Determinants and Effects of Rural Households' Participation in Land Markets on Agricultural Outputand Food Security in Siaya County, Kenya

David Jakinda Otieno

Working Paper GIZ-001

Bringing Rigour and Evidence to Economic Policy Making in Africa

Determinants and Effects of Rural Households' Participation in Land Markets on Agricultural Outputand Food Security in Siaya County, Kenya

By

David Jakinda Otieno
Department of Agricultural Economics,
University of Nairobi

Contents

List of tables

Abstract

This study seeks to understand the determinants and effects of rural households' participation in land markets on agricultural output and food security in the rural farming community of Siaya County, Kenya. Primary survey data from a random sample of 343 respondents were analyzed using multinomial logit (MNL) and Tobit models. The results show that 88% of respondents had participated in land markets through renting in, renting out, purchasing or selling land. The amount of land that an individual had prior to the land transaction, membership of a farmer group, monthly household income, age of the household head and household size had positive effects on the decision to rent in or purchase land. Conversely, the requirement of a lump sum payment had a negative effect on the decision and the extent of renting in or purchasing land. Maize output increased in rented in and purchased land, but declined for farmers who rented out or sold part of their land. Food insecurity incidences were higher in households that did not participate in any land market. These insights should be incorporated into local land administration, management and land use planning.

Key Words: *Rural households, land markets, agricultural output, food security, Kenya*

1. Introduction

Background and Rationale for study

Land is a critical factor of economic importance to the rural livelihoods of peasant farmers in East Africa. The majority of farmers depend on it for agricultural production and food security. Food security in this case refers to a situation "… when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (FAO, 2006). Also, land is of immense social, cultural and symbolic importance (Otto and Stahl, 2015). However, in recent decades, as noted by Otieno and Oluoch-Kosura (2019), land capture by domestic elites and irregular land acquisitions through purchase or leases (commonly referred to as "land grab") by international investors have led to the increased dispossession and alienation of peasant farmers from their land in both rural and urban African settings. This undermines household food security and weakens the social fabric of communities (Otto et al., 2019). It is estimated that 23% of people in sub-Saharan Africa (SSA) are undernourished (Lutomia et al., 2019). In Kenya, about 8.5% of the 47 million people are considered to be acutely food insecure (Mutea et al., 2019) and 12% have very low dietary diversity (WFP, 2016).

Rapid population growth and urbanization have increased the pressure on available land, thus pushing the demand for land upwards. This has led to an increased commoditization of land as a valuable asset in the factor market, giving rise to the emergence of land markets through sales, rentals or lease arrangements (Jin and Jayne, 2013). However, due to uncertainties and restrictions in credit and labour markets, coupled with unclear or incomplete tenure rights on land, formal land markets remain thin and mainly take the form of distress sales (to address emergencies such as food and medical needs). This has led to the emergence of land rental markets as a feasible alternative, whether formal or informal (Holden et al., 2009). Land rental markets can be realized in two ways: an individual can rent land from someone else to increase their farm size or amount of land for other uses, or an individual can rent out their land to others in order to earn land rates.

Well-functioning land rental markets can potentially contribute to efficiency and equity in two ways: rental markets transfer land from less efficient to more efficient producers, and improve access to land for households with relatively small farms (Chamberlin and Ricker-Gilbert, 2016). According to Holden et al. (2009) land

rental markets improve allocative efficiency by equalizing factor ratios among farm households, so that households rich in non-land resource endowments rent land from households that are poor in non-land resource endowments relative to their land endowments. However, Holden and Otsuka (2014) argue that there are major risks of the elite capturing large land areas with inefficient and inequitable outcomes. For example, Jayne et al. (2010) note that 25% of small-scale farmers, especially women in Kenya, Mozambique, Rwanda and Zambia, were approaching landlessness. Doss et al. (2018) emphasize the need to strengthen women's access to resources such as land needed for productive agriculture. Assuring the tenure security of such land is also critical to promoting long-term investment.

The decision and extent of land market development depend on land tenure security, among other factors. Land tenure security exists when landowners and users enjoy clearly defined and enforceable rights to land, whether anchored in formal or customary practices. As noted by Espinosa (2019), secure land rights provide greater incentives to manage and conserve the land, reduce conflicts and arbitrary evictions, provide opportunities for land rental and sales markets to transfer land to more productive uses and users, stimulate long-term improvements to land and land-related investments and, when combined with cost-effective systems of land administration, provide an opportunity to reduce the cost of credit by leveraging the land as collateral. Moreover, land tenure security is critical for building household resilience to various shocks arising from unpredictable climate, financial and health risks. As noted by Ali et al. (2014), secure tenure rights are critical for motivating the necessary investments to improve agricultural productivity, which currently falls below 25% of the potential in all African countries except South Africa.

Generally, large-scale farmers are better placed than smallholders to make use of evolving land markets and to influence agricultural policies and public expenditure in their favour. Birch (2018) observed that population growth is driving a steady fall in average farm size in Kenya. The resulting small farm sizes may undermine the capacity of households to generate a surplus and thus to finance the inputs needed to improve productivity. Obonyo et al. (2016) noted that land buying and leasing, respectively, contribute to 26.3% and 2.7% of land fragmentation in Siaya County. Farmers in such rural areas operate from smallholdings composed of many spatially dispersed parcels that are uneconomical for technology use and mechanization, leading to poor yields and low profits. About 81% of households in the county are food insecure and it is one of the areas where 12% of the national population has very low dietary diversity (Juma, 2019; WFP, 2016).

According to Van Arkadie (2016), since independence in 1963 the land policy-making process in Kenya has been characterized by political intrigues that have perpetuated land hunger and rural poverty. Klopp and Lumumba (2017) also observe that powerful networks of beneficiaries in land management institutions in Kenya create a strong system of control and exclusion around land, thereby providing a path dependency against reform. The outcome is weak implementation of envisaged processes and constrained production potential.

Following the reform of Kenya's Constitution (2010) four main land laws were enacted: the Land Registration Act 2016, the National Land Commission Act 2015 and the Community Land Act 2016, which focus on gender equity. Article 60 of the Constitution directs that gender discrimination in law, customs and practices related to land and property in land must be eliminated. Article 68 makes it obligatory to enact laws that protect matrimonial property and the interests of spouses in the occupation of land upon the demise of spouses. Further, the Land Act (Section 107) provides that compensation when community land or private land is compulsorily acquired is payable to the spouse/s of affected persons. The Community Land Act (Section 14-4ci) provides for the equal treatment of applications for women and men, while Section 30(5) of the Community Land Act stresses that women marrying into the community should not be excluded from land rights, and their entitlement to such rights should remain unless they divorce and remarry elsewhere. As Diiro et al. (2018) note, enhanced women's empowerment in agricultural decision making and land ownership could significantly improve agricultural productivity and rural livelihoods. However, the implementation of land laws remains a challenge, and women are seldom the recipients of just administration of land rights in Kenya (Wily, 2018).

Research problem

It is paradoxical that many rural households in Africa remain extremely poor despite having relatively large fallow land holdings (Jayne et al., 2003). The World Economic Forum (2015) observed that Africa has the highest uncultivated arable land (202 million hectares), yet most farms are less than 2 hectares. Recent estimates show that 82% of people living in extreme poverty in Africa are in rural areas and derive their income from farming (Beegle and Luc, 2019). Many of these households are characterized by low use of improved inputs such as high-yielding seeds, fertilizer and mechanization. Consequently, there is low farm productivity, high food insecurity and limited participation in output commercialization. Byerlee and Deininger (2013) found that all African countries were achieving less than 25% of their potential yields. The inability to correctly use emerging land markets as an economic growth avenue has denied countries such as Kenya the opportunity to transform the lives of many desperate jobless youths. These societies are therefore trapped by the multiple challenges of hunger, drug addiction and insecurity. Deininger et al. (2014) suggest that boosting the productivity of smallholder farmers by improving the efficiency of markets for land and other factors can help them leverage the food system, earn better incomes and escape the poverty trap. As noted by Singirankabo and Ertsen (2020), improved land governance through secure land rights can increase agricultural productivity and household food security by providing incentives to invest in land improvements, and enable access to financial resources and government services.

Despite the introduction of various reforms in land tenure, there is no record of how the changes have affected rural households' ability to buy, sell, rent in or rent out land for various uses. Further, the implications of these transactions on households'

food and nutrition security in terms of land available for cultivation, agricultural enterprise diversification, food security and nutrition diversity remain unclear due to a paucity of empirical evidence. Moreover, despite women contributing significantly to rural economies, food security and nutrition in Kenya, less than 5% of land is owned by women farmers, as they have fewer tenure rights and own small plots due to cultural factors that favour men in terms of land inheritance (Githinji et al., 2014). While the effects of the decade-long changes in land governance remain undocumented, a worrying trend of displacement of women from matrimonial land continues unabated in most rural patrilineal societies. Consequently, the levels of poverty and food insecurity continue to rise despite there being large unutilized parcels of land because of unresolved disputes on land ownership and use rights (Boone et al., 2018).

There is a vast body of literature on the impacts of land tenure security on land investments, credit access and agricultural productivity, but very little on the determinants and effects of land markets (Jin and Jayne, 2013). The sparse literature on land markets has mainly focused on Asia (for example, Hou et al., 2017), with a few exceptions in Africa such as the studies by Holden et al. (2009) and Jin and Jayne (2013). Existing studies on land markets in the SSA region focus on areas with high population density (such as Uganda, Malawi and the highlands of Ethiopia and Kenya). With the exception of Zambia, no study has assessed the household welfare effects of land markets in rural, less populated areas of Africa, in particular Kenya. Moreover, while there is a growing body of knowledge on large-scale land leasing, purchases and sales by multinational investors (Otieno and Oluoch-Kosura, 2019), the effects of such deals on rural households' productivity remain unclear. Also, no study has assessed the joint effect of land tenure on land market participation and food security along gender lines. The present study aims to fill the knowledge gaps on determinants of participation in land markets and the effects on agricultural output and food security.

Study objectives

The main objective of this study is to analyze the determinants of rural households' participation in land markets and how it affects agricultural output and food security. The specific objectives are to:

- analyze the factors that influence the decision of households to buy, sell, rent in or rent out land;

- evaluate the effect of land buying, selling, renting in and renting out on agricultural output; and

- assess the effect of renting in and renting out of land on food security.

Research hypotheses

The research hypotheses that informed the study are:

- Gender, income and household size do not jointly affect households' decisions to rent land.

- Land buying, selling and renting have no effect on agricultural output.

- Land buying, selling and renting have no effect on household food security status.

2. Review of knowledge gaps in the literature

Various studies have assessed the emergence of land markets and the implications for different development indicators. Deininger et al. (2008) investigated the efficiency and equity impacts of rural land market restrictions in India. Jin and Deininger (2009) show the productivity and equity impacts of land markets in China. Hou et al. (2017) find that in China, having more effective cultivated land before renting in reduces the share of land rented in. Chamberlin and Ricker-Gilbert (2016) assessed who benefits and by how much from participation in rural land markets in Malawi and Zambia. Their findings show that rural land market participation is higher in the densely populated Malawi than the less-densely populated Zambia; thus, land scarcity drives market development.

Returns to renting in land vary with the scale of production as tenants who produce more have higher returns from renting in. Jin and Jayne (2013) also note that although participation in land markets in Kenya promotes farm productivity and raises incomes, the increments in absolute terms are small and do not meaningfully affect rural poverty rates. Mutea et al. (2019) assessed the links between livelihoods and food security in the Mount Kenya region using a composite food security index comprising four indicators: food consumption score, household dietary score, coping strategies index and household food insecurity access scale. However, none of these studies specifically assessed the linkage between land markets, agricultural output and household food security. The current study seeks to fill this knowledge gap.

There are many studies on gender mainstreaming in agriculture, but there is little empirical evidence on how ownership and control of land by males, females or jointly, affect participation in land markets and food security. For example, Kassie et al. (2015) and Sharaunga et al. (2016) assessed the relationship between gender and food insecurity in Kenya and South Africa. Owoo and Boakye-Yiadom (2015) analyzed gender in relation to land ownership and agricultural productivity in Kenya, while Doss et al. (2014) focused on gender and asset ownership. However, these studies used household headship as the gender identifier, which ignores the intra-household roles of men and women.

Recently, Lutomia et al. (2019) used the relative positions of men and women in households as the gender indicator in assessing the determinants of gender differences in household food security perceptions in Western and Eastern Kenya. However, it is also important to use sex-disaggregated data that clearly identify how much land is owned by men, women or jointly, as well as the user rights. The current study contributes to the gender literature by investigating how land ownership and decision making by male and female persons in households affect participation in land markets and the resultant agricultural output and food security.

3. Methodology

Study area

The study was conducted in Siaya County in western Kenya, which makes up 2.3% of the national population of 47 million people (Republic of Kenya, 2019). The county has a land surface area of 2,530km^2 and a water surface area of 1,005km^2 that is partly covered by Lake Victoria, the third largest freshwater lake in the world (County Government of Siaya, 2018). The main causes of land fragmentation in the area are land inheritance (68.3%), buying (26.3%) and leasing (2.7%) (Obonyo et al., 2016). Agriculture accounts for 60% of total household income and 61% of employment. Farming is done on 51% of 2,059km^2 of the arable land, with an average smallholder farm size of 2.71 acres (Juma, 2019). Thus, there is vast fallow land in the area that could possibly be converted to beneficial economic use.

About 73% of the households grow food crops; 81%–100% are engaged in maize production and 61%–80% sorghum. Other food crops are beans, millet, cowpeas, sweet potatoes and groundnuts. Only 1% of households grow cash crops such as cotton, sugar cane and rice. Nearly half (48%) of the population in the county live in absolute poverty compared to 43.4% at the national level. Further, 34% suffer from food poverty and 23% of children are stunted (MoALF, 2016). It is therefore important to understand the extent of land market participation and how it could improve the livelihoods of households in such extreme situations.

This is a relatively rural area with 67% of land under ancestral tenure and a patrilineal cultural setting. Although more than half of the population in the county are women (52.6%) (MoALF, 2016), the place of women in land matters, especially inheritance from their spouses or the right of daughters to be bequeathed land by their parents, has often been challenged. Further, as in other rural counties, even following the enactment of new land laws as a result of the Kenya Constitution 2010, the achievement of gender equity in land matters remains a mirage in Siaya County (Boone et al., 2018). Therefore, selecting this county provides a suitable case to understand the extent to which unpredictable gender rights to land ownership and use affect rural households' participation in land markets and the attendant outcomes, such as agricultural output and food security.

Sampling procedure and data collection

Two sub-counties (Siaya Township and Ugenya) were purposively selected in order to capture the effects of emerging demand from gradual urbanization in a devolved local town centre and proximity to the Kenya-Uganda border, respectively, on the nature and extent of land market development. Siaya Township sub-county hosts the county headquarters and is the business hub, which implies rapid growth in housing developments that create high demand for land. Ugenya sub-county borders Busia County that stretches into the neighbouring country Uganda. A large part of Ugenya sub-county touches the main Kenya–Uganda highway where most transit goods are transported. The choice of this sub-county therefore provides an opportunity to understand how the rush to establish settlements and businesses along this transport corridor influences demand for land. These two sites represent 37% (361,777) of the total population of Siaya that is estimated at 993,183 (Republic of Kenya, 2019). A simple random sampling method was applied to select respondents, considering that participants and non-participants in land markets are expected to be fairly spread across each village in the chosen sub-counties.

Following Anderson et al. (2007), the sample size for each of the two sub-counties was calculated as follows:

$$n = \frac{(p(1-p)Z^2)}{E^2} \tag{1}$$

where n is the sample size to be determined, p is the population proportion that would be available at the time of the survey, E is the margin of error and Z is the confidence interval. Considering that the study site is a rural area in which farming (maize, sorghum, millet, sweet potato, cassava, vegetables and livestock) is a key activity, p was set at 0.5 as one of the decision makers (household head or spouse) was likely to be available during the survey, Z is 1.96 and E was set at 0.07 given that potential respondents are sedentary and the survey was conducted by well-trained enumerators to minimize errors.

$$n = \frac{(0.5(1-0.5)1.96^2)}{0.07^2} = 196 \tag{2}$$

In order to account for potential non-response and incomplete questionnaires, the target sample size was increased slightly to 200 respondents for each of the two sub-counties, thus giving a total sample size of 400. Based on sub-county population statistics (Republic of Kenya, 2019), the expected sample size of 400 was distributed among the two sites following a proportionate-to-size sampling method, which gave 62.6% and 37.4% in Siaya township and Ugenya sub-counties, respectively.

The unit of analysis (respondent) for this study was the adult (aged 18 or more, as per Kenya's Constitution 2010) in the household who owns the land and has decision-making power on the use and disposal of the land. In the absence of the landowner and decision maker, the principal assistant (spouse in some cases) was considered to be the respondent. In many rural settings, including the study site, the main decision maker also happens to be the household head, hence the interchangeable use of the words "decision maker" and "household head" in this paper. Data were collected through face-to-face interviews in a survey that was conducted using a comprehensive structured questionnaire. Only one person was interviewed in each household. Where there was joint ownership of the land, consensus was sought on who would answer the survey questions. The study acknowledges that this approach could have introduced some bias in the responses and recommends that future studies of this nature should interview joint landowners separately. The survey questionnaire was structured according to four key sections to capture information on: land ownership, use and rental dynamics; agricultural inputs and outputs; food consumption; and household socioeconomic characteristics.

During the household survey, the questionnaires were administered with the help of four trained enumerators, each conducting two to four interviews per day (due to the comprehensive nature of the questionnaire) for a period of 30 days. Data were collected in March and April 2020. Due to the travel restrictions imposed by the government to control the spread of COVID-19, the data collection team adhered to safety measures such as social distancing and use of face masks and sanitizers during the survey. In addition, the survey team followed security protocols including being accompanied by village elders and chiefs. A total of 394 households were approached but only 360 accepted the invitation to participate in the survey. Non-response was mainly due to a fear of interacting with non-household members (the survey team) given the COVID-19 situation at the time of the survey, and the general reluctance of households to divulge information on land matters. After data entry and cleaning, 17 questionnaires were dropped from the analysis due to incompleteness, leaving 343 (85.8% of the initial target of 400) as the effective sample size.

Data analysis

This study is anchored in the random expected utility theory (Mongin, 1997), which posits that individuals will choose the alternative (in this case type of land market) that offers the highest utility among the available options, subject to individual characteristics and attributes of the market option (Greene, 2011). Both descriptive statistics and econometric models were employed in the data analysis, as described below.

Assessment of Determinants of Participation in Various Land Markets

In this study, respondents would ideally have had the option of participating in four types of land markets, either simultaneously or in a mutually exclusive form. The

land markets are: renting in, renting out, buying, or selling land. Considering that the variable of interest (participation in a land market) had multiple non-binary options that were unranked/unordered, either multinomial logit (MNL) or probit models would be applicable (Greene, 2011). However, as the options were mutually exclusive for almost all respondents, the MNL regression was more appropriate. Therefore, other limited dependent variable models such as probit and Cragg's two-step procedure that assume complementarity of options (Cragg, 1971; Katchova and Miranda, 2004) were not appropriate for this study.

The MNL regression has been applied in studies with mutually exclusive dependent variable options, for example in the analysis of choice of breeding services (Murage and Ilatsia, 2011). Theoretically, the MNL assumes that each alternative offers some utility that comprises two components (Manski, 1977):

$$U_{in} = V_{in} + \varepsilon_{in} \tag{3}$$

where U_{in} is the utility derived by the nth individual from choice alternative i, V_{in} is the systematic (deterministic) component of utility and in is the random/stochastic part of utility.

The deterministic component of utility can be expressed as:

$$V_{in} = X_{in}\beta \tag{4}$$

where X is a vector of observable characteristics and β are unobservable parameters to be estimated.

The MNL specification assumes a *Gumbel* (extreme value type I) distribution where the location parameter (mean) is zero and μ is the scale parameter.

The MNL model was empirically specified as follows:

$$Y_i = X\beta \tag{5}$$

where Y_i is the probability that an individual chooses to participate in land market type i; X is the vector of factors hypothesized to influence choice of a particular market; and β are coefficients associated with each explanatory variable. Potential multicollinearity among the explanatory variables was tested in a preliminary analysis and was found not to have any influence on the estimates from the model. The independent variables included in the MNL model are shown in Table 1.

Table 1: Variables hypothesized to influence land market participation

Variable	Expected sign		
	Rent in	Rent out	Purchase
Gender (1 = male; 0 = female)	+/-	+/-	+/-
Duration of residency in the area, years	+/-	+/-	+/-
Total land owned in acres before land transaction	-	+	-
Payment mode (1 = lump sum; 0 = instalment)	+/-	+/-	+/-
Distance from home to nearest motorable, kilometres	-	+	-
Distance to from home to nearest natural water source such as stream, swamp, river	-	+	-
Farming experience of household head, years	+/-	+/-	+/-
Membership of household head in farmer group	+	+	+
Household head is native of area	-	+	-
Total monthly income of household, Kenyan Shillings (KSh)	+	-	+
Age of household head, years	-	+	-
Household size (number of people living in household)	+	-	+

Analysis of determinants of intensity of land market participation

The dependent variable "intensity of land market participation" was measured as a continuous variable represented by acres of land bought, rented in or rented out. Considering that the amount of land that could be transacted was bounded within a certain range, censored both from below and above, the Tobit model (Tobin, 1958) was applied in the analysis of intensity of land market participation. The lower censoring limit was set above zero as only positive values of land can be offered in the market. For the upper limit, values of land transacted in each market were censored at the mean plus three standard deviations in order to normalize the data (Greene, 2008). Alternative models for limited dependent variable data, such as the truncated regression model, were not appropriate for this study as they would have entailed a loss of observations outside the threshold values (Long, 1997). In recent literature, the Tobit model has empirically been applied to analyze determinants of land area rented in and rented out in high potential and central highlands of Kenya (Jin and Jayne, 2013), determinants of land area rented in for the case of China (Hou et al., 2017) and strategy research among US-listed firms (Amore and Murtinu, 2019).

Using the variables in Table 1, the Tobit model was specified as follows:

$$Y^* = X'\beta + e, \text{ with } e|x \sim N(0; \delta^2), \text{ with } y = y^* \text{ if } y^* > 0 \text{ or } y < L^u, \text{ and } y = 0 \text{ otherwise} \quad (6)$$

where y is the observed variable of interest (amount of land transacted in acres), y^* is the latent variable and L^u is the upper limit of censoring.

Measuring effect of land market participation on maize output and food security

Following Argyrous (1997) and Khamis (2008), various descriptive measures were applied to analyze changes in output and food security following land market participation. Recent studies such as that by Muthini et al. (2020) applied descriptive indicators to assess the association between farm production diversity and dietary diversity. Mutea et al. (2019) also used descriptive indices to analyze the linkages between various livelihood strategies and food security among rural households. The percentage of respondents that used key inputs such as hired labour, fertilizers and improved seed before and after participation in different types of land markets were computed and compared. For maize output, the percentage change after land market participation was derived. Food security was measured by computing three key indicators: percentage of households that experienced food insecurity incidences in the 12 months prior to the survey; frequency of food unavailability during the 30 days prior to the survey using a likert scale (rarely = once or twice, sometime = 3 to 10 times, often = more than 10 times); and percentage of households in different land markets that applied different coping strategies to manage food unavailability.

4. Results and discussion

Respondents' socioeconomic characteristics

Slightly more than two-thirds (70.3%) of respondents were male, with the remaining one-third female (Table 2). This is consistent with recent studies that show that men mainly participate in surveys on land matters. For example, Okeyo et al. (2020) also had 69% male respondents for a study on land and sorghum productivity in the same site. The study revealed that 64.1% of respondents are natives of the area, while the rest moved there from elsewhere. The average residency duration of households in the area was 34 years. Two thirds (65.6%) of the land is owned by males and 31.5% by females, while 2.9% is jointly owned. In terms of mode of land acquisition, 83.1% of respondents inherited land from relatives, 23.9% acquired their land through purchase, 17.8% through leasing, 0.6% are on settlement schemes and 0.3% received land as a gift. About 39.7% of respondents were members of farmers' groups. The average land owned before market participation was 1.27 acres, while the distances to motorable roads and natural water sources were 0.43km and 1.28km, respectively. The average farm experience of household heads (26 years) was half their age, implying that most household heads started farming in their adulthood. The average monthly household income (KSh13,393) was slightly lower than the minimum farm wage of KSh13,572 at the national level, and its value is further outweighed by the large household size of six persons per household. Okeyo et al. (2020) reported an average monthly household income of KSh11,337 (71.5% from off-farm activities) and a household size of five persons in the same county. Thus, farm incomes are generally low and households that cannot find off-farm opportunities remain poor.

Table 2:   Summary of selected socioeconomic characteristics of households

Variable	Statistic (n = 343)
Gender of respondent (% male)	70.3
Natives (% of respondents)	64.1
Gender of landowner	
Male owner	65.6
Female owner	31.5
Joint male-female ownership	2.9
Mode of primary land acquisition	
Inheritance from relatives	83.1
Purchase	23.9
Leasing	17.8
Settlement scheme	0.6
Gift	0.3
Membership in farmer group (% of respondents)	39.7
Average residency duration of household in village, years	34.05 (21.22)
Average land owned in acres before market participation	1.27 (1.26)
Average distance from home to motorable road in kilometres (km)	0.43 (0.57)
Average distance from home to natural water source	1.28 (1.11)
Average farm experience of household head, years	25.78 (16.77)
Average monthly household income in Kenyan Shillings (KSh)	13,398.11 (17,936.37)
Respondent's average age in years	51.24 (16.48)
Average household size	5.14 (2.50)

Note: standard deviations are shown in parentheses. KSh103 was equivalent to USD$1 at the time of the survey.

Land ownership, tenure security and investments

As shown in Table 3, more than two-thirds and half of those who acquired land through inheritance and purchase, respectively, got all their land through these means. However, only a third of respondents acquired up to 50% of their land through leasing. Nearly all users of leased land had no form of tenure security compared to half and four-fifths of those on inherited and purchased land, respectively, who had title deeds. Crop farming was reported as the main investment on inherited and leased land at 40% and 85%, respectively, compared to building residential houses on purchased land (47% of respondents).

Table 3: Proportion, tenure security and investments on land acquired through various methods

Variable	Mode of land acquisition (% of respondents)		
	Inheritance (n = 285)	Leased (n = 61))	Purchased (n = 82)
Proportion of land			
<25%	7.7	19.7	9.6
25%–50%	9.5	31.1	13.3
50%–75%	6.3	19.7	13.3
75%–95%	6.0	21.3	12.0
100%	70.6	8.2	51.8
Tenure security			
None	47.0	96.7	12.0
Allotment letter	0.4	0	8.4
Title deed	52.6	3.3	79.6
Land investment			
Crop farming	40.0	85.2	25.3
Livestock farming	4.9	1.6	2.4
Crop and livestock farming	29.1	8.2	13.3
Rental houses	2.1	1.6	9.6
Other businesses	0.7	0	0
Tree crops	0.4	0	1.2
Built homestead/dwelling house	21.8	3.3	47.0
Fallow land	1.1	0	1.2

Gender and land inheritance

Only 10.2% of respondents reported that daughters are allowed to inherit land in their village/clan. The main reasons for the limitation of daughters in land inheritance are: feeling that they should get land where they are married (63%), land is not enough (26.4%), and it is a taboo (10.6%). When asked whether they would personally bequeath land to their female relatives in different socioeconomic situations, more respondents expressed a willingness to give land to female persons who are widowed and disinherited by in-laws and those who are married but financially unstable compared to other scenarios (Table 4). Single and employed female persons and those who are married and financially stable would get the least consideration in land inheritance.

Table 4: **Willingness to bequeath land to female persons in different socioeconomic situations**

Daughter/female relative	% willing to bequeath land (n = 343)
Married and financially stable	37.6
Widowed and staying with in-laws	38.5
Single and employed	37.3
Married but financially unstable	53.1
Divorced	51.6
Separated	49.3
Widowed and disinherited by in-laws	55.4
Single and unemployed	46.1

Land market participation

Characterization of land market participation

The results show that 88% of respondents had participated in some form of land market during the five years preceding the survey. The majority were renting in/leasing in land (45.2%) followed by renting out/leasing out of land (21.4%). Only 0.6% rented in and rented out land simultaneously. Male-headed households participated more in all forms of land markets than their female-headed counterparts, with very wide variations in land purchase, renting in and selling land (Table 5).

Table 5: **Household participation in different land markets**

Land market participation type	% of respondents		
	Male-headed households (n = 241)	Female-headed households (n = 102)	Pooled (n = 343)
None (autarky)	58.5	41.5	12.0
Rented in/leased in	75.5	24.5	45.2
Rented out/leased out	57.3	42.7	21.4
Purchased land	83.9	16.1	15.2
Sold land	73.9	26.1	5.6

As shown in Table 6, the main reasons that motivate land acquisition are: renting in of land for food production (55.2%) and the need for more land (25.4%); the purchase of land to relocate elsewhere (35.2%); and food production (25.9%). Conversely, land disposal is motivated by: renting out to get money for buying food (40.7%) and to pay school fees (22.2%). Further, the sale of land is mainly driven by pressure to pay medical bills (35.3%) and the need to optimize net economic returns through enterprise diversification into non-agricultural investments (29.4%).

Table 6: Reasons for land market participation

Conditional purpose of participation	Type of land market (% of respondents)			
	Rent in	Rent out	Purchase	Sale
Medical bill	5.2	9.3	1.9	35.3
Need for more land	25.4	-	14.8	-
School fees	0.7	22.2	1.9	17.6
Food purchase	6.7	40.7	0	1.9
Food production	55.2	9.3	25.9	-
Conflicts	-	1.9	-	5.9
Relocation	6.7	-	35.2	11.8
Non-agricultural investment	16.7	18.5	29.4	

Most land market transactions are concluded within the village. The main partners in renting transactions are relatives, while purchases and sales are done with acquaintances and private individuals, respectively (Table 7). Both renting in and renting out involve almost exclusively verbal contracts, while purchases and sales entail written contracts for over 80% of respondents. Likewise, all renting and slightly over half of sales contracts are organized by farmers, while nearly two-thirds of land purchase deals are organized by the local county government. More than half of the contracts for all four land markets involve fixed amounts that are paid once by most people who rent in or rent out, while instalment payments are mostly used in purchases and sales. Overall, 47.3% of respondents paid instalments for rented in or purchased land.

Table 7: Nature of land markets

Variable	Type of land market (% of respondents)			
	Rent in	Rent out	Purchase	Sale
Scope				
Within village	72.9	92.3	52.6	95.8
Outside village but within sub-county	25.8	7.7	38.6	4.2
Outside sub-county	1.3	-	8.8	-
Partner				
Relative	52.9	50.0	21.1	25.0
Acquaintance	24.5	26.9	36.8	25.0
Farmers	16.1	20.5	12.3	20.8
Private individuals	6.5	2.6	29.8	29.2
Contract form				
Verbal	98.1	98.7	17.5	16.7
Written	1.9	1.3	82.5	83.3
Contract organized by				
Farmers	98.1	98.7	35.1	58.3
Local county government	1.9	1.3	64.9	41.7

Table 7 Continued

Variable	Type of land market (% of respondents)			
	Rent in	Rent out	Purchase	Sale
Contract type				
Gift	20.0	14.1	3.5	4.2
Fixed amount paid	55.5	59.0	87.7	83.3
Flexible amount paid	24.5	26.9	8.8	12.5
Payment mode				
Once	52.3	55.1	43.9	41.7
Instalments	47.7	44.9	56.3	58.3

Less than a sixth of respondents incurred transaction costs in their land market participation. Of these, brokers were only involved to some considerable extent in the search and negotiation process (Table 8).

Table 8: Land transaction costs and intermediaries

Land transaction cost	% of respondents who incurred transaction cost (n = 302)	% of respondents who involved brokers in transaction (n = 302)
Search	6.4	27.3
Negotiation	1.7	50.0
Legal charges	7.0	4.2
Adjudication/survey	13.4	6.5
Allotment charge	13.4	-
Title deed cost	13.4	6.5
Land taxes/rates	0.9	-

The average land size bought (1.4 acres) was higher than that transacted in other land markets. Thus, land sizes rented in, rented out and sold were 0.8, 0.58 and 0.81 acres, respectively. While the percentage of smallholder farmers that rent in or rent out land in this study is higher than other African countries, for example Malawi and Zambia (Chamberlin and Ricker-Gilbert, 2016), the share of land transacted is much smaller yet prices are higher. These differences can be attributed to population pressure on small land size as well as the flexibility to over-subdivide land into several plots due to private and communal ownership in Kenya as opposed to the tight state control of land in other countries. Overall, the average land ownership per household in the sample improved from 1.27 acres before land market participation to 1.67 acres after participation (see Appendix).

Determinants of participation in different land markets

Using autarky as the base category, a multinomial logistic regression model was estimated with the dependent variables as rent in, rent out or purchasing land. The sale option was omitted from the model due to insufficient observations. This is in line with the suggestion by Greene (2011) that the minimum sample size for meaningful statistical inference in a regression model must be 30 observations; in this case, only 5.6% of respondents (19) were in the sale category and a trial analysis gave insignificant coefficients.

The results show that the number of years of residency in a particular village had a positive and significant influence on the likelihood of renting in or renting out land (Table 9). Specifically, an increase of residency in a village by one year increases the likelihood of renting in and purchasing land by 48.2% and 51.8%, respectively. This can be explained by the fact that when an individual stays longer in an area, he/she is more likely to understand how land transactions are performed in the area and they also acquire the necessary social networks that help locate land and transaction partners more easily compared to those who are relatively new to the area. The amount of land (*Landtot*) that someone has prior to participating in land markets negatively influences their probability of renting in or purchasing more land. Thus, the urge to acquire more land is inversely proportional to the relative resource endowment; those who already have more land are likely to be interested in ways of utilizing the available land rather than acquiring more. This finding is consistent with the observation of Chamberlin and Ricker-Gilbert (2016) in Malawi and Zambia, and Otieno and Oluoch-Kosura (2019) in the coastal area of Kenya, that land scarcity drives land rental market development locally and globally. Hou et al. (2017) also found that, in China, households that had more effective cultivated land were significantly less likely to rent in land. Thus, land rental markets generate equity and households with more landholdings are more likely to rent out land, but less likely to rent in land. While this finding is rational, it is contrary to the common behaviour of land speculators who often acquire more land perpetually with the expectation of higher economic returns as the value of land appreciates rapidly over time. Nonetheless, it can be argued that in rural settings, the speculative demand for land is still low.

The payment mode (*Paymode*) significantly affects land market participation. Specifically, the likelihood of renting in, renting out and purchasing land are all reduced significantly if the transactions require payments to be made in one lump sum instead of instalments. This is plausible given that most rural farm households rely on using the land that they are either renting in or buying to grow crops, rear livestock or undertake other investments that take time (at least three to four months) and generate periodic returns, either seasonal or annual. For the renting out option, landowners who insist on being paid lump sum amounts are likely to lose clients to those who offer land for use on an instalment basis.

Table 9: Multinomial logit results on factors that influence rural farmers' participation in land markets

Variable	Rent in (n = 153)			Rent out (n = 75)			Purchase (n = 55)		
	Coeff	Std	tratio	Coeff	Std	tratio	Coeff	std	tratio
Gender (1 = male)	0.166	0.491	0.33	-0.656	0.492	-1.33	0.556	0.640	0.87
Residency years	0.482**	0.235	2.05	0.518*	0.269	1.92	0.085	0.268	0.32
Landtot	-1.376***	0.215	-6.41	-0.011	0.139	-0.08	-1.188***	0.242	-4.90
Paymode (1 = lump sum)	-2.018***	0.449	-4.49	-1.321**	0.438	-3.01	-2.508***	0.522	-4.80
Distroad	-0.067	0.125	-0.53	-0.027	0.128	-0.21	0.009	0.153	0.06
Distwater	0.143	0.167	0.86	-0.014	0.166	-0.09	0.277	0.218	1.27
Farmexper	0.009	0.015	0.60	0.002	0.016	0.14	0.002	0.180	0.09
Famgroup	1.270*	0.715	1.77	-0.324	0.807	-0.40	0.211	0.936	0.23
Native	-.0189	0.443	-0.43	0.238	0.462	0.52	-0.915*	0.522	-1.75
Income	0.132	0.211	0.62	0.013	0.222	0.06	0.893***	0.261	3.42
Age	-1.771**	0.824	-2.15	-1.482*	0.872	-1.70	0.234	0.968	0.24
Household size	1.745***	0.323	3.64	0.459	0.314	1.46	1.322***	0.454	2.91
Constant	6.084*	3.608	1.69	4.683	3.743	1.25	-8.057*	4.320	-1.86
Psuedo-R² = 23.74%; Log likelihood = -326.11114; Prob > chi2 = 0.0000									

Note: statistical significance levels: ***1%, **5%, *10%.

Contrary to expectations, the distance from home to the nearest motorable road (*Distroad*) and natural source of water such as swamp (*Distwater*) were not significant in explaining individuals' likelihoods of participating in land markets. It might be argued that as most rural households are subsistence farmers with limited or no marketable surplus, proximity to better roads may not be a major consideration when making land market decisions. Also, most rural households are poor and rely on bicycles and motor bicycles that do not require motorable roads. Further, the subsistence farming in the study site is mainly rainfed with little or no evidence of irrigation, thus, proximity to natural water sources does not influence land market decisions. Jin and Jayne (2013) also found that distance to road, piped water and electricity were all insignificant in determining households' decisions on land market participation and acreage transacted for a mixed sample of smallholder producers from low and high potential areas.

Membership of a household head in a farming group had a positive influence on the decision to rent in land. This could be due to the ease of getting a trusted, willing land supplier from a farmer group due to the social network provided by such groups. The variable "native" had a negative effect on the probability of purchasing land in an area. Original inhabitants (natives) of an area usually have land acquired through inheritance from family and relatives. Moreover, existing cultural beliefs that provide for "communal entitlement" do not support buying land in the village where one was born. Rather, the natives view such land as theirs and even non-natives who rent in or buy such land are considered to be temporary users of the land and it is hoped that, in the long run, the land would revert to descendants of the original owners by birth right.

As expected, individuals with higher incomes are more likely to buy land than their counterparts with low incomes. Also, relatively older people are less likely to participate in renting in or renting out of land. This can be attributed to fragility that prevents old people from actively supervising or monitoring land-based activities, especially when such land is located far away from the homestead. Hou et al. (2017) also found a negative significant effect of age on households' decisions to rent in land in China.

Household size positively affects the decision to rent in or buy land. This is to be expected, due to the need for more space to fulfil the food requirements and other needs of a large household. This finding provides a conclusive insight, as opposed to Jin and Jayne (2013) who showed an insignificant effect of population density on both the decision and intensity of land rental market participation. Overall, the results of this analysis do not support the rejection of the null hypothesis that gender, income and household size do not jointly affect decisions to participate in land renting in or renting out. Therefore, it is concluded that these factors affect different land markets individually.

Determinants of size of land transacted in different land markets

A Tobit model was estimated, in which the dependent variable (land size transacted in each market) was censored from below and above. The lower limit was set as zero as only a non-zero amount of land can be transacted. Additionally, to ensure statistical normality of the data (Greene, 2008), outlier values above the mean plus three standard deviations of the mean value were censored. Thus, the censuring limits were as follows: rent in (0, 4.61), rent out (0, 1.96) and purchase (0,9.71).

The results of factors that influence the intensity of participation in each land market form are shown in Table 10. As expected, possession of large land size prior to the transaction reduces the amount of land rented in or purchased by 32.5% and 44%, respectively. This is consistent with the observation by Hou et al. (2017) that having more effective cultivated land prior to renting in reduces the appetite for more arable land, hence the low share of land rented in. Further, a one-acre increase in land available prior to the transaction increases the amount of land rented out by 34.4%. These findings are economically plausible because only people who have a substantial amount of land can rent it out, while those with little or no land are realistically expected to rent in or buy more land in order to meet their livelihood needs.

The use of a lump sum payment negatively affects the size of land rented in or purchased by 27.4% and 83.6%, respectively. Thus, an instalment payment is favoured as it gives the individuals flexibility to accumulate more land while paying in staggered proportions over time. Membership of the household head of a farmer group increases the land size rented in by 39%. Thus, social networks created in such groups come in handy in helping an individual to have landowners who are willing to rent in or lease more land to him or her based on trust arising from positive peer ratings.

The results also show that, as rationally expected, an increase in a household's monthly income increases the size of land that they can purchase by 111.3%. This is consistent with the theory of demand, that a positive income effect guarantees higher purchasing power as it increases the ability to afford more of a good or service. This finding supports the idea that farming ability (guaranteed by income) promotes the net transfer of land from less efficient to more efficient producers. Similar results were reported by Chamberlin and Ricker-Gilbert (2016) for Malawi. However, this result contrasts the observation by Jin and Jayne (2013) that more able farmers are likely to participate in land markets both as tenants and landlords. The differences can be explained by the fact that Jin and Jayne (2013) sampled many households in the high potential and central highlands of Kenya where there is commercial farming, while the current study is limited to one lowland county that is purely subsistence-oriented.

Table 10: Tobit results on factors that influence size of land transacted in different markets

Variable	Rent in (n = 152)			Rent out (n = 71)			Purchase (n = 54)		
	Coeff	Std	tratio	Coeff	Std	tratio	coeff	std	tratio
Gender (1 = male)	0.142	0.167	0.85	-0.193	0.161	-1.20	0.400	0.603	0.66
Landtot	-0.325***	0.070	4.62	-0.344***	0.054	6.41	-0.440**	0.189	-2.33
Paymode (1 = lump sum)	-0.274**	0.128	-2.14	-0.020	0.133	-0.15	-0.836*	0.442	-1.89
Distroad	-0.025	0.042	-0.59	0.027	0.042	0.63	0.075	0.143	0.52
Distwater	-0.022	0.057	-0.38	-0.069	0.059	-1.17	0.375	0.235	1.60
Farmexper	-0.005	0.005	0.86	0.001	0.005	0.11	-0.001	0.017	-0.61
Famgroup	0.390*	0.223	1.75	-0.261	0.253	-1.03	-0.861	0.847	-1.02
Income	-0.025	0.074	-0.34	-0.090	0.078	-1.16	1.113***	0.251	4.43
Age	-0.477*	0.262	-1.82	-0.131	0.274	-0.48	2.195**	0.875	2.51
Household size	0.077	0.115	0.67	-0.109	0.114	-0.95	0.815*	0.39	1.86
Constant	2.039*	1.170	1.74	0.497	1.253	0.40	-21.629*	4.439	-4.87
	Psuedo-R^2 = 6.63%; Log likelihood = - 316.71; Prob > chi2 = 0.0000			Psuedo-R^2 = 13.65%; Log likelihood = - 182.88; Prob > chi2 = 0.0000			Psuedo-R^2 = 11.55%; Log likelihood = - 196.73; Prob > chi2 = 0.0000		

Note: statistical significance levels: ***1%, **5%, *10%.

As the household head's age increases, the size of land rented in decreases by 47.7%, while purchased land increases by 219.5%. Jin and Jayne (2013) also found that the household head's age reduces the land area rented in and rented out. In China, Hou et al. (2017) also observed that age had a significant negative effect on area of land rented in. Renting in is a temporary measure and involves seasonal use of the land, which entails a lot of energy in monitoring. This does not favour older people who prefer having most of their activities located in one place with minimum mobility. However, the purchase of more land as people advance in age can be explained by the cultural need to acquire more land and bequeath it to children. An African elder who bequeaths more land to his/ her children and/or grandchildren is considered to pass on more blessings than those who leave little or no land to their heirs. An increase in household size by one person increases the size of land bought by 81.5%, ceteris paribus.

Change in maize input use and output after land market participation

The use of essential farm inputs such as fertilizers, improved seeds and hired labour increased after participation in all land markets; with larger margins for farmers who purchased land and lower amounts in situations where land was sold (Table 11). This can be explained by the increase and decrease in land sizes due to buying and selling, respectively.

Table 11:   Change in input use due to land market participation

Land market participation	Hired labour (% of respondents)		Fertilizers (% of respondents)		Improved seeds (% of respondents)	
	Before	After	Before	After	Before	After
Renting in	47.8	66.0	73.1	86.8	48.1	64.7
Renting out	9.2	43.3	64.9	65.8	48.7	48.7
Purchasing	75.0	96.8	33.9	67.9	35.1	56.1
Selling	89.5	76.3	50.0	58.3	24.0	28.0

The results show that farmers who purchased or rented in land recorded increased maize output by 200% and 121%, respectively (Table 12). This can be attributed to the twin increases in land cultivated as well as the use of improved inputs. However, those who rented out or sold land decreased their maize output by 31% and 35%, respectively. This is expected due to the decline in land available for farming. These results contradict those of Chamberlin and Ricker-Gilbert (2016) who found that smaller producers in Malawi and Zambia who rent in land do so at an economic loss. Perhaps this could be attributed to differences in the intensity and efficiency of the use of the land that is rented in. The results support a rejection of the null hypothesis that land market participation significantly affects output. In particular, it is concluded that renting in or purchasing land contributes to a significant increase in output, while renting out and selling land led to a significant decline in output.

Table 12: Change in maize output due to land market participation

Land market participation	Average maize output in 50kg bags		% change in maize output
	Before	**After**	
Renting in	2.69 (3.77)	5.95 (6.02)	121.19
Renting out	5.78 (4.83)	4.00 (4.40)	-30.80
Purchasing	2.50 (4.75)	7.51 (9.39)	200.40
Selling	4.44 (4.93)	2.90 (4.05)	-34.68

Food security incidences and coping mechanisms after participation in different land markets

Land market participation is expected to contribute to food security either through making available more land for production or more money for purchasing food. This is confirmed by the finding that the incidence of food unavailability was highest in households that never participated in any land market (64.1%) compared to those who engaged in land markets (Table 13). The null hypothesis that land markets do not affect food security is thus rejected. Households that purchased land recorded the lowest incidence of food unavailability (30.33%). This reinforces the argument that self-sufficiency is the best way of achieving food security as a household that produces its own food is guaranteed to have food availability and safety even in times of disasters such as floods, droughts and disease outbreaks like the COVID-19 pandemic.

Further, more male-headed households (58%) experienced food insecurity compared to female-headed households. This affirms the belief that in African societies, women are the primary custodians of household food security, particularly in ensuring availability as they mostly operate kitchen gardens where they grow vegetables and keep poultry for subsistence needs. It is also important to note that fewer households whose members engaged in off-farm income-generating activities experienced food unavailability compared to those that rented in, rented out or sold land. This has two possible implications: either the returns from off-farm employment are higher than proceeds from land rentals and sales, and output derived from rented in land; or households that work off-farm are more likely to channel the money received to food purchases while those who rent out or sell land are likely to divert the money to non-food uses. Indeed, it is not uncommon to find some household heads selling land without informing or consulting with other members of their households, and in some cases they use the money to marry more wives while neglecting the welfare of their initial families.

Table 13: Food insecurity incidence in the previous 12 months

Variable	% of household that experienced food unavailability
Land market type	
Autarky (no land market participation)	64.10
Renting in	49.68
Renting out	49.33
Purchasing	30.33
Selling	43.48
Gender (male-headed households)	57.67
Participation of household member in off-farm income-generating activities	43.64

The average duration of a food insecurity incident over the year prior to the survey was 3.04 months. The specific frequency of food insecurity for each category in the month preceding the survey is shown in Table 14. More households who sold land had frequent incidences of food unavailability than those in other land market categories. Again, this finding points to the diversion of money from land sales to non-food expenditure, contributing to low food security. Consistent with earlier findings, fewer female-headed households and those with off-farm employment had frequent food insecurity. As noted by WFP (2016), access to and participation in off-farm income-generating activities reduce a household's poverty level and food insecurity incidence.

Table 14: Frequency of food insecurity in the previous 30 days

Variable	Frequency of food unavailability in the previous 30 days (% of households)		
	Rarely (once or twice)	Sometimes (3 to 10 times)	Often (more than 10 times)
Land market type			
Autarky (no land market participation)	30.43	56.52	13.05
Renting in	43.84	37.00	19.16
Renting out	40.00	45.00	15.00
Purchasing	42.86	42.86	14.28
Selling	69.23	7.69	23.08
Gender			
Male-headed households	*48.51*	*36.63*	*23.81*
Female-headed households	*34.92*	*46.03*	*19.05*
Participation of household member in off-farm income-generating activities	*43.89*	*41.84*	*14.29*

Households that purchased land and those who had never participated in any land market mainly borrowed money to buy food (Table 15). This is rational as those who buy land may not have money left for buying food, while those in autarky may

have offered their land as collateral against loans. Consistent with earlier findings, a majority (69.23%) of those who sold their land and diverted the money to non-food expenditures resorted to selling other non-land assets in order to obtain cash for buying food. This trend is not favourable for capital investment and sustainable development as it depletes economic resources. Male-headed households were more likely to sell other assets and take loans in order to buy food, while their female counterparts mostly relied on relief food or did nothing. This shows that women are more resilient to shocks such as food insecurity compared to men. Finally, households with off-farm employment mostly sold other assets or borrowed money to purchase food.

Table 15: Household food insecurity coping mechanisms

Variable	% of households				
	Did nothing	Borrowed to buy food	Sent part of family to live with relatives	Received relief food	Sold other assets
Land market type					
Autarky (no land market participation)	30.43	30.43	0	13.04	26.08
Renting in	22.67	28.00	1.33	5.33	42.67
Renting out	21.43	19.05	4.76	19.05	35.71
Purchasing	26.67	40.00	0	0	33.33
Selling	15.38	15.38	0	0	69.23
Gender					
Male-headed households	*19.23*	*34.62*	*1.92*	*1.92*	*42.31*
Female-headed households	*29.69*	*10.94*	*1.56*	*20.31*	*37.50*
Participation of household member in off-farm income-generating activities	*20.00*	*32.00*	*0*	*2.00*	*46.00*

5. Conclusions and policy implications

This study analyzed the determinants of participation in land markets and the effects on maize output and food security among smallholder farmers in a rural area of western Kenya. The results show that 88% of sampled households participated in land markets; 45% and 22% of them rented in and rented out land, respectively. Average household land ownership improved from 1.27 acres to 1.67 acres after market participation. Therefore, strategies that promote increased participation in land markets should be encouraged. More male-headed households (57%) than female-headed households participated in all land markets. This calls for enhanced access to the resources needed to facilitate increased participation by women in the land markets. The number of years of residency in an area was found to significantly influence land market participation. This suggests that effective land market participation requires potential clients to network with local residents in order to acquire the desired land on reasonable terms and possibly minimize land-related conflicts. The amount of land that an individual has prior to a transaction negatively influenced decisions to rent in or purchase land. The implication here is that different strategies are needed: resolving land market constraints for those with limited or no land to enable them to acquire land, while focusing on building the capacity of those who already have land on how to effectively put it to productive use.

Considering the negative effect of lump sum payment requirements for renting or purchasing land, landlords and owners should structure their transactions to provide for flexible instalment options that enable land users to invest in short-term enterprises that provide seasonal returns. The positive significant effect of farmer group membership on the decision and extent of land market participation implies that the role of social networks in sustainable land investments cannot be ignored. Local county officials should prioritize awareness of land market issues to such groups and facilitate their registration and coordination for efficient operation.

Large average household sizes of six persons, and the positive effect of this on land renting in and purchasing, have implications for the supply of land. In particular, there is a need for the two levels of government (national and county) to collaborate with research institutions such as the International Centre of Insect Physiology and Ecology (ICIPE) and other development partners to reclaim large parts of land in the county that is infested with tsetse fly and thus remains uninhabited. This would ensure adequate arable land for the growing population.

Among the participants in various land markets, the majority who rented in or purchased land recorded a considerable increase in the use of commercial inputs such as hired labour, fertilizers and seeds. Necessary interventions that strengthen participation in these markets (land renting in and purchasing) should be promoted as they are key to the growth of the rural commercial farm input sector. Such interventions may include reduced licensing costs for input suppliers to enable them to offer cheap inputs to emerging farmers on rented in or purchased land for an initial 3–5 years.

Renting in and purchasing of land contributed to an increase in maize output of 121% and 200%, respectively. Conversely, renting out and the sale of land reduced output by 31% and 35%, respectively. There is a need for inclusive consultation with local leaders and landowners with a view to change communal land ownership structures to free up more land for renting in or purchasing in order to generate more output and also contribute to rural employment and entrepreneurship. The incidence of food insecurity was higher among those who had never participated in any land market or those who sold land, male-headed households, and those without off-farm income-generating activities. Regulations to ensure a balance between the proportions of land sold and that reserved for household own production are necessary to cushion rural families from extreme food insecurity. It might also be prudent for local county governments to set a minimum percentage for land sale proceeds that must be channelled to food purchases in order to minimize food insecurity arising from the diversion of money to non-food expenditures. This can be deducted at the point of the land sale and released over a period of time to the household. Finally, capacity building in the upstream stages of agricultural value chains, such as processing and marketing, is necessary in order to make available more off-farm opportunities to reduce food insecurity.

References

Ali, D., K. Deininger and M. Goldstein. 2014. "Environmental and gender impacts of land tenure regularization in Africa: Pilot evidence from Rwanda". *Journal of Development Economics*, 110: 262–75.

Amore, M. and S. Murtinu. 2019. "Tobit models in strategy research: Critical issues and applications". *Global Strategy Journal*. https://doi.org/10.1002/gsj.1363.

Anderson, D., D. Sweeny and T. Williams. 2007. *Statistics for Business and Economics*. 11th edition. Cengage Learning, South-Western, United States of America.

Argyrous, G. 1997. "Introduction to measures of association". In: *Statistics for Social Research*. London: Palgrave. https://doi.org/10.1007/978-1-349-14777-9_19.

Beegle, K. and C. Luc. 2019. *Accelerating Poverty Reduction in Africa*. Washington, D.C.: World Bank.

Birch, I. 2018. "Agricultural productivity in Kenya: Barriers and opportunities". K4D Helpdesk Report. Institute of Development Studies. Brighton, United Kingdom.

Boone, C., A. Dyzenhans, A. Manji, C. Gateri, S. Ouma, J. Owino, A. Gargule and J. Klopp. 2018. "Land law reform in Kenya: Devolution, veto players and the limits of an institutional fix". *African Affairs*, 118(471): 215–37. https://doi.org/10.1093/afraf/ady053.

Byerlee, D. and K. Deininger. 2013. "Growing resource scarcity and global farmland investment". *Annual Review of Resource Economics,* 5(1):13–34.

Chamberlin, J. and J. Ricker-Gilbert. 2016. "Participation in rural land rental markets in Sub-Saharan Africa: Who benefits and by how much? Evidence from Malawi and Zambia". *American Journal of Agricultural Economics,* 98(5):1507–28.

Community Land Act No. 7. 2016. Kenya Gazette Supplement No. 148. Republic of Kenya.

County Government of Siaya. 2018. County Annual Development Plan 2019–2020. Siaya, Kenya.

Cragg, J. 1971. "Some statistical models for limited dependent variables with application to the demand for durable goods". *Econometrica*, 39: 829–44.

Deininger, K., T. Hilhorst and V. Songwe. 2014. "Identifying and addressing land governance constraints to support intensification and land market operation. Evidence from 10 African countries". *Food Policy*, 48: 76–87.

Deininger, K., J. Songqing and N. Hari. 2008. "Efficiency and equity impacts of rental land market restrictions: Evidence from India". *European Economic Review*, 52(5): 812–918.

Diiro, G., G. Seymour, M. Kassie, G. Muricho and B. Muriithi. 2018. "Women's empowerment in agriculture and agricultural productivity: Evidence from rural maize farmer households in Western Kenya". *Plos One,* 13(5): 1–27. https://doi.org/10.1371/journal.pone.0197995.

Doss, C., R. Meinzen-Dick, A. Quisumbing and S. Theis. 2018. "Women in agriculture: Four myths". *Global Food Security*, 16: 69–74.

Doss, C., G. Summerfield and D. Tsikata. 2014. "Land, gender and food security". *Feminist Economics*, 20(1): 1–23. https://doi.org/10.1080/13545701.2014.895021.

Espinosa, D. 2019. "Secure land tenure: Food security depends on it". Focus on Land in Africa Brief. https://doi.org/10.21955/gatesopenres.1115704.1.

FAO. 2006. "Food security". *Policy Brief 2*, 1–4. FAO Agricultural and Development Economics Division. http://www.fao.org/es/esa/.

Githinji, M., C. Konstantinidis and A. Barenberg. 2014. "Small and productive: Kenyan women and crop choice". *Feminist Economics*, 20(1): 101–29. https://doi.org/10.1080/13545701.2013.878467.

Greene, W. 2011. *Econometrics Analysis*, 7th edition. Upper Saddle River, NJ: Prentice Hall.

Greene, W. 2008. "Functional forms for the negative binomial model for count data". *Economic Letters*, 99: 585–90.

Holden, S. and K. Otsuka. 2014. "The roles of land tenure reforms and land markets in the context of population growth and land use intensification in Africa". *Food Policy*, 48: 88–97.

Holden, S., K. Otsuka and F. Place. 2009. "The emergence of land markets in Africa: Impacts on poverty, equity and efficiency". Resources for the Future Press, Washington, D.C.

Hou, J., X. Huo and R. Yin. 2017. "Land rental market participation and its impact on fixed investment and household welfare: Evidence from Chinese apple production sites". *Sustainability*, 9(11). 1961. https://doi.org/10.3390/su9111961.

Jayne, T., D. Mather and E. Mghenyi. 2010. "Principal challenges confronting smallholder agriculture in Sub-Saharan Africa". *World Development,* 38: 1384–98.

Jayne, T., T. Yamano, M. Weber, D. Tschirley, R. Benfica, A. Chapoto and B. Zulu. 2003. "Smallholder income and land distribution in Africa: Implications for poverty reduction strategies". *Food Policy,* 28(3): 253–75.

Jin, S. and K. Deininger. 2009. "Land rental markets in the process of rural structural transformation: Productivity and equity impacts from China". *Journal of Comparative Economics*, 37(4): 629–46.

Jin, S. and T. Jayne. 2013. "Land rental markets in Kenya: Implications for efficiency, equity, household income and poverty". *Land Economics*, 89(2): 246–71.

Juma, D. 2019. "Agriculture at the crossroads: Challenges of food security and rural development in Siaya County". Master's Thesis, Swedish University of Agricultural Sciences, Uppsala.

Kassie, M., J. Stage, H. Teklewold and O. Erenstein. 2015. "Gendered food security in rural Malawi. Why is women's food security status lower?" *Food Security*, 7(6): 1299–320. https://doi.org/10.1007/s12571-015-0517-y.

Katchova, A. and M. Miranda. 2004. "Two-step econometric estimation of farm characteristics affecting marketing contract decisions". *American Journal of Agricultural Economics,* 86(1): 88–102.

Khamis, H. 2008. "Measures of association. How to choose?" *Journal of Diagnostic Medical Sonography,* 24: 155–62. https://doi.org/10.1177/8756479308317006.

Klopp, J. and O. Lumumba. 2017. "Reform and counter-reform in Kenya's land governance". *Review of African Political Economy*, 44(154): 577–94. https://doi.org/10.1080/03056244.2017.1367919.

Land Registration Act. 2016. Cap 300. Republic of Kenya.

Long, J.S. 1997. *Regression Models for Categorical and Limited Dependent Variables*. London: Sage.

Lutomia, C., G. Obare, I. Kariuki and G. Muricho. 2019. "Determinants of gender differences in household food security perceptions in Western and Eastern regions of Kenya." *Cogent Food and Agriculture*, 5: 1694755. https://doi.org/10.1080/23311932.2019.1694755.

Manski, C. 1977. "The structure of random utility models". *Theory and Decisions*, 8:229–54.

McFadden, D. 1973. "Conditional analysis of qualitative choice behaviour". In P. Zarembka, ed. *Frontiers in Econometrics*, New York: Academic Press.

MoALF. 2016. "Climate risk profile for Siaya". Kenya County Climate Risk Profile Series. Ministry of Agriculture, Livestock and Fisheries (MoALF). Nairobi, Kenya.

Mongin, P. 1997. "Expected utility theory". In J. David, W. Hands and U. Maki, eds. *Handbook of Economic Methodology.* London, Edward Elgar, pp.342–50.

Murage, A. and E. Ilatsia. 2011. "Factors that determine use of breeding services by smallholder dairy farmers in Central Kenya". *Tropical Animal Health and Production*, 43: 199–207.

Mutea, E., P. Battazzi, J. Jacobi, B. Kiteme, C. Speranza and S. Rist. 2019. "Livelihoods and food security among rural households in the north-western Mount Kenya region". *Frontiers in Sustainable Food Systems*, 3(98): 1–12. https://doi.org/10.3389/fsufs.2019.00098.

Muthini, D., J. Nzuma and R. Nyikal. 2020. "Farm production diversity and its association with dietary diversity in Kenya". *Food Security*. https://doi.org/10.1007/s12571-020-01030-1.

National Land Commission Act. 2015. Cap 5D. Republic of Kenya.

Obonyo, V., C. Otieno and F. Ang'awa. 2016. "Land fragmentation and food security in Ugunja sub-county, Siaya County, Kenya". *American Scientific Research Journal for Engineering, Technology and Sciences*. ISSN 2313-4402.

Okeyo, S., S. Ndirangu, H. Isaboke and L. Njeru. 2020. "Determinants of sorghum productivity among smallscale farmers in Siaya County, Kenya". *African Journal of Agricultural Research*, 16(5): 722–31.

Otieno, D.J. and W. Oluoch-Kosura. 2019. "Assessment of local stakeholders' preferences for foreign land lease design attributes in Kenya: A participatory choice-based survey approach". *Heliyon*. https://doi.org/10.1016/j.heliyon.2019.e02730.

Otto, O. and M. Stahl. 2015. "Private or customary – whither land tenure in East Africa?" In M. Stahl, ed. pp.134–52. The Nordic Africa Institute, Uppsala.

Otto, O., A. Isinika and H. Musahara, eds. 2019. "Land tenure dynamics in East Africa: Challenging practices and rights to land". *Current African Issues No. 65.* The Nordic Africa Institute, Uppsala.

Owoo, N. and L. Boakye-Yiadom. 2015. "The gender dimensions of the effects of land tenure security on agricultural productivity: Some evidence from two districts in Kenya". *Journal of International Development,* 27(7): 917–28. https://doi.org/10.1002/jid.3028.

Republic of Kenya. 2019. Kenya Population and Housing Census Report, Volume 1. Kenya National Bureau of Statistics.

Sharaunga, S., M. Mudhara and A. Bogale. 2016. "Effects of 'women empowerment' on household food security in rural KwaZulu-Natal province". *Development Policy Review,* 34(2): 223–52. https://doi.org/10.1111/dpr.12151.

Singirankabo, U. and M. Ertsen. 2020. "Relations between land tenure security and agricultural productivity: Exploring the effect of land registration". *Land*, 9(138). https://doi.org/10.3390/land9050138.

Tobin, J. 1958. "Estimation of relationships for limited dependent variables". *Econometrica*, 26: 24–36.

Van Arkadie, B. 2016. "Reflections on land policy and the independence settlement in Kenya". *Review of African Political Economy,* 43(Sup1): 60–8. https://doi.org/10.1080/03056244.2016.1217837.

WFP. 2016. "Comprehensive food security and vulnerability survey". Summary Report, Kenya. World Food Programme. Nairobi, Kenya.

Wily, L. 2018. "The Community Land Act in Kenya: Opportunities and challenges for communities". *Land*, 7(12): 1–25. https://doi.org/10.3390/land7010012

World Economic Forum. 2015. *The African Competitiveness Report 2015.*

Appendix

Descriptive statistics of respondents and their land market participation

	N	Min	Max	Mean	Std
Land size in autarky, acres	41	0.25	5.00	1.64	1.38
Rent in land, acres	156	0.13	15.00	0.80	1.27
Number of rent in plots	155	1.00	2.00	1.02	0.24
Rent out land, acres	73	0.13	2.50	0.58	0.46
Number of rent out plots	73	1.00	3.00	1.03	0.36
Purchased land, acres	52	0.25	20.00	1.40	2.77
Price of purchased land, KSh/acre	52	1000.00	4500.00	78.95	596.04
Number of purchased plots	52	1.00	3.00	1.16	0.46
Sold land, acres	19	0.25	2.00	0.81	0.56
Number of plots sold	19	1.00	2.00	1.04	0.20
Amount of search costs, KSh	22	500.00	10000.00	1382.73	2029.05
Search duration, days	22	1.00	60.00	9.46	15.11
Amount of negotiation costs, KSh	6	200.00	3000.00	1616.67	960.03
Duration of negotiation, days	6	1.00	4.00	2.00	1.26
Amount of legal charges, KSh	19	2500.00	20000.00	7583.33	4370.52
Duration of legal charges completion, days	19	1.00	30.00	5.67	7.04
Amount of survey costs, KSh	46	2000.00	35000.00	10454.35	6921.17
Duration of land survey, days	46	1.00	40.00	9.24	11.15
Amount of allotment charges, KSh	2	1000.00	6000.00	3500.00	3535.53
Amount of title deed costs, KSh	46	500.00	80000.00	11084.78	12092.02
Duration taken to receive title deed, days	43	1.00	150.00	43.63	37.80
Land owned before market participation, acres	343	0.00	9.50	1.27	1.26
Land owned after market participation, acres	302	0.13	23.00	1.67	2.20

Mission

To strengthen local capacity for conducting independent,
rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

www.aercafrica.org

Learn More

www.facebook.com/aercafrica

www.instagram.com/aercafrica_official/

twitter.com/aercafrica

www.linkedin.com/school/aercafrica/

Contact Us
African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org