* is the test statistic

RSS_W = residual sum of squares for the whole sample

RSS_L = residual sum of squares for the rural sample

RSS_P = residual sum of squares for the peri-urban sample

T = total number of observations in the whole sample

K = number of regressors (including the intercept term) in each unrestricted subsample regression

$2K$ = number of regressors in both unrestricted subsample regressions (whole sample).

The computed F* was then compared with the respective value of *F(K, T-2K)* at the 5% level of significance. Because the computed test statistic was greater than the respective F-statistic in all the cases examined for this study, the null hypothesis was rejected and it was concluded that the subsamples were significantly different (Table 2). Therefore, separate models were estimated for the rural and peri-urban data. A whole sample regression was also estimated to compare coefficients with those derived from the subsamples.

Table 2: Chow test results

Commodity	RSS_W	RSS_L	RSS_P	*F**	*F(K, T-K) at 5% significance level*	Decision
Dairy (milk)	9656.06	3858.20	1143.01	4.75	2.00	Separate models
Vegetables (kales)	15251.69	8032.20	770.33	4.18	1.99	Separate models
Maize	16103.68	5513.30	2994.59	5.00	1.99	Separate models

Source: Computation from authors' household survey data (2007)

ii. Descriptive analysis

Various graphs were used to illustrate national trends in production and village-level commercialization of the commodities analyzed. Household socioeconomic data and variables of analysis are presented through means, standard deviations and percentage frequency distributions.

iii. Truncated regression model

Previous studies on market participation have typically adopted a two-step analytical approach involving the unobservable decision to participate and the observed degree or intensity of participation in the markets (for example, Vance & Geoghegan, 2004; Alene et al., 2008).

However, this study purposively analyzed the intensity of market participation, in order to trace factors that influence the degree of commercialization among households in the four village types identified in the RRA survey. The observed percentage of output Y_i^* that is actually sold in the market was used as a relevant proxy for intensity of market participation (equation 3). The focus on intensity of participation would enable the identification of variations between the average village perception of commercialization and the household-specific output sale. The rationale for this is to harmonize priority setting and target policy interventions at village and household levels appropriately. This is expected to contribute towards relaxing some of the barriers that often hinder households from adopting remunerative livelihood strategies (Brown et al., 2006). Because of the predetermined selection of only market participants in this study, the data collected does not allow use of selectivity models such as those applied in similar studies by Goetz (1992), Omamo (1998) and Lapar et al. (2003). Nonetheless, this study builds on previous work by estimating the relative influence of some variables used in past studies on the intensity of rural and peri-urban market participation in Kenya.

A truncated regression model is applied to analyze determinants of percentage of farm output sold. Observations on households who do not sell their produce are excluded, i.e. the lower bound of the truncation. The model assumes normal distribution with constant variance (Greene, 2003).

$$Y_i^* = \beta_i X_i + \mu_i \tag{3}$$

where Y_i^* is the percentage of output that is sold, β_i is the vector of parameters to be estimated, X_i is the set of explanatory variables and μ_i is the error term. A zero value of Y_i^* is observed when a household has no surplus to sell but has excess demand on the commodity. On the other hand Y_i^* = 100 if a household sells all output. The specific variables to be estimated in the model are described in Table 3.

Table 3: Exogenous variables used in the regression models

Variable	Description	Measurement	Expected sign
Age	Age of the household head	Number of years	+
Gender	Gender of the household head	0 = female 1 = male	±
Education	Education level of the household head	0 = not completed secondary education 1 = completed secondary education	+
Household size	Number of people in the household	Number	±
Non-farm income	Proportion of non-farm income in total monthly household income	Ratio	±
Output	Total quantity of output produced per season for crops or per day for milk	Kilograms for crops and liters for milk	+
Distance	Average distance from farm to main point of sale	Kilometers	-
Market information	Market information source/arrangement	0 = informal 1 = formal	±
Unit price	Average price at which each unit of output is normally sold	Kenya shillings (Kshs)	+

Age of the household head is used as a proxy for experience in farming. This is expected to improve the intensity of market participation. Gender represents differences in market orientation between male and female heads of households. Cunningham et al. (2008) found that men are likely to sell more grain early in the season when prices are still high, while women prefer to store more output for household self-sufficiency. If this observation holds in the present study, the gender coefficient would be positive; otherwise a negative sign would be expected. Human capital, represented by the household head's formal education (at least secondary level) is posited to increase a household's understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia (Makhura et al., 2001). The household size explains the family labor supply for production and household consumption levels (Alene et al., 2008). A positive sign implies that a larger household provides cheaper labor and produces more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is labor-inefficient and produces less output but consumes a higher proportion, leaving smaller and decreasing proportions for sale.

Alene et al. (2008) also noted that non-farm income contributes to more marketed output if the non-farm income is invested in farm technology and other farm improvements. Otherwise, marketed farm output drops if non-farm income triggers off-farm diversification. To meet both household consumption requirements and market demand, a household intuitively needs to generate surplus output. Key et al. (2000) and Makhura et al. (2001) found that distance to the market negatively influences both the decision to participate in markets and the proportion of output sold. Thus, the variable transport costs per unit of distance increases with the potential marketable load size. For farmers in very remote rural areas, geographic isolation through distance creates a wedge between farm gate and market prices. This leads to a shift from production of profitable but highly perishable commodities such as fruits and vegetables to relatively storable low-value cereals (Stifel & Minten, 2008). Input use is also affected in these rural areas by the substitution of commercial high-value varieties with easily available and affordable though poor-yielding varieties. Consequently, through negative multiplier effects, distance can have severe implications for technology uptake and poverty reduction efforts.

Information costs are often considered to be fixed transaction costs that influence market entry decisions (Goetz, 1992; Omamo, 1998; Vance & Geoghegan, 2004). The present study builds on this hypothesis by testing whether the type of information source has a significant effect on the intensity of market participation. A positive coefficient would imply that formal sources (for example radio, television, and public and private institutional channels) are significant in improving the proportion of output sold. On the other hand, a negative sign would mean that informal sources (mainly friends, neighbors and other non-institutional sources) are more effective for providing relevant market information that increases the intensity of participation.

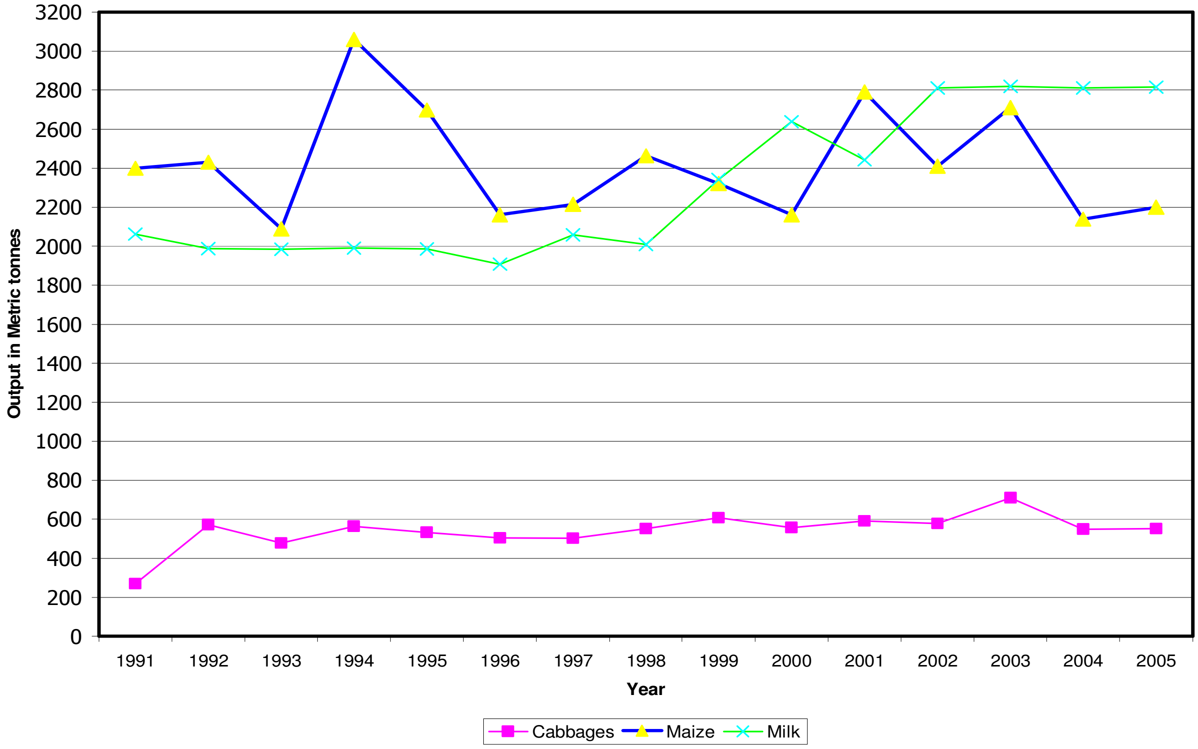
Finally, the notion held by most economists (for instance, Alene et al., 2008) that output price is an incentive for sellers to supply more in the market is tested in this study. We test the influence of price because in some cases non-price constraints may significantly affect the amount offered for sale at any given price level.

4. Results and discussion

The findings from the RRA survey are discussed in Sections 4.1 and 4.2 and those from the household survey in Sections 4.3 and 4.4.

4.1 Recent agricultural production trends in Kenya

Figure 2 shows that national production trends for maize, cabbages and milk were fairly stable from 1991 to 2005.



Source: FAO, 2006

Figure 2: National agricultural production trends in Kenya, 1991–2005

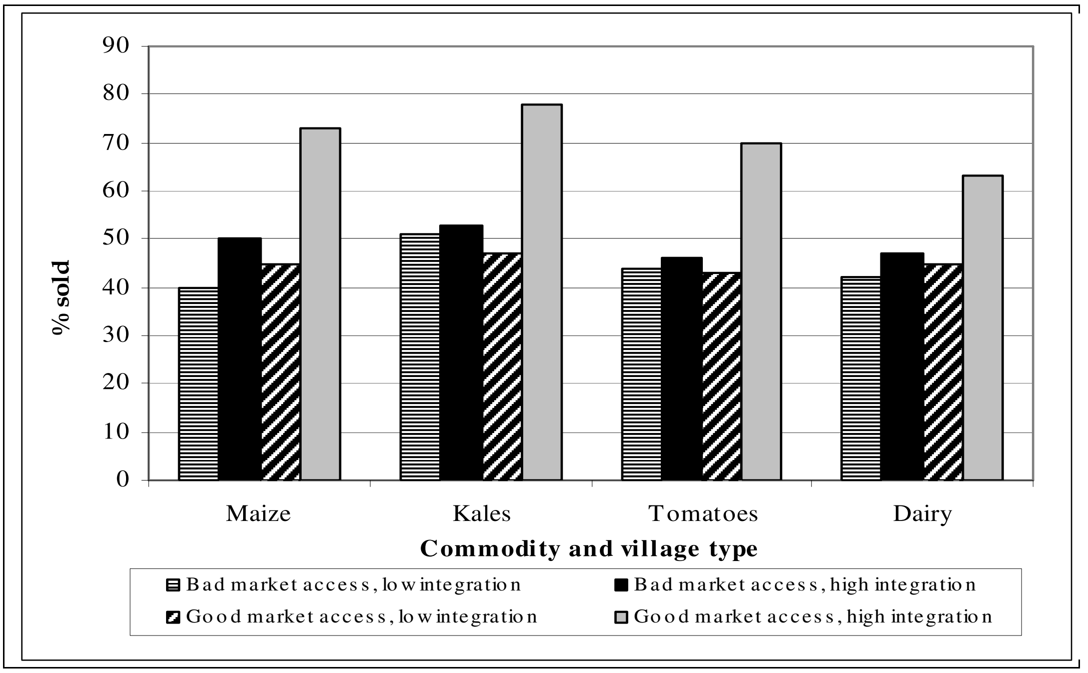
However, various changes have occurred in specific villages over the same period. On a general front, rapid population growth coupled with the challenges of urbanization and intense rural-urban migration has contributed to a decline in average landholdings (from over 20 acres to less than five acres per farm family). Consequently, land tenure systems have also changed from largely communal systems to individual commercially oriented owner-operator systems with or without title deeds. The average acreage of the main export crops, particularly tea and coffee, has declined partly because of increasing land scarcity.

In addition, changing enterprise competitiveness has occasioned significant resource re-allocation patterns and shifts in farm enterprise choices in various parts of the country. For instance, pyrethrum (a once profitable crop) has largely been substituted with high-value horticultural crops (partly because of various institutional bottlenecks such as delayed payments to farmers). The rising demand for housing in the peri-urban areas has also led to shifts from farm production to rental estate construction, thus limiting arable land. Within small-scale agriculture, there is evidence of transformation from relatively low-value cereals (such as maize) to high-value horticulture and dairy production. Despite the increased uptake of hybrid maize varieties, average yields are declining in both rural and peri-urban farms, mainly because of land fragmentation beyond economic levels of input use and the inherent poor quality of seeds and fertilizer used by the majority of resource-poor small-scale farmers. Production of important horticultural crops (kales, cabbages and tomatoes) is on an upward trend in the peri-urban areas because of a high demand arising from a rapid increase in urban population and the high cost of meat (beef, chicken and fish). In the rural areas, horticultural production continues to drop because of the high cost of seeds, fertilizer, pesticides and motorized transport. This last cost is a particular problem for farmers who can seldom afford such transport. They run the risk of goods perishing if they try to get them to the more profitable markets by slower means.

In the dairy subsector, milk production is on a steady rise in both rural and peri-urban areas; ostensibly in response to a huge demand. Marginal growth in per capita incomes, especially due to improved economic strategies since the year 2002 and increased understanding of the benefits of good nutrition, have helped to increase milk consumption in various forms (fresh milk, yoghurt, cheese, butter) and in the preparation of other foods such as tea, porridge and vegetables in nearly every household. Small-scale farmers have embraced improved technology to respond effectively to the growing demand for milk. For instance, there is evidence of increased uptake of improved zero-grazing methods and use of high quality purchased dairy feeds on increasingly fragmented landholdings. Higher milk yielding cattle breeds (especially Friesian and its crosses) are being adopted, and most dairy farmers are milking more frequently (at least twice a day, and sometimes three times, where possible) under better animal husbandry practices, including optimal feed rations, improved veterinary care and suitable housing.

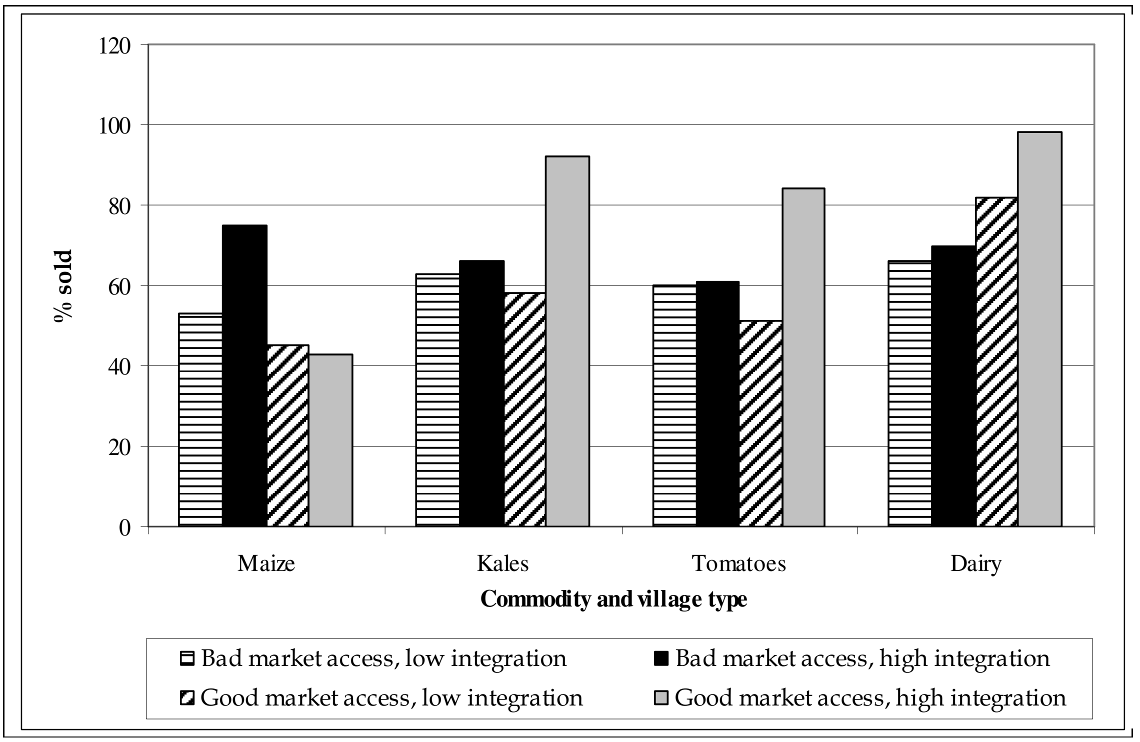
4.2 Trends in agricultural commercialization

Findings from the FGDs show that there is a higher degree of commercialization in peri-urban areas than in rural villages (about 67% and 52%, respectively). Rural households consume about half of their produce and sell the rest mainly in retail open-air markets within the rural areas. Peri-urban households, on the other hand, consume only about a third of their produce and sell two thirds. They sell almost exclusively in wholesale markets (such as the Wakulima and Kangemi markets in the capital city, Nairobi) and supermarkets such as Uchumi and Nakumatt. On average, 55% and 50% of produce is sold by farmers in peri-urban and rural villages respectively. Figure 3 shows the percentages of produce sold by farm households according to their market access and integration. It can be seen that there is a commendable proportion sold by the rural villages, for all commodities investigated in this study. The findings of the study also suggested the proportion is increasing.



Source: Authors' rapid rural appraisal survey data (2007)

Figure 3: Extent of agricultural commercialization in rural areas of Kenya



Source: Authors' rapid rural appraisal survey data (2007)

Figure 4: Market orientation in peri-urban areas in Kenya

The survey results show that the degree of enterprise competition in terms of resource allocation (for example acreage shares) varies from place to place depending on the array of incentives available to farmers and market prospects. Changes in enterprise combinations are evident over time. An important feature to observe is that distant rural producers tend to produce large quantities of less perishable and low-value commodities (such as dry cereals) than peri-urban areas. Irrespective of the commodity, it is evident that improvements in either market access (for example better roads) alone or market integration (connectedness) alone will not greatly improve opportunities of market participation for rural farmers. However, if factors influencing market access and integration are *simultaneously* improved, there is potential for a huge increase in the degree of market participation by rural households. This will reduce transaction costs and risks perceived to be related to urban food retail markets.

Figure 4 shows there is more commercialization of the relatively higher-value and more perishable commodities in peri-urban areas than in the rural villages, and the findings of the study suggest that the proportion of sales of these commodities is increasing. Transaction costs often decline with increased urbanization, improvements in market access and the degree of market integration, while enterprise competition intensifies. This leads to a transition from low-value crops (such as maize) to more profitable enterprises such as dairy and tomatoes (see Figure 4). Even among such high-value enterprises, there is still potential for more value-adding activities.

4.3 Comparison of characteristics of rural and peri-urban farm households

i. Means and standard deviations

a) *Percentage of output sold*

Results from the household survey indicate that, for the whole sample, a higher percentage of vegetables and milk is sold than of maize (using independent samples t-tests). In addition, a higher proportion of output is sold by farmers in peri-urban areas (except maize) than by their rural counterparts (see Tables 4, 5 and 6). These findings are consistent with the observations made in the RRA survey (Figures 3 and 4), which showed that peri-urban villages were more commercialized than rural villages. In the peri-urban areas, a higher percentage of vegetables is sold than of milk and maize. Farmers in the rural areas, however, sell more maize than milk and vegetables. This reflects the growing urban consumer preference for fresh vegetables and the high demand for cereals in rural markets. Following Engel's Law, the higher proportion of maize sold by rural farmers implies that most rural consumers are poor; hence a large share of their incomes is spent on cereals (Ritson, 1977). This holds true for the present study, considering that the rural sample was obtained from villages where a large proportion of households are classified as being below the national poverty line (<US$1 per person per day).

Table 4: Means and standard deviations for milk

Variable	Rural (n=37)		Peri-urban (n=34)		Whole sample (n=71)	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Percentage output sold (%)	67.58	13.25	90.79	7.22	78.69	15.85
Age of household head (years)	48.32	12.88	51.15	16.92	49.68	14.91
Household size (number)	7.22	3.23	6.35	3.72	6.80	3.48
Per capita land (acres per person)	0.75	0.65	1.02	1.10	0.88	0.90
Proportion of nonfarm income in total monthly income (ratio)	0.18	0.32	0.14	0.25	0.16	0.28
Output (liters)	7.62	2.82	10.06***	3.45	8.79	3.35
Distance (km)	17.81***	18.75	5.32	6.59	11.83	15.52
Unit price (Kshs)	17.14	4.77	21.12***	6.84	19.04	6.15

Source: Computation from authors' household survey data (2007)
***p<0.01

Table 5: Means and standard deviations for vegetable (kales)

Variable	Rural (n=37)		Peri-urban (n=40)		Whole sample (n=77)	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Percentage output sold (%)	62.91	17.42	94.95***	5.7	79.56	20.49
Age of household head (years)	45.27	16.35	43.33	13.37	44.26	14.81
Household size (number)	6.30	2.87	5.90	3.67	6.09	3.29
Per capita land (acres per person)	0.70	0.52	0.70	0.83	0.70	0.69
Proportion of nonfarm income in total monthly income (ratio)	0.16	0.28	0.12	0.23	0.14	0.25
Output (kg)	3232.43*	3252.87	1869.75	2961.23	2524.55	3159.36
Distance (km)	8.68***	7.12	2.82	2.83	5.63	6.07
Unit price (Kshs)	14.24	3.52	19.98***	8.13	17.22	6.93

Source: Computation from authors' household survey data (2007)
***p<0.01, *p<0.10

Table 6: Means and standard deviations for maize

Variable	Rural (n=43)		Peri-urban (n=33)		Whole sample (n=76)	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Percentage output sold (%)	74.94***	18.85	53.52	12.70	65.64	19.55
Age of household head (years)	46.12	13.25	45.67	14.17	45.92	13.57
Household size (number)	6.77	3.09	6.76	3.55	6.76	3.28
Per capita land (acres per person)	0.81*	0.49	0.59	0.65	0.72	0.57
Proportion of nonfarm income in total monthly income (ratio)	0.26	0.30	0.16	0.27	0.22	0.29
Output (kg)	1680.23***	1172.90	729.09	753.50	1267.24	1112.58
Distance (km)	20.92*	16.44	14.22	17.52	18.01	17.13
Unit price (Kshs)	19.07	5.02	24.97***	4.89	21.63	5.74

Source: Computation from authors' household survey data (2007)
***p<0.01, *p<0.10

b) Mean age of the household head

Dairy farming household heads in peri-urban areas are on average older than their rural counterparts. Commercial dairy farming in Kenya began before the 1960s on European settler farms near peri-urban areas, and therefore dairy household heads here are more experienced than those in other parts of the country. Maize and vegetable farming household heads in rural areas are on average older than their peri-urban counterparts. Rural farmers have been the main producers of these commodities for a longer period, before commercial peri-urban farming developed fully.

c) Average household size

Households in both rural and peri-urban areas consist of seven persons on average (family members and other relatives). However, rural dairy households have on average eight members, while peri-urban vegetable farmers have on average six. Most households rely on own-farm milk for child nutrition.

d) Per capita landholdings

The area of land owned per capita is largest for dairy farmers and smallest for vegetable farmers for the whole sample. This is understandable, given that dairy requires a large amount of land for pasture and for cultivating fodder, while vegetable farming is less land intensive. On average, there is more land per capita for peri-urban dairy farming (1.02 acres) and less for peri-urban maize farming (0.59 acres). Diversification into high value dairy and vegetable production, as well as profitable non-farm enterprises such as rental estate, reduces the amount of land allocated to maize in the peri-urban areas. This is consistent with the historical land use changes reported by respondents in the RRA survey.

e) Proportion of non-farm income

The proportion of non-farm income in total monthly household income is higher in rural than in peri-urban areas. Although this seems counterintuitive, a possible explanation is that land scarcity is a serious constraint to farming in the rural area sampled. Indeed, most households in this rural area either work as hired laborers in tea estates within and outside Kisii District or depend on remittances from relatives in other areas. There is also a large share of working class people who are engaged in vocational jobs (such as education, the military or retail businesses), or in passenger service transport, and so on.

f) Total farm output

The peri-urban areas produce slightly more milk than rural areas. This can be attributed to better access to improved dairy technology (different breeds, supplementary feeds, veterinary services, and so on). On the other hand, rural households produce more than twice the average output of maize and vegetables produced by peri-urban farmers.

g) Distance from farm to main point of sale

Maize farmers in the whole sample travel the longest distances on average (about 18 km), while vegetable farmers cover less than one third of the same distance from farm to main market. Also, rural farmers travel nearly three times the distance covered by their peri-urban counterparts in search of market channels. Transport costs are therefore potential constraints, particularly for the rural farmers.

h) Unit output price

Prices per unit of output are higher in peri-urban than in rural areas for all three commodities. In the rural areas, the lower prices imply that production is done by most farmers at the same time and the rural markets are thin, such that temporary or seasonal gluts naturally dictate a drop in price. For the peri-urban areas, however, fewer farmers produce the bulk of the output and can possibly stimulate price variations through storage or processing, with the aim of benefiting from the large population and relatively price-inelastic food demand in urban areas.

ii. Percentage frequency distributions

A high proportion (>60%) of farms sampled in both rural and peri-urban areas had male household heads. Nearly 50% of dairy and vegetable farming household heads in both study sites had completed secondary education. More rural maize farming household heads had completed secondary education than the peri-urban ones. A higher percentage of dairy and vegetable farming rural households had secure land tenure systems (i.e. possession of title deeds) than the peri-urban ones, but more peri-urban maize farmers had title deeds than the rural ones. In both study sites, more households had access to and therefore mainly used informal sources of market information than formal ones. Market information includes insights on prices and quantities of commodities in various markets. Formal sources include institution-based sources such as television, radio, newspapers, and public or private organizations. Informal sources, on the other hand, are non-institutional channels such as social networks of neighbors, friends, relatives and so on. Peri-urban households had higher access to tarmac and murram roads than the rural households. More peri-urban dairy and vegetable farmers than maize farmers considered roads linking their villages to wholesale markets and supermarkets to be in good condition for most of the production year. Rural roads were generally described by farmers as being of average condition. However, most maize farmers complained of the bad state of the roads from their farms to retail open air markets. (See Table 7.)

Table 7: Percentage frequency distributions for milk, kales and maize

Variable		Milk			Kales			Maize		
		Rural (n=37)	Peri-urban (n=34)	Whole sample (n=71)	Rural (n=37)	Peri-urban (n=40)	Whole sample (n=77)	Rural (n=43)	Peri-urban (n=33)	Whole sample (n=76)
1. Gender	Male	78.40	79.40	78.90	62.20	92.50***	77.90	86.00	72.70	80.30
	Female	21.60	20.60	21.10	37.80	7.50	22.10	14.00	27.30	19.70
2. Education	Completed secondary level	48.60	50.00	50.70	51.40	57.50	54.50	62.80	27.30	47.40
	Not completed secondary level	51.40	50.00	49.30	48.60	42.50	45.50	37.20	72.70***	52.60
3. Security of land tenure	Has title deed	75.70	67.60	71.80	62.20	45.00	53.20	46.50	75.80***	59.20
	No title deed	24.30	32.40	28.20	37.80	55.00	46.80	53.50	24.20	40.80
4. Market information source	Formal	48.60	38.20	43.70	40.50	35.00	37.70	25.60	42.40	32.90
	Informal	51.40	61.80	56.30	59.50	65.00	62.30	74.40	57.60	67.10
5. Type of road from farm to market	Tarmac	45.90	47.10	47.10	43.20	70.00**	57.10	53.50	57.60	55.30
	Earth road	37.80	23.50	31.00	35.10	15.00	24.70	32.60	18.20	26.30
	Murram	16.20	29.4	22.6	21.60	15.00	18.20	13.90	24.20	18.40
6. Status of road	Good	37.80	44.10	40.80	32.40	47.50	40.30	44.20	57.60**	50.00
	Average	37.80	29.40	33.80	43.20	25.00	33.80	9.30	27.30	17.10
	Bad	24.30	26.50	25.40	24.30	27.50	26.00	46.50	15.20	32.90

Source: Computation from authors' household survey data (2007)
***p<0.01, **p<0.05

4.4 Determinants of intensity of market participation

a) Marketed milk

Distance to the market significantly reduces the percentage of milk sold for the whole sample and particularly in the rural areas (see Table 8). The use of informal market information channels also contributes to increased output sale in the rural areas and in the whole sample. Total output has a positive influence on percentage sold, but it is only significant for the pooled sample. Household size significantly reduces the amount of milk sold by peri-urban farmers. This applies to situations where the household has more children below working age, who thus do not contribute to farm labor but significantly increase household consumption. The unit price has a positive but insignificant influence on milk sold in both sites and even for the whole sample. The proportion of non-farm income, education, gender and age of the household head all have an insignificant influence on the amount of milk output that is sold.

b) Marketed vegetable production

The unit price acts as an incentive by significantly increasing the percentage of vegetables sold in both rural and peri-urban areas (see Table 9). Total output and being a male head of a household significantly increase the marketed vegetable production. As expected, distance to market reduces the percentage marketed in rural areas and for the whole sample. Household size also significantly reduces the percentage of vegetables sold by rural farmers. For peri-urban farmers, the intensity of market participation is significantly increased by household head's education level and access to formal market information channels. Non-farm income on the other hand, significantly reduces the amount of vegetables sold. Informal market information sources significantly increase the percentage of vegetables marketed by the whole sample. This can be explained by the observation that vegetable marketing usually involves bulking of the produce by farmers for various purposes; for instance to reduce per unit transport costs, to provide an adequate quantity for a given market, or as a bargaining strategy for better prices. In such situations, farmers rely mostly on informal sources of information, particularly neighbors and friends who are involved in the same enterprises and are thus more likely to provide timely and relevant information for a particular market than institutional sources such as newspapers (farmers do not purchase or read newspapers on a regular basis).

c) Marketed maize surplus

Education level of the household head and total output significantly increase the percentage of maize sold by rural farmers (see Table 10). In the peri-urban areas, price and formal information sources enhance the intensity of market participation. But non-farm income and distance negatively affect the supply of maize to the market in both rural and peri-urban areas.

Table 8: Determinants of percentage of milk sold by smallholder farmers in Kenya

	Rural (n=37)		Peri-urban (n=34)		Whole sample (n=71)	
Variable	**β**	**t-ratio**	**β**	**t-ratio**	**β**	**t-ratio**
Constant	85.69	5.36***	89.99	13.28***	56.96	4.14***
Age	-0.02	-0.12	0.03	0.49	0.16	1.02
Gender	1.20	0.25	-2.79	-0.99	3.14	0.64
Education	1.03	0.24	-1.03	-0.41	3.50	0.76
Household size	-0.42	-0.60	-0.79	-2.02**	-0.50	-.0.76
Non-farm income	-4.22	-0.70	1.61	0.35	-9.25	-1.31
Output	0.09	0.11	0.31	0.99	1.55	2.17**
Distance	-0.27	-2.55**	-0.32	-1.75	-0.41	-3.42***
Market information	-9.32	-2.27**	3.16	1.33	-10.76	-2.40**
Unit price	0.36	0.78	0.19	0.99	0.66	1.76
	Log likelihood ratio = -138.47 Pseudo R^2 = 18.56		Log likelihood ratio = -109.00 Pseudo R^2 = 15.40		Log likelihood ratio = -249.5 Pseudo R^2 = 37.00	

Source: Regression estimation from authors' household survey data (2007)
***p<0.01, **p<0.05

Table 9: Determinants of percentage of kales sold by smallholder farmers in Kenya

	Rural (n=37)		Peri-urban (n=40)		Whole sample (n=77)	
Variable	**β**	**t-ratio**	**β**	**t-ratio**	**β**	**t-ratio**
Constant	34.62	1.70	90.46	23.18***	63.39	8.13***
Age	0.23	1.14	0.09	1.28	0.14	1.01
Gender	7.34	2.42**	-0.21	-0.07	13.07	3.24**
Education	-2.96	-0.40	3.53	2.18**	-0.01	-0.44
Household size	-0.98	-3.91***	-0.23	-0.90	-1.00	-1.64
Non-farm income	4.86	0.48	-9.15	-2.80**	-5.06	-0.76
Output	0.16	2.15**	0.03	1.05	0.18	2.60**
Distance	-0.49	-2.42**	-0.52	-1.87	-1.44	-4.85***
Market information	-8.83	-1.21	1.77	1.97**	-7.32	-1.98**
Unit price	0.04	1.96**	0.13	1.99**	1.14	4.48***
	Log likelihood ratio = -152.03 Pseudo R^2 = 19.22		Log likelihood ratio = -115.92 Pseudo R^2 = 21.02		Log likelihood ratio = -312.87 Pseudo R^2 = 45.80	

Source: Regression estimation from authors' household survey data (2007)

***p<0.01, **p<0.05

Table 10: Determinants of percentage of maize sold by smallholder farmers in Kenya

	Rural (n=43)		Peri-urban (n=33)		Whole sample (n=76)	
Variable	**β**	**t-ratio**	**β**	**t-ratio**	**β**	**t-ratio**
Constant	83.40	5.60***	13.90	0.97	62.03	4.68***
Age	0.11	0.69	0.24	1.31	0.16	0.94
Gender	9.41	1.69	-4.21	-1.01	2.67	0.59
Education	8.48	1.98**	5.89	1.27	11.76	3.08**
Household size	-1.01	-1.30	0.12	0.18	0.19	0.29
Non-farm income	-17.48	-2.87**	-0.32	-4.57***	-13.73	-2.26**
Output	0.26	1.97**	0.03	1.26	0.46	3.94***
Distance	-0.83	-6.55***	-0.22	-2.02**	-0.38	-3.61***
Market information	0.50	0.10	7.89	2.03**	4.50	1.16
Unit price	0.17	0.42	1.07	2.55**	0.59	1.80
	Log likelihood ratio = -165.37 Pseudo R^2 = 23.72		Log likelihood ratio = -121.21 Pseudo R^2 = 19.29		Log likelihood ratio = -311.38 Pseudo R^2 = 36.16	

Source: Regression estimation from authors' household survey data (2007)
***p<0.01, **p<0.05

5. Conclusions and policy implications

Most farmers in rural areas produce low volumes of relatively low-value and less perishable marketed surpluses than their peri-urban counterparts. They also sell mainly at the farm gate and in rural markets. Only a small proportion of the total output is taken to the more lucrative (but distant) urban markets. These farmers do not participate effectively in the urban markets, which offer excellent opportunities for increasing their farm incomes and extracting themselves from the poverty and squalor in which they currently live.

This study demonstrated the relevance of participatory survey methods in enhancing farmers' involvement in policy making for commercial agriculture. Results from both the rapid rural appraisal and household surveys showed that peri-urban areas had a higher market orientation than rural villages. More vegetables are sold in the peri-urban areas than milk and maize, which are mainly sold in the rural areas. Besides being influenced by various factors of market participation, the relative proportions of output sold in the respective areas could indicate the demand patterns for these commodities in rural and peri-urban settings.

The study findings confirmed assertions in the literature that distance indeed confines rural farmers to the perpetual production of low-value and less perishable commodities, particularly cereals such as maize. It was also established that market information plays a significant role in farmers' decision on how much output to make available to the market depending on the prevailing price and nearness of the specific market outlet. Two sets of policy interventions are suggested. First, it is necessary to upgrade farm-to-market roads and establish more and better equipped retail market centers in the villages in order to reduce transport costs and encourage rural farmers to produce and trade in high-value commodities (such as milk). A second strategy would be to promote the formation of rural information bureaus alongside the mobile-telephony systems that are already being piloted by some institutions. These could enhance farmers' supply response to market dynamics for households in various socioeconomic profiles and village categories.

It is often claimed that once the requisite infrastructure (roads, market facilities, and so on) has been put in place that should be enough to encourage farmers and traders to engage in agribusiness. This study, however, suggests that improved infrastructure is a necessary but not sufficient condition for enhancing agricultural commercialization. The sufficient condition would be simultaneous efforts to improve *integration*, through institutional reforms, and *access*, by building sustainable and predictable linkages to urban markets. Efforts towards this end would include group marketing arrangements to bring down transaction costs, bargain for better prices, enforce farmer-trader contracts and explore other opportunities inherent in economies of scale and scope.

Priority issues for future research include harmonizing farm-level definitions or measurements of market integration and access, and developing a joint analytical framework for group responses and individual household data, particularly in the context of agricultural commercialization and the desired investment policy.

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References

Alene, AD, Manyong, VM, Omanya, G, Mignouma, HD, Bokanga, M & Odhiambo, G, 2008. Smallholder market participation under transactions costs: Maize supply and fertilizer demand in Kenya. Food Policy 33, 318–28.

Brown, D, Stephens, E, Ouma, J, Murithi, F & Barrett, C, 2006. Livelihood strategies in the rural Kenyan highlands. African Journal of Agricultural and Resource Economics 1(1), 21–36.

Burke, WJ, Jayne, TS, Freeman AH & Kristjanson, P, 2007. Factors associated with farm households' movement into and out of poverty in Kenya: The rising importance of livestock. International Development Working Paper No. 90, Michigan State University, East Lansing.

CBS (Central Bureau of Statistics), 2003. Geographic dimensions of well-being in Kenya: Who and where are the poor? From Districts to Locations. Vol. I. CBS, Ministry of Planning and National Development, Nairobi.

CBS (Central Bureau of Statistics), 2005. Geographic dimensions of well-being in Kenya: Who and where are the poor? A Constituency Level Profile. Vol. II. CBS, Ministry of Planning and National Development, Nairobi.

CBS (Central Bureau of Statistics), 2006. Economic Survey. CBS, Ministry of Planning and National Development, Nairobi.

Chow, GC, 1960. Tests of equality between sets of coefficients in two linear regressions. Econometrica 28(3), 591–605.

Cunningham, LT, Brown, BW, Anderson, KB & Tostao, E, 2008. Gender differences in marketing styles. Agricultural Economics 38(1), 1–7.

EABC (East Africa Business Council), 2006. East African Community 2006/07 Business Climate Index Survey Report. Arusha, Tanzania.

FAO (Food and Agriculture Organization), 2006. Statistical database – FAOSTAT. FAO, Rome. www.faostat.org

Geda, A, De Jong, N, Mwabu, G & Kimenyi, M, 2001. Determinants of poverty in Kenya: A household level analysis. Institute of Social Studies (ISS), The Hague.

Goetz, S, 1992. A selectivity model of household food marketing behavior in sub-Saharan Africa. American Journal of Agricultural Economics 74, 444–52.

Greene, WH, 2003. Econometric Analysis. Macmillan, New York.

Haddad, LJ & Bouis, HE, 1990. Agricultural commercialization, nutrition and the rural poor: A study of Philippine farm households. International Food Policy Research Institute (IFPRI), Washington, DC.

IFAD (International Fund for Agricultural Development), 2001. The challenge of ending rural poverty. Rural Poverty Report. Oxford University Press, Oxford.

Jayne, TS, Mukumbu, M, Duncan, J, Staatz, J, Howard, J, Lundberg, M, Aldridge, K, Nakaponda, B, Ferris, J, Keita, F & Sanankoua, AK, 1995. Trends in real food prices in six sub-Saharan African countries. Policy Synthesis No. 2, US Agency for International Development (USAID), Washington, DC.

Johnston, J & DiNardo, J, 1997. Econometric Methods. McGraw-Hill, Singapore.

Key, N, Sadoulet, E & de Janvry, A, 2000. Transaction costs and agricultural household supply response. American Journal of Agricultural Economics 82(1), 245–59.

Kherallah, M, Delgado, C, Gabre-Madhin, E, Minot, N & Johnson, M, 2000. The road half-travelled: Agricultural market reform in sub-Saharan Africa. Food Policy Report, International Food Policy Research Institute (IFPRI), Washington, DC.

Lapar, ML, Holloway, G & Ehui, S, 2003. Policy options promoting market participation among smallholder livestock producers: A case study from the Philippines. Food Policy 28, 187–211.

Makhura, M, Kirsten, J & Delgado, C, 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, 11–15 February, Pretoria, South Africa.

McCulloch, N & Ota, M, 2002. Export horticulture and poverty in Kenya. Working Paper No. 174, Institute of Development Studies (IDS), University of Sussex, Brighton.

Minot, N & Ngigi, M, 2003. Are horticultural exports a replicable success story? Evidence from Kenya and Côte d'Ivoire. Paper presented at the InWEnt, IFPRI, NEPAD, CTA Conference on Successes in African Agriculture. 1–3 December, Pretoria, South Africa.

Muriuki, H, Omore, A, Hooton, N, Waithaka, M, Ouma, R, Staal, S & Odhiambo, P, 2003. The policy environment in the Kenya dairy sub-sector: A review. Smallholder Dairy Project (SDP) Research and Development Report No. 2, International Livestock Research Institute (ILRI), Nairobi.

Omamo, SW, 1998. Farm-to-market transaction costs and smallholder agriculture: Explorations with a non-separable household model. Journal of Development Studies 35, 152–63.

Omiti, J, McCullough, E, Otieno, D, Madelon, M, Nyanamba, T & Murage, A, 2006. Participatory prioritization of issues in smallholder agricultural commercialization in Kenya. Discussion Paper No. 64, Kenya Institute for Public Policy Research and Analysis (KIPPRA), Nairobi.

Pender, J & Alemu, D, 2007. Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia. Discussion Paper No. 745, International Food Policy Research Institute (IFPRI), Washington, DC.

Pender, J, Ehui, S & Place, F, 2006. Conceptual framework and hypotheses. In Pender, J, Place, F & Ehui, S (Eds), Strategies for sustainable land management in the East African Highlands. World Bank and International Food Policy Research Institute (IFPRI), Washington, DC.

Peters, P, 1999. Agricultural commercialization, rural economy and household livelihoods in Malawi, 1990–1997. Harvard Institute for International Development (HIID), Harvard. www.eldis.org/static Accessed 24 November 2007.

Pingali, PL & Rosegrant, MW, 1995. Agricultural commercialization and diversification: Processes and policies. Food Policy 20(3), 171–86.

Ritson, C, 1977. Agricultural economics: Principles and policy. Crosby Lockwood Staples, London.

RoK (Republic of Kenya), 2001a. Kiambu District Development Plan 2002–2008. Ministry of Finance and Planning, Government Printer, Nairobi.

RoK (Republic of Kenya), 2001b. Kisii Central District Development Plan 2002–2008. Ministry of Finance and Planning, Government Printer, Nairobi.

RoK (Republic of Kenya), 2007. Economic Survey Report. Ministry of Planning and National Development, Government Printer, Nairobi.

Shilpi, F & Umali-Deininger, D, 2008. Market facilities and agricultural marketing: Evidence from Tamil Nadu, India. Agricultural Economics 39, 281–94.

Stifel, D & Minten, B, 2008. Isolation and agricultural productivity. Agricultural Economics 39, 1–15.

Vance, C & Geoghegan, J, 2004. Modeling the determinants of semi-subsistence and commercial land uses in an agricultural frontier of Southern Mexico: A switching regression approach. International Regional Science Review 27(3), 326–47.

World Bank, 2006. Where is the wealth of nations? Measuring capital for the 21st century. World Bank, Washington, DC.

World Bank, 2007. World Development Indicators. Green Press Initiative, World Bank, Washington, DC.