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EFFECT OF AGRICULTURAL LAND RENTAL MARKET PARTICIPATION ON AGRICULTURAL INCOME OF SMALL SCALE FARMERS IN KWALE COUNTY, KENYA

Joseph Jabu Mbudzya

A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements of the Award of Master of Science Degree in Agricultural and Applied Economics of Egerton University

Egerton University

May, 2017

DECLARATION AND APPROVAL

Declaration

I hereby declare that this is my original work and has not been submitted in this or any other university for award of any degree.

Signature: _____ Date: _____/ _____/ 2017

Mbudyza Joseph Jabu

KM17/13507/14

Approval

This thesis has been presented to the Graduate School of Egerton University with our approval as university supervisors.

Signature: _____ Date: _____/ _____/ 2017

Dr. Oscar Ingasia Ayuya, PhD

Department of Agricultural Economics and Agribusiness Management,

Egerton University

Signature: _____ Date: _____/ _____/ 2017

Prof. Patience Mshenga, PhD

Department of Agricultural Economics and Agribusiness Management,

Egerton University

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DEDICATION

This thesis is dedicated to my lovely parents, siblings and lecturers.

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ABSTRACT

Kwale County has a vibrant agricultural land rental market due to its relative good climate and fertile soil. However, it is faced with several challenges including inefficiency use of resources such as land. There is evidence in Ethiopia and other parts of the world that participation in agricultural land rental markets can be a solution to solving food insecurity and land inequalities in Sub -Saharan Africa and the world at large. However, there are few studies which have been conducted in Kenya on agricultural land rental market. This study was conducted to fill this gap. The general objective of the study was to contribute to enhanced livelihood through improved effectiveness of agricultural land rental markets among small- scale farmers in Kwale County, Kenya. Specifically, it was to characterize the socioeconomic and institutional attributes of land rental market participants and to determine the socioeconomic and institutional factors influencing small scale farmer's participation in the agricultural land rental market and its effect on agricultural income. A multi- stage sampling technique was used to obtain a sample size of 386 small scale farmers. Descriptive statistics, bivariate Probit, and a two stage Instrumental Variable approach were used in data analysis. Participants in land renting in were young (47 years), more educated and owned relatively small farms (2.05 acres) while the participants in renting out were relatively old (53 years), less educated and owned large pieces of land (8.08 acres). Transaction costs, access to extension services and ownership to oxen were the main determinants of land rental market participation. Finally, participation in agricultural land renting in had no significant influence on agricultural income. Therefore, the study recommends stakeholders to develop policies geared towards reduction in transaction costs and land rental prices. This could be through development in communication and road infrastructure to ease the access to information and agricultural land markets. There is a need for investment in the provision of affordable and quality formal education, up to date, relevant demand-driven extension services and low cost and readily available credit so as to encourage the participation in agricultural land rental market and increase agricultural income. There is also to heighten land equalization, policies that enhance reinvestment in agricultural assets such oxen, access to extension services and reduces transaction cost which is important in increasing the agricultural income of small scale farmers.

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ACRONYMS AND ABBREVIATIONS

DEA	-	Data Envelopment Analysis
GLA	-	Government Land Acts
G o K	-	Government of Kenya
IEBC	-	Independent Electoral and Boundaries Commission
IV	-	Instrumental Variable
KCIDP		Kwale County Integrated Development Plan
KNBS	-	Kenya National Bureau of Statistics
NLC	-	National Land Commission
OLS	-	Ordinary Least Square
PRSP	-	Poverty Reduction Strategy Paper
SPSS	-	Statistical Package for Social Scientists
UNDP	-	United Nations Development Programme
FAO		Food and Agriculture Organization
KES		Kenya Shillings

CHAPTER ONE
INTRODUCTION

1.1 Background information

Land is critical to the economic, social and cultural development of many developing nations including Kenya. It is a central category of property in the lives of Kenyans. Moreover, it is a principal source of livelihood and material wealth as well as being culturally significant for many Kenyans. Consequently, its importance is recognized by various Government initiatives including the initial Poverty Reduction Strategy Paper (PRSP), political party manifestoes and the Economic Recovery Strategy for Wealth and Employment Creation 2003-2007 (Hermunen, 2004). Kenya has an area of approximately 582,646 (km2) comprising 97.8% land and 2.2% water surface. Only 20% of the land area can be classified as medium to high potential (suitable for arable agricultural) and the rest of the land is mainly arid or semi-arid (suitable for extensive livestock production, wildlife and irrigated farming (Siriba and Mwenda, 2013). Arable land in Kenya is increasingly becoming scarce due to a rapidly growing population and continuous land degradation.

Purchasing land is clearly a limited option since not only are the procedures complex but there is also very little land available for sale. The system is fraught with institutional rigidities and other transaction costs that make land purchase procedures lengthy, cumbersome and expensive (Nyangena, 2010). In addition, most people are poor and face lots of financial constraints. An obvious result of this is the creation of new uncertainties and a proliferation of costly litigation matters (Njuguna and Baya, 2000). The above challenges associated with the land sales market have led to the emergence of a new trend of accessing land through both formal and informal land rental markets commonly referred to land leasing. Land leasing is the voluntary transfer of possession rights of land (the right of use) for a limited period of time.

The leasing of land is very common in the Coast region of Kenya. The Coastal region is highly significant when it comes to the history of Kenya as a nation. This is especially because the Coast plays host to many resources both natural and manmade. These have since the colonial times elicited a lot of interest from government, citizens, tourists as well as investors keen to enjoy a piece of the rich heritage that abides in the area. On perceived or otherwise existing imbalances, the land question stands out as the most prominent and widespread problem at the coast. The main problem is access and ownership as often

highlighted in various fora and the media. The majority of the population in this region are squatters and do not have ownership to the land (Ngatia, 2010).

The Coast region of Kenya has experienced problems related to land since pre-independence Kenya. The coastal land was previously controlled by Swahili/Arabs until the British Colonized both Kenya and Tanzania. Since independence, the squatter problem has escalated due to rising populations, increased demand for land for agriculture and non-agricultural activities and the non-restriction of land-ownership in the country (Kanyinga, 1998). This has led to the emergence and growth of land markets in the Coast of Kenya. These markets have developed not only in the areas which are fertile and have high agricultural potential areas as in the case of Kwale County but also in other areas in the region.

Land leasing can take two forms: cash rent and sharecropping. In cash rent lease, the farmer pays a fixed annual amount of money per acre of land and owns the entire produce. As a result, they supply their own inputs but may overuse any inputs provided by the land owner, including the un-priced land attributes. In crop share lease, the farmer does not pay any fee for use of the land but simply pays a predetermined share of the harvest of the crop to the land owner at the time of harvest (Nyangena, 2010). Land rental markets offer several advantages. First, leasing arrangements can enhance efficiency by allowing gains from specialization. Second, renting land requires less liquidity or access to credit. With credit imperfections in Kenya and other developing countries, this is an important consideration for poor rural households. Lastly, leasing contributes towards reducing inequality in land holdings and facilitating access to land for poorer households. The division of ownership and use, however, may create potential incentive problems for both landlords and tenants regarding optimal maintenance and use of the property (Nyangena, 2010).

The prime importance of land as an important factor of production calls for policies and laws to govern its management and use. In Kenya, agricultural land use is mainly guided by The Constitution of Kenya (2010), The Land Control Act, Chapter 302, The County Government Act, Chapter 265 and The Physical Planning Act, Chapter 286, Laws of Kenya. Land policy is a set of socio-economic, legal, technical and political measures that dictate the manner in which land and benefits accruing from land are allocated, distributed and utilized (Njuguna and Baya, 2000). In Kenya, there are numerous laws and statutes governing the leasing of land including the Indian Transfer Act (1882), the Registered Land Act (Cap 300)

and the customary law system. The Government Lands Act as one of the first land policies was enacted about 70 years ago, and it is the statute under which all land in Kenya is administered apart from trust land or plots of land with freehold title which is registered in the name of an individual or a body corporate.

Land legislations in Kenya have over the years given rise to three types of land tenure systems categories. These are private, customary and public tenure systems. The land laws gave prominence to private land over indigenous/communal land. The current constitution and subsequent land laws recognize indigenous/communal land and consequently categorize land into public, community and private land and these are in the ratios of 10%, 70% and 20%, respectively (Siriba and Mwenda, 2011). Public land is the land that was formerly crown land that is now held by the government, for example, army barracks, forest lands, national parks, game reserves, wetlands, riparian reserves and protected areas. Trust land is the land held by the local authorities (county governments) on behalf of the people ordinarily resident in their areas of jurisdiction. Trust land includes un-adjudicated land in the rural areas, rural markets and rural public schools. Private land is land held by individual persons or legal persons like private companies and co-operative societies after alienation from government land or adjudication from trust lands (NLC Act, 2012).

Along the coastal strip and the coastal uplands, the land is mainly owned by absentee landlords, leading to the squatter settlement problem. The trust and government land within these areas have since been adjudicated and government settlement schemes established. In the drier areas of the Nyika Plateau in Kinango, Kasemeni, Samburu, Ndavaya and some parts of Lunga Lunga Constituency, the land is held in trust and under group ranches. Land is viewed as a communal asset where every member of the community has the right to use it. In most areas adjudication has not yet been done thus land is still held under the group ranch. Most of the group ranches currently are non-functional and this has resulted in unplanned human settlements in the land. The land is also used for small-scale farming, mining, quarrying as well as settlements (KCIDP, 2013).

1.2 Statement of the problem

Access to land even if only through use rights has implications for effective utilization of resources and improved food security. Kwale County has had challenges of poor land tenure systems and unequal distribution of land ownership, thus in their quest to access land for agricultural activities, rural households have over the years participated in agricultural land markets particularly in land rental markets. Agricultural land rental markets have potential benefits such as improve the access to agricultural land, food and increase efficiency and agricultural income. Despite the potential positive effects posed by participation in agricultural land rental markets, the market is still emerging amidst the existing land issues in Coastal region of Kenya. In addition, there is still inadequate literature in developing countries on drivers of agricultural land rental markets participation, particularly in regions that still experiences land injustices. In light of the low incidence of participation in land rental market, empirical evidence on its drivers is needed by policy makers and local government on modalities of spurring the sector. From the foregoing, the objective of this study is to provide empirical evidence on drivers of smallholder participation in agricultural land rental markets in regions still experiencing historical land injustices in Kenya.

1.3 General Objective

The general objective was to contribute to enhanced livelihood through improved effectiveness of agricultural land rental markets among small-scale farmers in Kwale County, Kenya.

1.3.1 Specific objectives

1. To characterize the household socio-economic and institutional attributes of agricultural land rental market participants.
2. To determine the socioeconomic and institutional factors influencing participation in agricultural land rental market.
3. To determine the effect of renting in agricultural land on agricultural income.

1.3.2 Research questions

1. What are the household socio-economic and institutional attributes of agricultural land rental market participants?
2. What are the socioeconomic and institutional factors influencing participation in agricultural land rental market?
3. Does renting in of agricultural land have an effect on agricultural income?

1.4 Justification of the study

Due to the scarcity of land, unavailability of well-defined property rights and differences in the efficiency of land use, agricultural land rental markets have progressively been developing over the years. The development of such markets has not been smooth. It has been faced with various challenges such as high transaction costs, inadequacy of credit due to poor collateral (McClung, 2013). The markets, however, have had a remarkable impact on the agricultural income and on the society in general. Due to the informal nature of the market in most of the areas in sub-Saharan Africa, few studies had been conducted to document its impact on agricultural income (Nyangena, 2010), thereby creating an information gap. In addition to that, this research was informed by a study by Jin and Jyne (2013) that recommended further research on the constraints affecting land rental markets and impact of the rental markets on agricultural income.

As noted by Nyangena (2010), much of the policy focus, often under pressure from donors such the World Bank has been on the encouragement of land sales markets, while land rental markets are more likely to play an important, and positive, role at present. Hence, rental markets should not be considered a side issue in the discussion of land markets, but instead should be a focal point of attention. Therefore, determination of impact of agricultural land rental market participation on agricultural income helps in the enhancement of better utilization of high and medium potential lands by farmers, hence helping the achievement of Vision 2030 Economic pillar of achieving economic growth of over 10% and sustaining it for over 25 years (GoK, 2007). This was achieved by focussing more on agriculture whose expected transformation under the pillar is to promote an innovative, commercial-oriented and modern agricultural sector through, among others, the introduction of land use policies.

Determination of effect of participation on livelihood assists in achieving the Sustainable Development Goal on ending hunger achieves food security and improved nutrition and promotes sustainable agriculture thereby enhancing efficient land market participation by small-scale farmers (UNDP, 2015). The study has generated imperative information which improves the understanding of households' participation in agricultural land rental markets and its effect on agricultural income. Further, the information helps rural development planners and policy makers in setting priorities for enhanced agricultural land rental markets to help improve the livelihood of small-scale farmers in Kwale County.

1.5 Scope and limitation of the study

The study determined the effect of participation of small-scale farmers in agriculture land rental markets on agricultural income in Lunga Lunga Constituency, Kwale County. Illiteracy and inadequacy of properly kept records affected the accuracy of the estimates and hence the study heavily relied on farmer's ability to recall information. This study was also restricted to small-scale farmers. Climatic, topography and technological factors were not considered in this study.

1.6 Operational definition of terms

Livelihood- Refers to means of securing the basic necessities of life such as food, water, shelter and clothing.

Household- Refers to a social unit composed of people who live together in the same dwelling.

Small scale farmer-Refers to farmer who resides at Lunga Lunga Constituency and owns not more than 10 acres of land.

Market participation- It is the renting in, autarky or renting out of agricultural land.

Renting in- Refers to the act of hiring in agricultural land from a landlord.

Renting out- Refers to the act of hiring out agricultural land to a tenant.

Autarky- Refers to neither renting in nor renting out agricultural land.

Land market- The interaction between tenants and landlords of agricultural land.

Agricultural income- All income gained from agricultural activities such as crop and animal production.

CHAPTER TWO
LITERATURE REVIEW

This chapter consists of the following sections; Land lease in Kenya, emerging informal land rental markets in Kwale County, socioeconomic and institutional factors and effect of small-scale farmer's participation in agricultural land market on agricultural income. This section is meant to review other studies on agricultural land rental markets. It helps in understanding the existing literature on the concept of land rental markets and its effect on various aspects such as agricultural income. It also helped in identifying the research gap which this study sought to address.

2.1 Agricultural land rental market in Kenya

Land leasing arrangement is an important way of obtaining land through the market. Agricultural land rental markets have become an important mechanism for readjusting land-labour ratios among farm households. This is because the majority of land cultivated by African small-scale farmers is under customary tenure systems and the purchase and sale of land are sometimes prohibited by the government authorities and even communities in Africa (Holden and Bezabih, 2009). Another reason for land renting is in cases where poor and land constrained households want to generate quick cash in response to emergency needs. Thus they lease their land. In such cases, leasing may not represent movements toward optimal land-labour ratios. However, poor households in developing countries such as Kenya may not be able to make advance fixed rent payments especially under imperfect credit markets, which would constrain their ability to acquire needed land through rental markets. These concerns give rise to doubts about the long-term impacts of land commercialization on rural equity and productivity (Yamano *et al*., 2009).

Kenya is unique in Africa in terms of land registration because it has been undertaking nationwide large-scale land registration and titling since 1960's. According to the nationwide survey data, 58.4% of small-scale households in 2007 owned a land title deed for at least part of the land they controlled. Thus holding other factors constant, this might have led to less active land rental markets than elsewhere in Africa because the transaction costs associated with the sale and purchase of land would presumably be relatively low. Cross-country African estimates of the prevalence of land leasing are spotty, but a review by Holden and Bezabih (2009), noted that land rental markets appear to be most active in densely populated areas where land is highly fragmented, as in some areas of Burundi and Rwanda. Evidence from several districts of Kenya in the 1990s suggests that less than 10 percent of households

rented in land (Wangila, 1999) but more recent evidence from 15 districts in 2004 reports that 17.9 percent of households rented land (Yamano *et al*., 2009).

The Government of Kenya through the National Land Policy took a positive stance toward land leasing, stating that it has the potential to provide access to land to those who are productive but own little or no land. It is a government policy to encourage the development of land rental markets while protecting the rights of small-scale farmers by providing better information about transactions to enhance their bargaining power (GoK, 2007). In Kenya, there are two types of land rental markets namely formal and informal. The most common form among the small-scale farmers in developing countries such as Kenya is the informal land rental market. This is because of first; many farmers are not able to engage in lengthy and complex land agreements. Secondly, finding the land to lease may be difficult since land markets are under developed and also the desirable plot of land may be already purchased. Thirdly, there may be little or no motivation to invest due to the insecurity of tenure. Lastly, the presence of diverse and multifaceted informal laws with regards to land lease (Nyangena, 2010). The above reasons have led to many farmers participating in informal land rental markets with an aim of increasing productivity and hence their welfare through the increase in their agricultural income.

There are two main types of informally arranged land rental contracts in place; share tenancy and cash rentals. By far, the most common and predominant is the cash rental, followed by share cropping. The crop-share tenancy contract occurs when the landlord lets a tenant work on the land, while the output is shared between the two parties. Under this type of contract, both parties can gain by organizing their transactions in when the tenants, who collaborate with landlords by renting their land, pay a fixed amount for its use over a discrete time period. The tenant pays for all inputs, reaps all of the benefits and bears all of the risk from his production (Pender and Fafchamps, 2000). Share tenancy is very limited in the country though it is common among resident farmers with close social ties and with a low financial status (Jin and Jyne, 2003). Unlike share contracts that are orally discussed, most cash rentals are based on written agreements sometimes involving the local administrators as witnesses. The contracts are short term and rarely exceeding two seasons. Land rental rates vary from one plot to another depending on size, soil fertility and scarcity of land in a region. In places where arable land is scarce and of high quality, the farmers leasing out demand higher prices.

Generally, since the land market is thin and fragmented, rental rates are geographically localized and dependent on the economic status of the households involved (Nyangena, 2010). Several kinds of market imperfections have been considered in the literature on land tenure contracts in developing countries such as Kenya to explain the existence and types of land tenure contracts that arise. Among these are missing insurance markets, unobservable or costly monitoring of labour effort, asymmetrical information about labour quality, transaction costs of monitoring treatment of leased land or other capital goods, indivisibilities and not-tradability of other productive inputs, and capital market imperfections (Cheng and Wan, 2001; Deininger and Feder, 2001; Deininger and Jin, 2005). However, it is not clear how it could lead to multiple contract forms coexisting in the same communities, as is often observed in Ethiopia and in many other countries, unless, as it seems unlikely in the context of smallholders in Ethiopia, some tenants are risk-neutral while others are risk-averse.

Furthermore, since most of the literature on land tenure contracts assumes constant returns to scale, the level of land operated by any tenant is not determined by these theories. Indeed, agents are usually assumed to be either tenants or landlords, without any explanation of what determines whether they will be one or the other (or neither) (Pender and Fafchamps, 2000). Whether a household is a landlord or tenant is determined by its demand to use farmland relative to the amount of land it owns. If there are no transaction costs or indivisibility of land, all households would be expected to be either landlords or tenants, since the case of sole owner-operators would be a knife-edge solution that results only if the household's demand for land happened to exactly equal its land endowment (Deininger and Feder, 2001).

2.2 Emerging informal land rental markets in Lunga Lunga Constituency

Lunga Lunga Constituency in Kwale County formerly known as Lunga Lunga district is considered as a "hot cake" by many people especially those coming from other parts of the Coast region due to its favourable climate for agriculture, fertile soils and availability of land for farming. Recently, there has been a steady influx of legal immigrants into the area. These legal immigrants have come to the constituency through individual land buying and rentals and sometimes invitation by relatives (GoK, 2007). There have been also some cases of illegal immigrants in the sub-county. These immigrants who mostly are small-scale farmers can hardly feed themselves due to the small sizes of land they possess.

The government response has been to halt new land allocations and it gave a directive to the District Land Control Board not to give consent for such sub-divisions. Due to these

reasons, many people have resorted to land rentals so as to meet their food and income consumption needs (Wangila, 1999). There is no official data stating the size of land which has so far been rented because the transactions carried out are majorly informal. This factor has given rise to forgery and double allocation of land by the participants. According to Jin and Jyne (2003), this has led to many people resort to family and social connections to search for land rental without encumbrances. The fact that rental agreements in this area are temporary and thus provide little incentive for efficient farm investments is an important feature in this market. Due to the nascent nature that there is no minimum length of a rental contract, thus renting can be for several years in order to allow tenants sufficient security of land operation.

2.3 Factors influencing participation in agricultural land rental market.

Studies conducted on land rental markets came up with different socioeconomic and institutional factors influencing small scale farmer's participation in agricultural land rental markets. According to Jin and Deininger (2003), farmer ability has no significant influence on renting out land. However, land endowments negatively influenced the decision to rent out land, implying that neither low agricultural ability nor large land endowments provided a strong motivation for households to rent out land. In fact, the positive and significant signs on total assets, past off-farm experience, and the share of households with credit access in the village all suggest that opportunities for off-farm employment are the driving force behind supply of land to the rental market, a notion that is supported by the negative and significant sign.

Klaus and Deininger (2011) argued that land markets seem to transfer land from resource poor, female-headed, and slightly older households to wealthier ones with better access to family labour. This is in contrast to what is observed in many other settings such as Ethiopia, where skilled, wealthy households rent out land to pursue non-agricultural options, possibly because barriers to entry into non-farm activities remain high (Benin *et al*., 2006). Female-headed households are more likely to participate in markets as landlords than as tenants. This may indicate a lack of available labour for female-headed households, or the possibility of some distressed rental on the part of female-headed households when their husbands die or leave the home for other reasons (Ricker *et al*., 2010).

The likelihood of renting in land is higher for farmers with inadequate owned cultivated land (Benin *et al*., 2006). The implication is that those who are rich in non-land factors

(livestock or farm capital assets), rent in land to optimise their farm sizes, in order to utilize their surplus resources (Sanzidur, 2010). Similar findings were also reported by Holden *et al*. (2007), and Masterson (2007), for farmers in Ethiopia and Paraguay respectively. However, Vranken and Swinnen (2006), found that, households who have a large size of land were more likely to rent in more land and they argued that land bought in the previous periods is likely to both tighten the credit constraints in the current period because of the investments in the land purchase, and to reduce the marginal benefits of security, which falls with more land purchased already thus they opt to rent in land.

More educated households are significantly more likely to rent in land and significantly less likely to rent out land (Ricker *et al*., 2010). This finding provides some evidence to support the idea that better-educated households are able to take advantage of the opportunity to acquire more farm land that land rental markets provide to them. This argument is supported by Jin and Jayne (2013). The finding is in contrast with empirical findings by Deininger and Jin (2005), who found that those with higher education are more likely to lease their land while they devote their labour to higher return off-farm jobs. On the other hand, it may suggest that there are either limited off-farm opportunities or the off-farm jobs are mostly low-skill jobs. Results by Jin and Jayne (2013), show that farmers tend to rent-in land in fertile areas in order to reap the benefit of higher productivity of crops from soils of relatively high fertility status of the soils. They also found that migrants are significantly more likely to rent in land and less likely to rent out land and this is what is expected as people likely move from one rural area to another in search of land to farm.

Livestock ownership positively influences the probability of participation in land rent-in market (Masterson, 2007) in rural context; livestock ownership is an important indicator of household's wealth position. Livestock serves as an important source of cash. This implies that households that are rich in this non-land factor of production (livestock ownership) are more likely to rent-in land to produce surplus. The population density of a particular location also contributes to household decision on whether to participate in a land rental market or not Ricker *et al*. (2010) shows that households in areas of higher population are significantly more likely to rent in land, this supports the notion that the increasing number of people in rural areas is driving these markets into existence out of necessity. However, the interesting finding is that population density has a statistically significant negative effect on renting out. This may suggest that small-scale farmers in densely populated areas are resistant to parting with their land.

Inadequate access to credit negatively affects the small scale farmers participation in agricultural land rental markets, that is for a farmer to feel confident enough to enter into a rental contract for land, they must know that the inputs needed to farm effectively is within reach (Masterson, 2007). This argument is also backed by Amare and Beyene (2015), in their study on the determinants of rental market participation in Ethiopia. The positive and significant coefficient of access to credit implied that imperfection in credit market leads farm households to adjust their operational landholdings through the land rental market. The significant effect of credit access in rental market suggested that labour advantages of family farms can be offset by capital constraint resulting in smaller farm sizes.

Renting in land is inversely and significantly influenced by age of the household head (Amare and Beyene, 2015). This finding can be attributed to the fact that young people are regarded to have high entrepreneurial skills to put the land to good use. Jin and Deininger (2003), also noted that rental markets tended to transfer land to producers in the most productive age, this tendency to rent in land increased though only weakly, up to a maximum of 48 years. According to Bizimana (2011), the effect of age and education is less certain. The age of a farm household captures three elements namely ability to farm, managerial experience and degree of risk-tolerance, all of which tend to change with age. Their effects on land rent decisions are mixed. A young farmer is more willing to trade in the land rental market. But his propensity to trade may diminish in later years, as he gains farm experience and skill. The effect of education is also ambiguous. As a farm household acquires more education that enhances its ability to obtain process and utilize new information, it may choose to rent out less of its land and work on its farm efficiently. But the propensity to rent out may increase, as the opportunity cost of farming increases, especially in areas where farmers have off-farm employment opportunities. The effect of education can be positive on the decision to rent out land in such an environment.

Village level variables illustrated that higher security of tenure in Vietnam in the form of land use certificates was highly significant in increasing the demand for renting in land. However, rental activity was higher rather than lower in villages that depended more heavily on agriculture, as proxied by the mean share of income from agriculture (Jin and Deininger, 2003). Household who rent in land also tends to have bigger household size or adult equivalence than those who rent out land (Jin and Jayne, 2011). This was because they tend to have readily available labour to supply to the farm.

Jin and Deininger (2003), in his study, found that farmers with poor extension contacts are also more likely to rent-out land. This may be because farmers with lack of access to technological information and know-how find it better to rent out land and earn a fixed predetermined income rather than going through the uncertain production process. Access to extension services tends to positively influence participation in agricultural land rent in while negatively influencing participation in agricultural land rent out (Amare, 2013).

The effect of non-agricultural income share is uni-directionally negative but is significant in the rented-out model, which implies that farmers with a lower share of non-agricultural income tend to rent out land to raise total agricultural income (Kung, 2002). It was, however, noted that households with active participation in the off-farm labour market rent in less land in China. The distance of home from the main market of the district has a positive effect on participation in the land rent out market. The probable reason is that poor infrastructure development reduces the incentive of sample farmers to produce surplus production to supply to the markets (Amare and Beyene, 2015).

2.4 Effects of participation in agricultural land rental markets on agricultural income.

According to theory, there are three primary channels in which land rental markets may impact small scale farmers namely; equity, efficiency and agricultural income (Holden *et al*., 2009). The literature defines equity gains in terms of equality as the reallocation of land across households with different assets in a way that land and non-land factor ratios tend to equilibrate (Jin and Deininger, 2003). Efficiency gains are associated with net land transfers from less to more productive users. Welfare gains are implied by greater access to land as the primary productive asset within small-scale production systems, but also derive from the higher agricultural incomes and food security associated with enhanced equity and efficiency outcomes.

Based on theoretical assessments, land rental markets have the potential to improve farm efficiency by facilitating the equilibration of land and non-land factor ratios across farm households when non-land factor markets are imperfect (Deininger, 2003). Such gains may be further enhanced by the inverse farm-size-productivity relationship under which net transfers of land from land-rich to land-poor households would contribute to overall efficiency gains, in addition to welfare improvements. However, there are several reasons why I might question the ability of land markets to deliver on these theoretical benefits.

Rental markets contributed to a concentration of operational land holdings as compared to land ownership; the Gini coefficient increased from 0.37 for land ownership to 0.48 for operated land holdings, different from other countries such as China where rental markets help equalize the operational land distribution (Klaus *et al*., 2011). Ricker *et al*. (2010) examined the impact of renting land on off-farm income to see if there is any evidence of crowding out of off-farm work from land renting. They found out that, being a tenant generates significantly more off-farm income while being a landlord generates lower off-farm income. On the other hand, the marginal effect of an extra hectare rented in or out is not statistically different from zero. It may be that the marginal effects of renting off-farm income are not statistically significant, but there could be a few people at the end of the distribution who rent in or out some land, and are also able to generate high off-farm income. It is concerning that while we find evidence indicating that landlords have a lower value of crop production and net crop incomes than other households.

Participants in agricultural land renting in were able to generate roughly twice as much net crop revenue as the amount of rent payment to the owner of the land. According to Place *et al*. (2006) in Amhara Region of Ethiopia rented plots produced relatively high yields as compared to owner cultivated plots. Otsuka and Hayami (1988) found that the owner cultivated crops yielded highly as compared to rented plots of land. Most of the African agriculture is traditional and characterized by labour intensive production and excess demand for labour often occurs during periods of land preparation, weeding and harvesting. According to Antwi (1997), most small-scale farmers use family labour and therefore it is availability affects household decision to employ new technologies in the farm. Larger household size with effective members implies more labour is available for farming operations, thus increasing the production of farmers and agricultural income (Tijani, 2006). On contrast, over utilization of labour input negatively affects farm production (Tchale and Sauer, 2007).

The majority of studies of agricultural productivity in developing countries support the view that there is an inverse relationship between agricultural income and farm size. Fufa and Hassan (2003) also found that the estimated coefficient of land is positive and significant. This shows that the positive influence of land on agricultural income. Most literature shows a positive relationship with an output. However, producing farm outputs in uneconomic region or zone found to negative correlation with agricultural income (Chirwa's, 2003).

2.5 Theoretical Framework

The theoretical framework for analysing agricultural land rental participation is based on random utility and property rights theories.

2.5.1 Utility Maximization Theory

According to Deininger *et al*. (2008), this study is built on the assumption that the small scale farmer's decision to participate in land rental market is based on whether or not they will maximize their utility (agricultural income) by optimally employing their endowed resources (land, labour and productive assets) through land markets. Participation then takes place if U*(R)>U*(NR). The random utility theory has the following assumptions; First, the generic decision maker i in making a choice, considers m_i mutually exclusive alternatives that constitute her choice set I_i. The choice set may differ according to the decision-maker. Secondly; decision maker assigns to each alternative j in his choice set a perceived utility or "attractiveness" U_{ij} and select the alternative that maximizes this utility. Thirdly, the utility assigned to each choice alternative depends on a number of measurable characteristics, or attributes, of the alternative itself and of the decision maker $U_j^i = U_i(X_{ij})$, where (X_{ij}), is the vector of attributes relative to alternative and to decision-maker i. Fourthly, because of various factors, the utility assigned by decision maker i to alternative j is not known with certainty by the researcher wishing to model the decision maker's choice behaviour, thus U_{ij} must be represented in general by a random variable. From the above assumptions, it is therefore not possible to predict with certainty the alternative that the household decision-maker will select. However, it is possible to express the probability that the household will select alternative j conditional on her choice set I_i; this is the probability that the perceived utility of alternative j is greater than that of all the other available alternatives:

$$p^i(j/I_i) = \Pr[U_J^i > U_k^i \forall k \neq j, k \notin, I^i] \quad (1)$$

The perceived utility U_{ij} can be expressed as the sum of two terms; a systematic utility and a random residual. The systematic utility V_{ij} represents the mean (expected value) utility perceived by all decision makers having the same choice context (alternatives and attributes) as the decision maker i. The random residual ε_{ij} is the (unknown) deviation of the utility

perceived by the user i from this mean value it captures the combined effects of the various factors that introduce uncertainty into choice modelling.

2.5.2 Property rights theory

Property rights theory provides an understanding of the application of property rights. Property rights are the social institutions that define or delimit the range of privileges granted to individuals to specific resources, such as parcels of land or water. Property rights over assets consist of the rights, or the powers, to consume, obtain income from, and alienate these assets where these rights vary based on the capacity of right holders to protect them from "other people's capture" (Barzel, 1989). In essence, the extent to which rights are delineated corresponds to the transaction costs of transferring, capturing and protecting those rights. A broader view with far-reaching practical application regards property rights as "bundles of rights" including access and withdrawal, exclusion, management and alienation rights (Schlager and Ostrom, 1992). Rights holders are classified into positions (ranging from authorized entrant to full owner) with respect to the bundles of rights (Ostrom, 2003). This gives a better explanation on the status and organization of a particular right holder. It expands the concept of property rights much further than it is conventionally reduced to private, common and state property rights (Ostrom, 2003). Thus, distinguishing the bundles of rights and positions of right holders provides a means to understand circumstances under which different arrangements over rights to a resource generate variable benefits and the social relationships established around such benefits.

A relatively recent view classifies property rights as "absolute" and "relative" (Furubotn and Richter, 2005), advancing our understanding. The former involves the assignment of exclusive individual property rights to physical objects. The central point is that it ensures the transferability of rights to induce better use of a resource by others. The "relative" property rights include all rights related to contractual obligations and agreements (Furubotn and Richter, 2005). Although all types of contracts are characterized by the lack of foresight between contracting parties and asymmetric information, self-enforcing agreement between two parties can extend the asset base of individuals and communities. In addition, self-enforcing agreements involving no third party but building on the motive to gain reputation help examine how "relative" property rights arrangements in land renting have evolved and function among farmers (Kim and Mahoney, 2005). Inherently, the cataloguing of rights as absolute and relative more or less resembles that of 'bundles of rights' concept. Absolute property rights fulfil all types of rights whereas relative property rights are determined by the

nature of the underlying contractual agreements where gains from such simple transaction could be maximized by keeping a less complex governance to enforce the agreements (Macher and Richman, 2008).

In connection with the above property rights theory, an agricultural land transaction occurs when the landlord, who has bundles of rights to the land, exchanges the land or certain rights to use the land, to a land user/tenant (Schlager and Ostrom, 1992). These transactions occur either temporarily or permanently (Emana *et al*., 2005). The landlord has to transfer fully his bundle of property rights to the new individual under land selling. However, when property rights from one landlord are not fully transferred to another individual, the land transaction between both parties can be designated as a tenancy (temporary) contract (Schlager and Ostrom, 1992). A tenancy contract establishes a transfer of money in exchange for rights to use the land. The agricultural land rental contract specifies the rules to which both parties must adhere. For example, it can be specified whether land can be transferred to a third party, what happens if there is abuse to the land, whether yield will be shared between both parties, and how decisions are made to cultivate the land. Within the literature on land transactions, it is the issue of agricultural land tenancy which is most frequently explored. The contracts relating to renting of land are largely neglected, due to the complexity of institutions surrounding it (Toulmin and Quan, 2000).

2.6 Conceptual framework

Figure 1 represents a conceptual framework which provides a link between the factors influencing land rental markets participation, rental market participation, increased agricultural income. The land rental market participation by the small-scale farmers is influenced by socioeconomic and institutional factors such as land endowment, the level of education, and access to credit facilities. These factors may encourage or limit a farmer to participate in the land rental market. The government land policies and laws act as an intervening variable. If farmers participate in the market, this study expected them to increase their yields which eventually leads to an increased agricultural income when the farmers sale their produce.

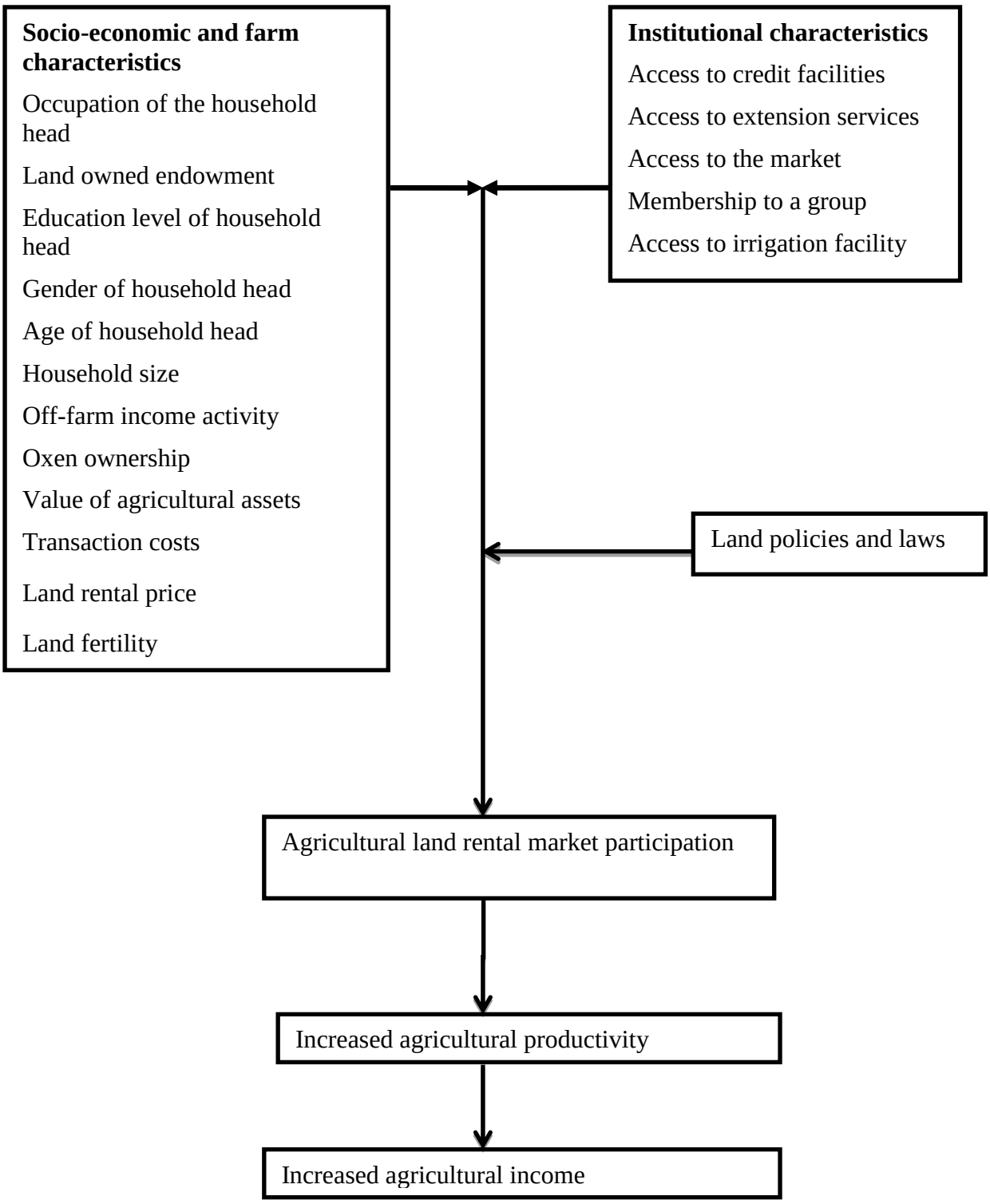

Figure 1: Factors influencing participation in agricultural land rental markets.

CHAPTER THREE
METHODOLOGY

3.1 Study Area

The study was conducted in Lunga Lunga Constituency, Kwale County, Kenya. It is located at the extreme south eastern Kenya, at the international border with the United Republic of Tanzania. Lunga Lunga was chosen for this study due to its history of poor land tenure systems (Nyangena, 2010). The region is favourable for this study due to the development of the land rental market hence it offers a unique feature in the improvement of food security in the region. It is also rich in fertile soils and favourable climate which is good for rain fed agriculture (KCIDP, 2013).

Lunga Lunga constituency lies approximately 102 kilometres by road, south of the port city of Mombasa, the nearest large city in the region. Lunga Lunga is one of the four Constituencies found in Kwale County, Coast Region of Kenya. Its geographical coordinates are 4° 33'18 0" South, 39° 7'23 0" East. It is divided into 4 administrative wards namely Vanga, Dzombo, Mwereni and Pongwe/Kikoneni. It covers an area of 2,864.80 Sq. Km. According to the 2009 Population Census it has a population of 164,098 persons. The study area has a tropical climate and it receives an average rainfall of 990 mm per annum and an average temperature of about 26.3°C it has two rainy seasons, from March to June/July (long rains) and from October to December (KCIDP, 2013). The main economic activity in the area is agriculture especially crop production. The main crop grown in the area is maize due to the favourable climate and fertile soils found in the area (KCIDP, 2013. The map of the study area is presented in Figure 2.

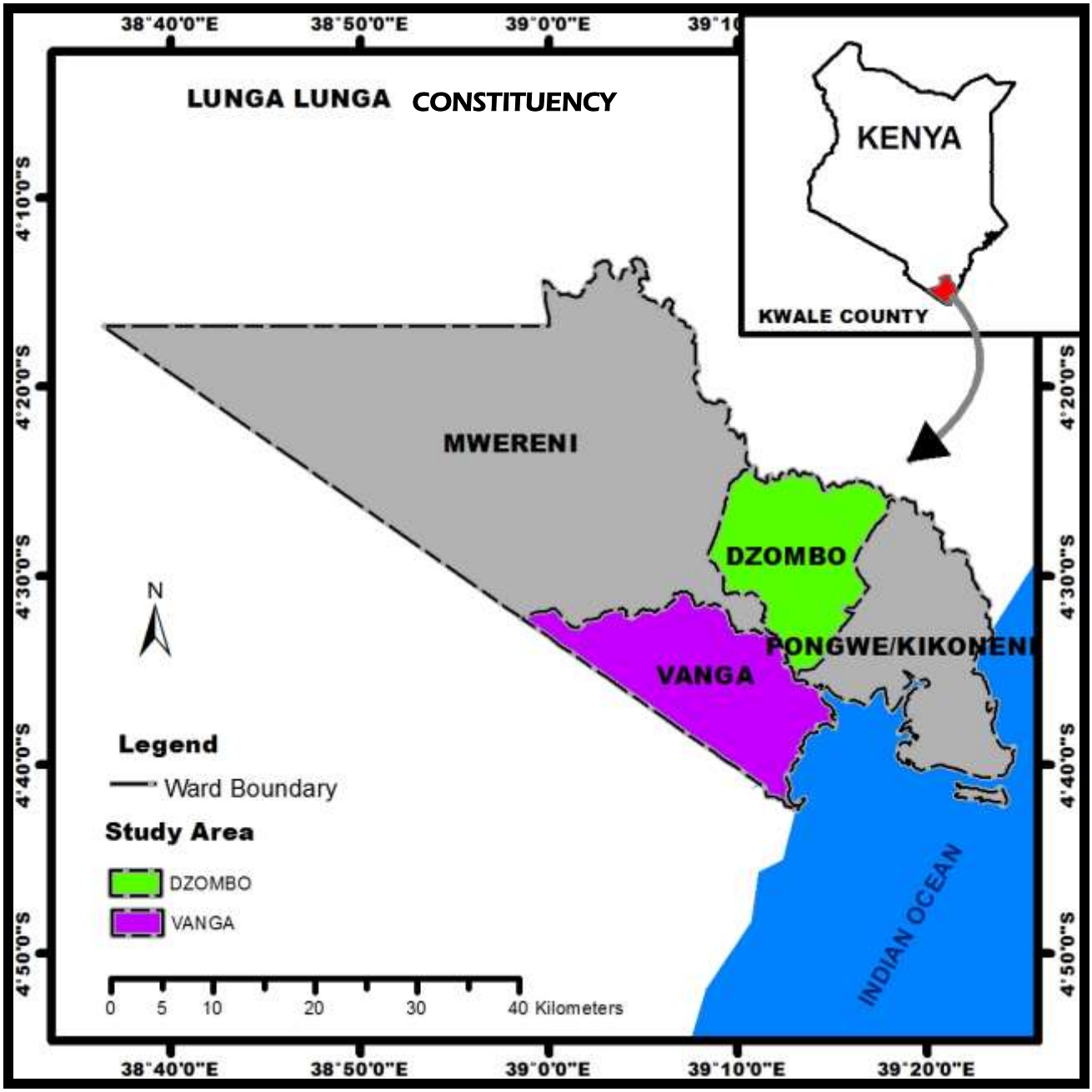

Figure 2: Map of the study area

Source: Independent Elections and Boundaries Commission (2012)

3.2 Sampling technique

The study used a multistage sampling technique to obtain the required sample size. The first stage was to purposively select Lunga Lunga constituency because of the development of agricultural land rental markets as compared to other constituencies in the county. The second stage involved purposively selection of Vanga and Dzombo wards among the 4 wards because they have the most active participation in the agricultural land rental market. According to KNBS (2009), the number of households in Vanga and Dzombo wards is 2563 and 2335, respectively; therefore the sample size per ward was calculated using probability proportional to the ward household. Lastly, the respondents from the respective wards were randomly selected from a list of small scale farmers which was provided by the Sub County agricultural officer.

3.3 Sample size determination

The sample size determination followed a proportionate to size sampling methodology as specified by Bowley's (1977) and was calculated as follows;

$$S_{total} = \frac{N}{1 + N(e)^2} \tag{2}$$

Where; S_{total} is the sample size

N is the total population of farming households in Lunga Lunga Constituency which is 11200 households (KNBS, 2009).

1 is a constant

e is the level of error allowable (0.05)

$$S_{total} = \frac{11200}{1 + 11200(0.05)^2} = 386.21$$

$S_{total} \approx 386$

The total sample size was 386 small scale farmers.

$$\frac{P}{N} \times S_{total} \tag{3}$$

3.3.1 Determination of sample size per ward

Where; P =number of households in the ward

N = total number of households in the two wards

S_{total} = Total sample size.

Table 1: Determination of sample size per ward

Ward	Population	Sample size
Vanga	2563	202
Dzombo	2335	184
Total sample	4898	386

3.4 Data collection

Cross-sectional primary data was collected from 386 respondents using semi-structured questionnaires which were administered by trained enumerators. A pilot test of the questionnaire was first carried out to determine its suitability and validity for the study. The data collected included the socio economic and institutional characteristics of the farmer and farm characteristics.

3.5 Data Analysis

Data from the field was edited, coded to ensure consistency, uniformity, and accuracy for analysis purposes. It was done to generate descriptive, inferential and econometric results. Objective one was analysed using descriptive and inferential statistics such as mean, standard deviations, percentages, Chi-square and F- test statistics.

3.5.1 Analytical Framework

To determine the socioeconomic and institutional factors influencing small scale farmer's participation in agricultural land renting in and renting out using a bivariate Probit model. The advantage of this bivariate approach, as opposed to the univariate approach (single equation Probit models of either renting-in land or renting-out land estimated independently), is that it enables us to examine the decision making process of a single farmer who engages with the land rental market both as a tenant and as a landlord at the same time and also it not only tests individual univariate models but also enables us to determine jointness of the decision making process by providing an estimate of the correlation between the error terms of the two univariate models. Some of the factors that influence the renting in and are linked to factors influencing land renting out. These phenomena generate modelling problems related to self- selection and endogeneity (Doss, 2006).

The two decisions, participation renting in and participation in renting out, can be specified independently of each other using Probit or logit models, However, such a specification would provide inefficient estimates of the parameters of participation in land renting in and land renting out, since it ignores the potential correlation between the unobservable (captured by the error terms) of the two decisions. This is because the decision to rent in is contingent on the decision to rent out. Such modelling can be accomplished by a bivariate Probit with sample selection (Neill and Lee, 2001; Wooldridge, 2002).

The model employed in this case is similar to the Heckman's selection model except that the Probit model appears in both the selection decision (agricultural land renting in) and the decision (land renting out). The bivariate Probit model which is a natural extension of the Probit model is used to control the simultaneity problem as suggested by Maddala (1983) considering it as a joint decision of renting in and renting out.

The structural form of the bivariate Probit model can be expressed as follows.

$$Y^*_{i1} = \alpha_1 Y^*_{i2} + x_{i1}^{`}\beta_1 + \varepsilon_{i1} \; ; y_{i1} = 1 \text{If } y^*_{i1} > 0 \text{ ;=0,otherwise} \quad (4)$$

$$Y^*_{i2} = \alpha_2 Y^*_{i1} + x_{i2}^{`}\beta_2 + \varepsilon_{i2} ; y_{i2} = 1 \text{If } y^*_{i2} > 0 \text{ ;=0,otherwise} \quad (5)$$

$$E(\varepsilon_{i1}) = E(\varepsilon_{i2}) = 0 \; ; Var(\varepsilon_{i1}) = Var(\varepsilon_{i2}) = 1 ; Cov(\varepsilon_{i1}, \varepsilon_{i2}) = \rho \text{ and } i = 1,2,3...n \quad (6)$$

The unobservable, perceived utility Y^*_{i1} from participation in the land renting in market depends on a vector of explanatory variables x so that the binary outcome $y_{i1} = 1$ arises

when the latent variable $y^*_{i1} > 0$. While on the other hand, we observe y_{i2} (renting out) if and only if y_{i2} (renting out) = 1. The empirical model was expressed as follows

$$\text{Rentin}^*_{i1} = \alpha_1 \text{Rentout}^* + x_{i1}^{`}\beta_1 + \varepsilon_{i1} \; ; \text{Rentin}_{i1} = 1 \text{If Rentin}^*_{i1} > 0 \; ;=0,\text{otherwise} \quad (7)$$

$$\text{Rentout}^*_{i1} = \alpha_2 \text{Rentin}^*_{i1} + x_{i2}^{'}\beta_2 + \varepsilon_{i2} \; ; \text{Rentout}_{\;i1} = 1 \text{If Rentout}^*_{i1} > 0 \; ;=0,\text{otherwise} \quad (8)$$

$$E(\varepsilon_{i1}) = E(\varepsilon_{i2}) = 0 \; ; Var(\varepsilon_{i1}) = Var(\varepsilon_{i2}) = 1 ; Cov(\varepsilon_{i1}, \varepsilon_{i2}) = \rho \text{ and } i = 1,2,3...n \quad (9)$$

Where Rentin^*_{i1} and Rentout^*_{i1} are latent dependent variables referring to the household's decisions to participate in agricultural land renting in and out respectively, $x_{i1}^{`}$ and $x_{i2}^{`}$ is the vector of explanatory variables. The random errors ε_{i1} and ε_{i2} are distributed as standard bivariate normal variables (σ) with correlation coefficient ρ. The bivariate model has the following characteristics: firstly, the dependent variables are binary; secondly, the binary dependent variable of first equation is entered as covariate in the second equation and vice versa and finally, the unobserved heterogeneities of the two decisions are assumed to be correlated.

To determine the effect of small scale farmer's participation in agricultural land renting in on agricultural income, a two-step Instrumental Variable approach was used to analyse this objective. In this model R_i indicated the participation or non- participation of household i in agricultural land rental market, but due to the unobservable nature of the market participation we referred it as R_i^* while the observed participation was R_i. The participtaion model can be expressed as

$$R_i^* = \beta_o + \beta_i X_i + \varepsilon_i \text{ with } R_i = 1 \text{ If } R_i^* > 0 \text{ and 0 otherwise} \quad (10)$$

Where, X_{ij} is the vector of socioeconomic and institutional variables which influence participation in the land rental market while ε_i represents the unobserved factors.

$$Y_i = \alpha X_i + \mu_i \quad (11)$$

Y_i Represent the outcome variable (agricultural income), X_i represent the exogenous variables which affect agricultural income, μ_i is the random disturbances associated with the impact model. The effect of participation on the outcome variable is measured by the

estimates of the parameter in a two-stage simultaneous procedure. Note that it is not possible to simply estimate Equation (10) because the decision to participate in the agricultural land rental market may be determined by unobservable variables that may also affect agricultural income. If this is the case, the error terms in Equations (10) and (11) are correlated, leading to biased estimates of which is the productivity effect of participation in the agricultural land rental markets. The decision to participate or not is not voluntary and may be based on individual self-selection. Farmers who participate may have systematically different characteristics from the farmers who did not participate, and they may have decided to adopt based on expected benefits. Unobservable characteristics of farmers and their farms may affect both the participation decision and agricultural income, resulting in inconsistent estimates of the effect of participation on agricultural income. This was tested by using the Hausman and Durbin test for endogeneity. The solution was to account for such endogeneity was done by using an instrumental regression technique that assumes a joint normal error distribution (Di Falco *et al*., 2011).

The choice of the instrument is challenging as we need a variable that is correlated with the participation in the agricultural land rental market, but not with the error term of the agricultural income models. The study adopted the choice of the instrument as used by Algesheimer *et al.* (2010) which followed two steps. The first step was to specify a participation model (Equation 10) which linked the farmer's participation in an agricultural land rental market with the farmers socioeconomic and institutional characteristics. Thereafter predicted probabilities were obtained from the results of the participation model. The predicted probabilities obtained were used as an instrument in the in Equation 11 to instrument the rental participation variable (R_i).

$$Y_i = \alpha X_i + \gamma R_i + \mu_i \quad (12)$$

Y_i Represents the outcome variable (agricultural income), X_i represent the exogenous variables which affect agricultural income, μ_i is the random disturbances associated with the impact model. γR_i Represent the predicted probabilities generated in the Probit model (Equation 16) which instrumented agricultural land rental participation. The quality of the instrument was assessed by using an F-test. According to Stock and Staiger (1997), the weak instrument hypothesis is rejected if an F-test is greater than 10. Propensity score matching technique was also used for sensitivity analysis.

Table 2: Variables used in econometric analysis

Variable	Description	Measurements	Expected sign
Dependent Variable			
Rentingin	If household rented in agricultural land (Yes=1 and 0 = Otherwise)	Dummy	±
Rentingout	If household rented out agricultural land (Yes=1 and 0 = Otherwise)	Dummy	±
Agricincome	Income resulting from agricultural income	Continuous	±
Explanatory Variables			
HHsize	Number of people in the household	Discrete	±
Agehead	Number of years of the household head	Continuous	±
Genderhead	Gender of the household head (Male=1,Female=0)	Dummy	±
Occupation	Occupation of the household head(Pure farmer=1, None pure farmer=0)	Dummy	+
Edulevel	Level of education of the household head (None=1, Primary=2, Secondary=3, College=4, University=5)	Categorical	+
Transactioncosts	Amount of costs incurred in transport, communication and negotiation of the land renting contract.	Continuous	±
Irrigationaccess	Access to irrigation facility (yes=1, 0 otherwise)	Dummy	+
Marketaccess	Access to the market (yes=1, 0 otherwise)	Continuous	±
Extensionaccess	Access to an extension service (1= yes and 0= otherwise)	Dummy	+
Ownedfarmsize	Amount of land owned in acres	Continuous	±
Offfarmactivity	Participation in off farm income generating activity (1 =yes and 0 otherwise)	Dummy	±
Oxenwnership	Number of livestock (cattle) owned by the household	Dummy	±
Creditaccess	Access to credit by the farmer (1= Yes, 0= Otherwise)	Dummy	+
Rentprice	Amount of money charged per acre (Ksh).	Continuous	_
Agricassets	Value assets possessed by the household	Continuous	+
Groupmemb	If the farmer is a member of a group (Yes= 1 and 0 otherwise)	Dummy	+
Landfertility	Fertility of the soil (Yes=1, No=0)	Dummy	+

CHAPTER FOUR
RESULTS AND DISCUSSION

This chapter is divided into two major sections. The first section discusses the descriptive results comprising of household, socioeconomic and institutional characteristics. In the second section of the chapter, empirical results of bivariate Probit and two stage instrumental variable models are discussed. The descriptive statistics show that 55%, 38% and 7% of the households participated in renting in, autarky and renting out of land, respectively.

4.1 Descriptive statistics

4.1.1 Farmer and farm characteristics

Table 3 presents results of household head's occupation gender, education level, and participation in off-farm income activity by category of agricultural land market participation. The main occupation of 69.48% of the households' heads who rented in agricultural land was farming as compared to 34.62% and 76.87% of those who rented out land and autarky, respectively. Having farming as the main occupation provides adequate farming experience which helps farmers to make informed decisions on how to effectively utilize the available land, thus there is no incentive to participate in the land rental market. Yamano *et al*. (2009) argued that households that have farming as their main occupation gain experience on production and marketing, thus they are able to maximize production in their parcels of land they own.

In terms of the gender of the household head, 77% of those engaged in renting in land were male as compared to 28.57%, 88.46% in autarky and renting out, respectively. According to FAO (2011), the gender of the household head influences the household's access to land, credit and other productive resources in Africa and other developing countries. Male-headed households, particularly in developing countries, have higher access to the resources and information that increases their chances of participating in land rental markets than the female headed households (Wangila, 1999).

Slightly over half of the household heads (51.64%) who rented in agricultural land had secondary school education level, while 10.88% and 19.23% of those who were in autarky and renting out, respectively had secondary school education level. The education level of the household head was found to be significantly related to the participation in agricultural land rental market at 1%. Formal education improves the access to opportunities and information so as to critically evaluate different ideas meant to improve agricultural productivity. The

higher education levels among those who rented in land suggested that farmers with higher levels of education were more open to new ideas and opportunities, hence easier for them to participate in land rental markets. According to Marenya and Barret (2007), formal education was found to enhance managerial competence and successful implementation of improved production. Further, Makhura *et al*. (2001) stated that human capital, represented by the household head's formal education, posited to increase a household understanding of market dynamics and therefore improve their ability to make crucial decision making in their farms such as renting in land.

Table 3: Education level, occupation, gender and off farm income activity (%)

		Categories of land rental market participants			
Variables	**Response**	**Renting In**	**Autarky**	**Renting Out**	χ^2
Occupation	Farmer	69.48	76.87	34.62	2.97
	Otherwise	30.52	23.13	65.38	
Genderhed	Male	77.00	28.57	88.46	3.95
	Female	23.00	71.56	11.54	
Educlev	None	12.21	34.01	26.92	90.69***
	Primary	22.54	49.66	42.3	
	Secondary	51.64	10.88	19.23	
	College	12.68	4.08	11.34	
	University	0.94	1.36	0.00	
Off farm income activity	Yes	64.32	44.90	50.00	13.71*
	No	35.68	55.10	50.00	

Note: *, ***= significant at 1% and 10% level, respectively.

Household's heads who participated in off-farm income activities among those who rented in land were 64.32% as compared to 44.90% and 50% in autarky and renting out, respectively. Participation in off-farm income activity was statistically related to participation in agricultural land rental markets at 10%. Off-farm income comprised of average income from employment, business and any other income apart from farm income. Off farm income activity is important in agricultural land renting in as it improves the disposal income and farm liquidity through the provision of supplementary income for acquiring land through land renting in. It also helps in the purchase of farm inputs and payment of labour. It improves access to information due to exposure of the household head thus enhancing participation in agricultural land rental market. However, Tikabo and Holden (2004) argued that participation in off-farm income activities reduces time available for carrying out agricultural activities thus households tend to rent out agricultural land.

Table 4 presents results of age of the household, household size and value of household agricultural assets. Household heads who engaged in agricultural land renting in had the lowest average age of 47.29 years as compared to 55.10 and 53.05 years for those who engaged in autarky and rent out, respectively. The age of the household head was significantly different at 5% level among the groups. Younger farmers may not have adequate capital to purchase land and they are flexible in adapting to new market requirements, less risk averse, and more innovative than older farmers. They also have high mobility and can better carry out supervision especially in cases where farms are located at a far distance than the old. According to Nyangena (2010), young household heads are open to new ideas and opportunities, therefore; they often rent in land to maximize their production.

Households who participated in land renting in had an average of 4 members as compared to 3 and 2 members for autarky and renting out, respectively. Household participation in agricultural land renting in market could possibly be because of the high demand for food and other services as a result of the larger household size, thus they would seek innovative ways such as land renting in land in order to increase food production. Household size also determines labour availability for farm production and is an important input when a household participates in renting in of agricultural land because renting requires more labour (Tikabo and Holden, 2004).

The average farm size of the farmers who participated in agricultural land renting in market was 2.05 acres as compared to 3.80 acres and 8.08 acres for those in autarky and renting out, respectively. Owned farm sizes were significantly different at 1% in all the market categories. Farmers with small land size could seek alternative ways of increasing their land endowment such as renting in agricultural land. Amare (2013) argued that, due to the high demand for food, households with small owned farm sizes tend to rent in agricultural land so as to increase their food production.

Table 4: Mean age, Household size, Owned farm size and agricultural assets value.

	Categories of land rental market participants			
Variable	**Renting In**	**Autarky**	**Renting Out**	***F*-Stat**
HHAge (Years)	47.29	55.10	53.04	1.49**
	(10.77)	(11.27)	(13.92)	
HHSize	3.83	2.84 1.28	1.92	1.28
	(0.90)	(0.94)	(0.94)	
Ownedfarmsize (acres)	2.05	3.80	8.08	3.33*
	(2.36)	(3.48)	(3.39)	
Agricasstsvalue (KES)	4046.58	3164	2864.80	5.50***
	(1354.55)	(4037.11)	(3778.70)	

Note: Figure in parenthesis represent standard deviation and*, **, ***= significant at 1%, 5% and 10% level, respectively.

Households who participated in land renting had the highest average value of agricultural assets at KES 4046.58 as compared to KES 3164, KES 2864.80 of those engaged in autarky and rent out, respectively. The mean value of agricultural assets was significantly different at 1% level in all land market categories. Assets rich farmers tend to have a higher likelihood to absorb risks in production and thus they are more likely to take a risk by renting in land. Households with high assets endowment increase farm liquidity which enables them to expand their farm operations by renting in land (Yamano *et al*. 2009; Kersting and Wollni, 2012).

Table 5 presents the results on ownership of oxen, access to irrigation facilities and fertility of land. According to the results, 62.44% of those who rented in land owned oxen as compared to 23.13% and 23.08% of those in autarky and renting out, respectively. Ownership of oxen was statistically significant at 10%, indicating that there was statistically significant relationship between ownership of oxen and participation in land rental market. Oxen in the study area are used as a source of farm labour (cultivation, weeding, transport of inputs and outputs to and from the market). It also acts as a source of income if hired by other farmers. Therefore, those who had ownership to oxen had access to cheap labour and also surplus income to invest in other farm activities thus the need to rent in land. Previous studies (Kung, 2002; Tikabo and Holden, 2004; Amare and Beyene, 2015) have argued that farmers who are rich in non-land factors such as livestock or farm capital assets rent-in land to increase their farm output in order to utilize their surplus resources.

Table 5: Oxen ownership, access to irrigation and fertility of land (%)

		Categories of land rental market participants			
Variables	**Response**	**Renting In**	**Autarky**	**Renting Out**	χ^2
Oxenownership	Yes	62.44	23.13	23.08	59.68*
	No	37.56	76.87	76.92	
Irrigationacess	Yes	15.38	5.44	11.74	5.06***
	No	84.62	94.56	84.26	
LandFertility	Yes	48.36	79.59	69.23	36.57*
	No	51.64	20.41	30.77	

Note: *, *** = significant at 10% and 1% level, respectively.

Results in Table 5 show that majority (15.38%) of those who participated in land rent in had access to irrigation facilities as compared to 11.74% and 5.44% of those who engaged in renting out and autarky, respectively. Access to irrigation facilities was found to be statistically significant at 1%. Access to irrigation facilities such as pipes provides farmers with an opportunity to produce agricultural commodities all year round thus the farmers do not necessarily depend on rain fed agriculture. These farmers were mostly found in areas where the climate is unfavourable for farming and thus they opted to rent in land in another area so as practice irrigation as well as increase their food production. Holden, *et al*. (2009), urged that access to irrigation facilities allowed farmers to increase their yields and thus farmers had the incentive to rent in.

In terms of fertility of the land, 79.59% of those in autarky stated that they had fertile land as compared to 48.36% and 69.32% of those engaged in renting in and out, respectively. Fertility of land was found to be significant at 10% level indicating that there was a significant relationship between fertility of land and rental market participation. Fertile farms are more likely to produces high yields of the produce and thus farm households are less likely to have the incentive to participate in land rental market. Amare and Beyene (2015) noted that households with fertile farms had small household sizes thus they were satisfied with yields they got hence found no incentive to either rent in or rent out land.

The results on agricultural rental price and agricultural income are presented in Table 6. The average rental price for those renting in was KES 2999.77 while those who engaged in renting out and autarky had an average income of KES 3153.85 and KES 0 respectively. The rental price was significantly different at 1% level for all the three groups. The land rental price is the cost per acre of renting land and it determines the participation in renting in, autarky and renting out. The rent price is influenced by fertility of land, location of the land

amongst other factors. High rental price provides incentive to farmers to rent out land so as to get more income. Amare and Beyene (2015) found that rental price motivates households who are rich in land but poor in non-land resources to rent out land so as to get income to invest in their farms.

Table 6: Rental price per season and agricultural income per annum in KES

	Market Participants by Categories			
Variable	**Renting In**	**Autarky**	**Renting Out**	***F*-Stat**
Rentprice	2999.77	0.00	3153.85	13.43***
	(708.31)	(657.34)	(596.14)	
Agricincome	44987.49	25657.55	27163.22	2.83***
	(83428.78)	(90 928.62)	(43730.88)	

Note: Figure in parenthesis represent standard deviation and *** = significant at 1% level.

The mean agricultural income for those who participate in renting in was higher (KES 44987.49 per year) as compared to those who engaged in autarky and renting out who had KES 25657.55 and KES 27163.22 per year, respectively. The agricultural income consisted of all income gained from agricultural activities such as crop and animal production. Household agricultural income was significant at 1%, implying that, the mean income among the three categories was significantly different. Renting in provided the farmers with adequate land and thus an opportunity to diversify their farming operation thus increasing their income. Participation in land rental markets has the ability to increase incomes of land resource poor farmers by transferring land from land rich households to land poor households (Jin and Jyne, 2013).

Table 7 presents results of access to market, credit, extension services and group membership. Majority (21.60%) of those who were rented in land had access to the market as compared to 13.61% and 15.38% of autarky and rent out, respectively. According to Fort and Ruben, (2009), market access is an important variable in commercialization of agriculture by the small holder farmers because it provides an avenue for farmers to access input, sale their output and access information on rental land availability, prices and fertility status. Jin and Deininger (2009) indicated that household who rent in land required market to sell their produce as well as for access to information on agricultural land rental markets.

Table 7: Institutional characteristics (%)

		Categories of land rental market participants			
Variables	**Response**	**Renting In**	**Autarky**	**Renting Out**	χ^2
Marketaccess	Yes	21.60	13.61	15.38	3.88
	No	78.40	86.39	84.62	
Extensionaccess	Yes	61.50	80.27	23.08	66.44***
	No	38.5	19.73	76.92	
Groupmembership	Yes	40.85	21.09	30.77	15.48***
	No	59.15	78.91	69.23	
Creditaccess	Yes	31.62	19.73	26.92	17.44***
	No	68.38	80.27	73.08	

Note: *** = significant at 1% level.

Those who were engaged in autarky in had the highest number of farmers who had access to extension services at 80.27% as compared to 23.08% and 61.50% of those engaged in renting out and renting in, respectively. There was a statistical significant relationship at 1% between access of extension services and agricultural land rental market participation. Access to extension services is a mean through which information is transmitted to farmers by the extension officers for the purpose of improving their farming skills and knowledge through adoption of new technologies The higher number of farmers who had access to extension services in those renting in land may be because of the need of the farmers to maximize the yields. Deininger and Jin (2005) and Sanzidur (2010) noted that farmers who rent in land are under pressure to get the maximum returns for their investment and thus they seek extension services to fulfil their goal.

Results on membership to groups indicate that 40.85% of those who rented in land were members of a group while those who were engaged in renting out and autarky were at 30.77% and 21.09%, respectively. Membership to a group was found to have a significant relationship with rental market participation at 1% level. A group such as farmers group help farmers to access marketing, information, credit, farming skills and other services. The highest number of farmers who were members of a group in those who rented in land could be attributed to their high demand for information and knowledge on the availability of affordable and fertile rental agricultural lands. Deininger *et al*. (2008) argued that membership to a group increases the bargaining power of farmers in acquiring land and access to information of land availability in their areas of operation.

Those farmers who participate in renting in had 31.62% of them who had access to credit compared to 19.73% and 26.96% of those in autarky and renting out, respectively. Access to credit was statistically significant at 1% level. The credit was sourced from formal credit market (banks, micro finances, saving and credit cooperatives) and the informal credit market (merry go round). Access to credit provides the farmers with the ability to access financial resources to invest in improved technologies, pay rental prices, purchase farm inputs and other investments in agriculture. Access to credit facilitates payment of rental charges, introduction of innovative technologies and ensures input and output marketing arrangements (Reddy *et al*., 1998; Hoang, 2013).

4.2 Determinants of agricultural land rental market participation

Table 8 presents maximum likelihood estimates of bivariate Probit model regression results used to determine factors that influence small holder farmer's participation in the agricultural land rental market. The log likelihood for the fitted model of -55.2112 and p-value of 0.000 indicted that; at least one of the regression coefficients was not equal to zero. The rho value of 0.02 indicated that agricultural land rental market participation decisions of renting in and renting out were likely to be interdependent and therefore validating the use of the bivariate Probit model. Variables; education level, farm size, rental price, transaction cost, ownership of oxen and access to extension services were statistically significant in determining agricultural rental market participation.

Better educated household heads were more likely to participate in agricultural land renting in but were less likely to participate in renting out. The education level of the household head was statistically significant at 10% and 5% significance level for renting in and renting out, respectively. Higher education levels give household heads the ability to perceive, interpret and respond to new information faster than the less educated household heads (Feder *et al*., 1985). It is also important in changing perception on farming and shaping farmers ability to be more innovative and critical when converting to new production and market requirements. This finding provides some evidence to support the idea that better educated households are able to take advantage of opportunities such as acquiring cheaper and fertile farm land which agricultural land rental markets provide them. Ricker and Jyne (2010) argued that more educated household heads have more farming skills and are therefore are expected to be more productive in agricultural activities as well as be more aware of the potential benefits of land investment. On the other hand, higher education levels of the household head exposed them to new ideas, farming skills and technologies which helped them to identify the potential

benefits that can be derived from farming on land instead of renting it out. Previous studies (Tikabo and Holden, 2004; Masterson, 2007; Holden and Bezabih, 2009) reported that education levels of the household head had a negative effect on agricultural land rent out, implying imperfection in the market for human capital.

Table 8: Bivariate Probit results

	Renting in		Renting out	
Variables	**Coefficient.**	**Std. Error.**	**Coefficient.**	**Std. Error.**
Occupation	0.252	0.583	-0.413	0.376
Agehead	-0.031	0.030	-0.004	0.014
Genderhed	0.800	0.753	0.186	0.449
Educlev	0.492*	0.293	-0.458**	0.195
HHsize	0.194	0.145	-0.122	0.083
Ownedfarmsize	-0.544***	0.154	0.128***	0.034
Rentprice	-0.002***	0.000	0.001***	0.000
Transactioncost	-0.004**	0.002	-0.005*	0.003
Oxenownership	1.069*	0.580	-0.769**	0.385
Marketaccess	-1.281	0.939	0.548	0.535
Extensionaccess	0.076***	0.570	-0.765*	0.420
Groupmembership	0.991	0.703	0.601	0.414
Creditaccess	0.496	0.655	-0.429	0.454
Landfertility	-0.961	0.660	0.256	0.346
Constant	-3.493	2.031	-1.513	1.191
Number of observations = 381		Wald chi2 (28) =		76.84…rho = 0.02
Log likelihood = -55.211171		Prob. > chi2 =		0.0000

Note: ***, **, * indicate significant at, 1%, 5%, 10% level, respectively

Households with smaller farm sizes had a higher probability of participating in land renting in market while on the other hand; it reduced their probability of renting out land at 1% significance level. Agricultural land provides the space to carry out agricultural activities such as crop production and livestock keeping. Due to increased demand for land for the agricultural purposes, households with small land holdings tend to rent in land so as to meet the growing demand for food. This finding is consistent with previous studies (Nyangena, 2010; Jin and Jayne, 2011; Amare and Beyene, 2015), who found that household participation in land rent-in was inversely and significantly affected by the size of landholding. They argued that agricultural land rental markets increase access to land for households with relatively little owned land. In terms of renting out market, households with relatively large landholding do not tend to specialize in agricultural production and therefore they rent out land to get an extra income to invest in other activities. Studies by Ricker and Jyne (2010) and Amare and Beyene (2015) in Zambia and Ethiopia respectively argued that,

rental transactions tend to equalize farm sizes, with agricultural land transferred from land-rich to land-poor households.

High agricultural land rental price lowered the probability of a household to participate in land renting in; however, it increased the probability of participating in land rent out. The influence of agricultural land rental market on participation was statistically significant at 1% level. Agricultural land rental price is the cost of renting in or renting out agricultural land. It is influenced by the location of the land and its fertility amongst other factors. High land rental price implies that farmers pay more to acquire one acre of land and this reduces the resources which can be used for renting more land and make investments. Higher rental price means that farmers sacrifice the little financial resources they have to acquire agricultural land and this discourages them from renting in agricultural land (Jin and Jayne, 2011). In terms of land renting out market, land rental price acts as income for household engaged in land rent out. An increase in agricultural land rental price translates to better earnings which can be invested in other off farm income generating activities hence motivating famers to rent out land. Swinnen and Vranken (2006) noted that rental price was significantly positive and therefore land renting out was more important in regions where the land sale price corrected for soil fertility was high due to its increased value.

Higher transaction costs (transport, communication and negotiation) reduced the likelihood of a household to participate in agricultural land renting in and renting out market at 5% and 1% significance level, respectively. Transaction costs are costs incurred when making an agricultural land rental transaction. These results imply that as the transaction costs (transport, communication and negotiation) increases, the cost of renting in land also increase hence making it expensive for the already poor farmers. An increase in transaction costs is a deterrent to renting in of land because it increases the cost of renting in (Hoang, 2013; Swinnen and Vranken (2006). On the other hand, high transaction costs reduce the profit from the transaction; therefore, households are less likely to rent out agricultural land when the cost is high. Hoang (2013) noted that transaction costs need to be reduced in order to stimulate the rent out market in Vietam because it reduces the income acquired by the land owners.

Ownership of oxen positively influenced the probability of participation in land renting in market at 1% significance level but negatively influenced the probability of renting out land at 5% significance level. An ox provides cheap labour to the rural areas and is a source of

income when hired by other farmers. The extra income is used to rent in agricultural land and other investment in new technologies to produce surplus. Amare and Beyene (2015) argued that ownership of oxen offers an opportunity for resource constraint farmers to get access to land by transferring it from those who cannot use it efficiently (say, due to lack of traction power) to those who are capable of using it efficiently. On the other hand, oxen provide cheap labour to the farms. Household who owned oxen were less likely to rent out land because of the availability of labour to work on their farms as well the alternative source of income to finance farming activities thus able to put their available land into effective use. Households who owned oxen were wealthier and therefore they were less likely to rent out their land. Furthermore, Holden *et al*. (2011) noted that, households with oxen needed to keep land so as to provide fodder for their livestock.

Access to extension services increased the household's probability of participating in agricultural land renting in market land but decreased the probability of renting out land and this was significant at 1% and 10%, respectively. Extension services provide farmers with farming skills, knowledge, and agricultural land rental market information. Farmers who have access to extension services are more empowered on farming skills, information of new technologies and market information, which they use in understanding the dynamics in the agricultural land rental market in terms of prices and land fertility differences. However, Hoang (2013) found that access to extension services had a negative impact on renting in of land. This was attributed to extension services may be targeting at areas where the marginal productivity of land is relatively low and perhaps the quality of information given is low or even outdated. On the other hand, access to extension services negatively influenced household's participation in agricultural land renting out. Perhaps this is because extension services received by them farmers provided them with a good understanding on how to put their available land into productive use instead of renting it out. Tikabo and Holden (2004) found that farmers who have contact with extension services tend to have more farming skills and therefore use their land holdings effectively. It is supposed that such contacts prompt the farmer to take measures that would increase production. As one way to increasing productivity, the farmer tends to rent in land.

4.3 The effect of participation in agricultural land renting in on agricultural income.

To determine the effect of participation in agricultural land renting in on agricultural income (crop and livestock income), a two stage instrumental variable approach was used. The study used predicted probabilities (Pin) as used in the previous study (Algesheimer *et al*.,

2010) as an instrument and it referred to the propensity to participate in agricultural land rent in. It was generated by first, estimation of a Probit model for the determinants of household participation in agricultural land renting in market and then predicted probabilities were estimated form the results. The results of the Probit model are presented in appendix 2. Rentingin was the endogenous variable and it referred to household participation in agricultural land renting in or not. A variable is said to be endogenous if it is correlated with the error term in the model.

Several tests such as endogeneity test, validity test of the instrument and test for strength of the instrument. Hausman test presented in appendix 2 indicated that participation in agricultural land renting in was endogenous. This finding, therefore, necessitated the use of an instrument in the model. A Durbin test score was conducted to supplement the results of the Hausman test and it was $Durbin(score)\chi^2 = 2.84504$ confirming that indeed Rentingin was endogenous. Appendix 3 presents falsification tests that indicated predicted probabilities (Pin) as valid instrument because it was correlated with participation in land renting in (Rentingin). Lastly, it was to test the strength of the instrument. The result of the F statistic was $F(1,375) = 4194.81 \Pr ob > F = 0.000$ indicating that Pin was a strong instrument. Weak instruments give biased estimates and therefore inaccurate results (Chao and Swanson, 2005).

The Hausman, Durbin and validity tests validated the use of two stage Instrumental Variable Approach in this objective. Table 9 presents results of two stage instrumental variable approach. The Wald chi square was 74.06 and the model was strongly significant at 1% level indicating that at least one of the explanatory variables is not equal to zero. Land rich households increased their probability of having higher agricultural income at 1% significance level. Land is one of the four factors of production and provides the place to carry out agricultural activities thus; farmers with large land size are more likely to produce more leading to higher incomes. Households with larger farm size tend to invest in various agricultural enterprises such as livestock and crop farming as well as encouraged to adopt new technologies leading to improvement in yields and agricultural income. Large land endowment with land use rights such as tittle deed enable farmers to acquire credit facilities from financial institutions so as to invest in agricultural activities. Aikaeli (2012) and Fadipe *et al.* (2014) in Tanzania and Nigeria, respectively argued that, household with larger farm sizes diversify their farming which leads improvement in agricultural income.

Table 9: Two stage instrumental variable model results

Log of agricincome	Coef.	Std. Err.	P>z
Rentingin	0.006	0.244	0.982
Ownedfarmsize	0.069***	0.025	0.005
Log of assets	0.199***	0.076	0.009
Occupation	-0.271	0.177	0.126
Agehead	0.005	0.007	0.466
Genderhed	0.213	0.195	0.275
Educlev	0.181**	0.092	0.048
HHsize	0.035	0.034	0.303
Oxenownership	0.296*	0.172	0.086
Offfarm income activity	0.807***	0.309	0.009
Extensionaccess	0.012	0.185	0.949
Marketaccess	0.202	0.172	0.239
Groupmemb	-0.115	0.178	0.519
Creditaccess	0.531***	0.179	0.003
Irrigationfacility	-0.074	0.288	0.797
Landfertility	-0.036	0.166	0.831
Constant	6.300***	0.889	0.000
Wald chi2 (16) = 74.06	Prob > chi2 = 0. 0000	R-squared =	0.3349

Note: *, **, *** = significant at 10%, 5% and 1% level, respectively.

Higher value of agricultural assets increased the probability of higher agricultural income and was significant at 1% level. High endowment in agricultural assets provides a cushion against production risks as well as reduces costs in farming, this saved costs can be invested in other productive uses in the farm leading to an increase in agricultural income. Agricultural assets help in safeguarding the farmers against risks as well as providing liquidity during production and marketing of agricultural produce (Ayuya, 2015).

Better educated household heads were more likely to have more agricultural income and this, was found to be significant at 5%. Household heads with higher level of income tend to have better managerial skills and easier can easily search for opportunities such as new technologies and credit facilities as compared to those with lower level of education. (Lelissa, 1998; Beyene, 2000) argued that, household heads who attend more level of education are expected to have more exposure to the external environment and accumulate knowledge of farm practising. This enhances their ability to identify the problem in their farm business as well as analyze the costs and benefits of a farm enterprise. Therefore, have a better opportunity to increase agricultural productivity thus increasing their incomes.

Households who owned oxen were more likely to get higher agricultural income at 10% significance level. In rural areas, oxen are used to provide farm labour such as ploughing, weeding and transportation of inputs and outputs to and from the farm which helps saving time and labour cost. These saved resources can be channelled in other farming activities to increase income. Oxen can also be hired by other farmers and the income acquired from their services can be invested in farming activities leading to increased agricultural income. Earlier studies (Aikaeli, 2012; Beyene, 2015) argued that, the availability of labour from oxen enables farmers to increase their land under cultivation leading to increased agricultural income.

Household heads who participated in off-farm activities were more likely to have higher agricultural income and the variable was significant at 1%. Participation in off farm activities exposes household head to more information on how to make sound decision on the farm such as adoption of new technologies. Furthermore, households' heads who participate in off farm activities get a supplementary income which can be reinvested in farming activities leading to higher agricultural income. Omotola (2008) and Endale (2011) argued that, participation in off farm activities provide the households with diversified income, which enhances their ability to invest in new technologies leading to increased agricultural income.

Households who had access to credit facilities were more likely to have higher agricultural income. Access to credit provides an opportunity for the farmers to access funds so as to invest in new technology and other farm operations aimed at increasing yields. Households who have access to credit can easily purchase inputs and employ skilled labour in their farms thus increase their productivity and eventually their incomes. Farmers who have access to credit may overcome their financial constraints and therefore buy inputs and access other factors of production (Wolday, 1999; Mulugeta, 2000). However, Guirkinger and Boucher (2008) in Peru, argued that, farmers may divert the credit to other non-agricultural uses hence leading to low agricultural incomes.

Participation in agricultural land renting in had no significant influence on having higher agricultural income perhaps due to the high transaction costs and high rental prices associated with the transaction. This therefore, reduced the income which could have been channelled to other farming activities to increase agricultural income. Furthermore, the rented farms were probably of poor soil fertility leading to low yields. Jin and Jyne (2011), however argued that, participation in land renting in had a positive influence on agricultural income since it

provided land for farming for those who had small or even lacked agricultural land as well as better utilization of farm labour.

4.4 The effect of participation using propensity score matching model.

Propensity score matching technique was used to confirm the results of the 2 stage instrumental variable approach. Average treatment on treated (ATT) was calculated using three matching techniques that is, nearest neighbour, radius matching and kernel matching. The control group for this analysis were the small scale farmers who did not participate in land renting in (autarky and renting out). The results of the estimation of ATT are presented in Table 10.

Table 10: Sensitivity Analysis

Matching algorithm	Treated	Control	ATT	Standard error	t-value
Nearest neighbour Matching	117	270	8364.70	19824.59	0.42
Radius matching	117	270	10143.43	13014.72	0.78
Kernel matching	115	270	9921.04	24915.78	0.42

The balancing requirement was satisfied and common support was invoked to eliminate potential outlier observations. The results show that, after controlling for observables, the agricultural income differences between those who rented in land and those who did not, was insignificant. This finding can be attributed to the high transaction costs and rental prices associated with the agricultural land rental markets especially in the rural areas where the market is not well developed. Holden *et al*. (2011) argued that, due to the fact that those who rent in agricultural land do not have absolute and well defined land use rights, they invest less capital on the land.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

1. Participants in the agricultural land renting in were young, more educated, owned small farm sizes while those who participated in land renting out were relatively old, less educated and owned large pieces of land.

2. The main determinants of land rental market participation were transaction costs, access to extension services, ownership to oxen and rental price.

3. Participation in agricultural land renting in had no significance influence on agricultural income.

5.2 Recommendations

There is need to provide up to date, quality and demand driven extension services and provision of quality and affordable formal education. The findings provide strong evidence that such investments not only encourage farmers to participate in agricultural land rental markets but also enable the farmers to obtain high agricultural produce hence high agricultural income.

Stakeholders in the land sector should develop policies which are aimed at reducing the transaction costs involved in land rental transactions. These policies may include strengthening the land ownership rights such as provision of tittle deeds and policies which favour ease access to information. These policies helps in reduction of transaction costs hence encourage participation in the agricultural land rental markets.

Stakeholders should encourage reinvestment in agricultural productive assets such as oxen and the need to improve road and communication infrastructure so as to promote the access to the agricultural land rental market. Access to the market could enable farmers' access information on the land rental prices and quality of land available for renting.

Although this study has found that, participation in land renting in has no significant influence of agricultural income; efforts by stakeholders should be made so as to reduce the transaction costs involved in land market.

5.3 Suggestions for further research

While this research only covered the effect of participation in land rental markets on agricultural income, further research can be conducted to establish the effect of participation on overall household income in other parts of Kenya. The study used cross sectional data to determine the effect of household participation in agricultural land rental markets but it is known that identification of causal effects based on cross-section data is difficult. Therefore future research should use panel data in order to capture the dynamism effect of participation in agricultural land rental markets.

REFERENCES

Aigner, D., Lovell, C. A. K. and Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics,* 6(1): 21-37.

Aikaeli, J. (2006). Determinants of excess liquidity in commercial banks in Tanzania. *International Journal of Economics and Financial Issues*, 5(1): 249-259.

Algesheimer, R., Borle, S., Dholakia, U. M. and Singh, S. S. (2010). The impact of customer community participation on customer behaviours: An Empirical Investigation. *Marketing Science*, 29 (4): 756–769.

Amare, A. (2013). Drivers of household participation in land rent-out market: Evidence from Amigna District, Arsi Zone, Ethiopia. *Journal of Agricultural Extension and Rural Development.* 8(8): 164-173

Amare, A. and Beyene, F. (2015). Determinants of household participation in land rental markets in Amigna District, Arsi zone of Oromiya Region, Ethiopia. Addis Ababa. *Eastern Africa Social Science Research Review*, 31(1): 21-42.

Asfaw, S., Shiferaw, B., Simtowe, F. and Lipper, L. (2013). Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food Policy,* 37: 283–295.

Ayuya, O. A. (2015). Effect of Certified Organic Production Systems on the Livelihood of Smallholder Farmers in Kenya. PhD published Thesis, Egerton University, Nakuru, Kenya.

Barzel, Y. (1989). Economic analysis of property rights. Cambridge: Cambridge University Press.

Benin, S., Place, F. and Nkonya, E. (2006). Land markets and agricultural land use efficiency and sustainability: Evidence from East Africa, Kenya: International Food Policy Research Institute and World Agroforestry Centre. Washington, D C, USA and Nairobi, Kenya.

Beyene, F. (2015). Incentives and Challenges in Community-Based Rangeland Management: Evidence from Eastern Ethiopia. *Land Degradation Development*, 26: 502–509.

Bizimana, C. (2011). Determinants of land rental markets: Theory and econometric evidence from rural Rwanda. *Journal of Development and Agricultural Economics*, 3(4): 183-189.

Carter, M. R. and Yao, Y. (2002). Local versus global separability in agricultural household models: the factor price equalization effect of land transfer rights. *American Journal of Agricultural Economics,* 84(3): 702-15

Chao, J. C. and Swanson N. R. (2005).Consistent Estimation with a Large Number of Weak Instruments. *Econometrica,* 73(5): 1673-1692.

Chirwa, E. W. (2003). Sources of technical efficiency among smallholder maize farmers in Southern Malawi. Department of Economics, Chancellor College, Zomba, Malawi.

Deininger, K. and Jin, S. (2005). The potential of land rental markets in the process of economic development: Evidence from China. *Journal of Development Economics*, 78(1): 241-270.

Deininger, K., Jin, S. and Nagarajan, H. K. (2008). Efficiency and Equity Impacts of Rural Land Market Restrictions: Evidence from India. *European Economic Review*, 52(5): 892–918.

Di Falco, S., Veronesi, M. and Yesuf, M. (2011). Does adaptation to climate change provide food security? A micro perspective from Ethiopia. *American Journal of Agricultural Economics*, 93(3): 829–846.

Doss, C. R. (2006). Analysing technology adoption using micro studies. Limitations, challenges, and opportunities for improvement. *Journal of Agricultural Economics*, 34(5): 207-219.

Emana, B., Gemtessa, K. and Jirata. M. (2005). Land transaction and market-oriented production: The case of East Shewa Zone, Ethiopia. Paper presented to Land and Sustainable. Symposium Organized by the FSS, EEA and AESE 2005. Addis Ababa, Ethiopia.

Fadipe, A. E. A., Adenuga, A. H. and Lawal, A. (2014). Analysis of income determinants among rural households. *Trakia Journal of Sciences*, 4: 400-404.

FAO (2011). The State of Food and Agriculture: Women in Agriculture – Closing the Gender Gap for Development. Rome: FAO.

Feder, G., Just, R. E. and Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: a survey. *Economic Development and Cultural Change*, 33: 255-297.

Fort, R. and Ruben, R. (2009). The impact of Fair Trade on banana producers in northern Peru. Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference on August 16-22, 2009, Beijing, China

Fufa, B and Hassan, R. M. (2003). Stochastic Maize Production Technology and Production Risk Analysis in Dadar District, East Ethiopia. *Agrekon*, 42(2), 116-128.

Furubotn, E. G. and Richter. R. (2005). Institutions and economic theory: The contribution of the new institutional economics. Ann Arbor: The University of Michigan Press.

Government of Kenya (2007). Kenya Vision 2030: Popular Version. Nairobi. Government of the Republic of Kenya.

Guirkinger, C. and Boucher, S. (2008). Credit Constraints and Productivity in Peruvian Agriculture. *Agricultural Economics*, 39: 295-308.

Hermunen, T. (2004). Land and Use Policy in Kenya. Experiences from Taita Taveta District. Theses submitted for MSc to University of Helsinki.

Hoang, H. T. (2013). *Low farm incomes and the rental market for cropland in Vietnam*: Published Doctoral thesis. Lincoln University Digital Thesis, Christchurch, New Zealand.

Holden, S. T. and Bezabih, M. (2009). Gender and land productivity on rented land in Ethiopia. Chapter 9 in: Holden, S. T., Otsuka, K, and Place, F.M (editors). The emergence of land markets in Africa: Impacts on poverty, equity and efficiency. *Resources for the Future Press*, 56: 179-198.

Holden, S. T., Deininger, K. and Ghebru, H. (2011). Tenure insecurity, gender, low-cost land certification and land rental market participation in Ethiopia. *The Journal of Development Studies*, 47(1): 31-47.

Independent Electoral and Boundaries Commission (2012). Report on constituency and ward boundaries, Nairobi, Kenya.

Irz, X and Thirtle, C. (2004). Dual technological development in Botswana agriculture: A Stochastic Input Distance Function Approach. *Journal of Agricultural Economics*, 55 (3): 455-478.

Jin, K. D. (2003). Land sales and rental markets in transition, Evidence from rural Vietnam. Washington, D.C and Davis CA: The World Bank and University of California.

Jin, S. and Deininger, K. (2009). Land rental markets in the process of rural structural transformation: Productivity and equity impacts from China. *Journal of Comparative Economics*, 37(4): 629-646.

Jin, S. and Jayne, T. (2011), Impacts of land rental markets on rural poverty in Kenya, Paper prepared for the Agricultural and Applied Economics Association's 2011 AAEA and NAREA joint annual meeting, Pittsburgh.

Jin, S. and Jyne, T. S. (2013). Land rental markets in Kenya, Implications for efficiency, equity, Agricultural income and poverty. *Land Economics*, 34: 246-271.

Kanyinga, K. (1998). Struggles of access to land; The 'Squatter Question' in Coastal Kenya. Vienna: Centre for Development Research.

Kega V. M., Jamoza, J. E., Kiuru, P., Ali, A. R., Muniu, F. K., Kirui, A., Ojiambo, R. N. and Dzillambe, K. K. (1994). Report of a farming systems survey in Milalani sub-location, Kwale District. Internal Report, RRC-Mtwapa No. RRP/004.94.

Kenya National Bureau of Statistics (2009). Kenya Population and Housing Census. Nairobi Kenya.

Kersting, S, and Wollni, M. (2012). New institutional arrangements and standard adoption: Evidence from small-scale and vegetable farmers in Thailand. *Food Policy*, 37: 452-462.

Kim, J. and Mahoney, J. T. (2005). Property rights theory, transaction cost theory and agency theory: An organizational economics approach to strategic management. *Managerial and decision economics*, 26: 223 – 242.

Klaus and Deininger, D, A. (2011). Effects of Land rental markets in Ethiopia Evidence from a matched tenant-landlord Sample. Productivity Policy Research. Working Paper 5727. World Bank, Washington DC.

Kung, J. K. (2002). Off-farm labour markets and the emergence of land rental markets in Rural China. *Journal of Comparative Economics*, 30 (2): 395-414.

Kwale County Integrated Development Plan (2013). County Government of Kwale, Kwale, Kenya.

Macher, J. T. and Richman, B. D. (2008). Transaction cost economics: An assessment of empirical research in the social sciences. *Business and Politics*, 10(1): 1–65.

Maddala, G. S. (1983). Limited-dependent and qualitative variables in economics, New York: Cambridge University Press.

Makhura, M. (2001). Overcoming Transaction Costs Barriers to Market Participation of Smallholder Farmers in the northern province of South Africa. Unpublished PhD Thesis Submitted, University of Pretoria, Pretoria, South Africa.

Makhura, M., Kirsten, J and Delgado, C, (2001). Transaction costs and smallholder participation in the maize market in the Northern Province of South Africa. Proceedings of the Seventh Eastern and Southern Africa Regional Conference, 11–15 February, Pretoria.

Marenya, P. P. and Barrett, C. B. (2007). Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in western Kenya. *Food Policy, 32*: 515-536.

Masterson, T. (2007). Land rental and sales markets in Paraguay. The Levy Economics Institute, Annandale-on-Hudson, New York, USA.

Mc Clung, M. (2012). Making land rental markets .Addis Ababa: Focus on land in Africa.

Neill, P. S. and Lee, D. R. (2001). Explaining the adoption and dis-adoption of sustainable agriculture: The case of cover crops in Northern Honduras. *Economic Development Culture Change*, 49 (4): 793-820.

Newey, W. K. (1987). Efficient Estimation of Models with Conditional Moment Restriction, Department of Economics, Pricenton University.

Ngatia, P. (2010). Addressing regional imbalances and integration at the Coast. Inter-Ethnic Forum Coast Regional conference, Mombasa, Kenya.

Njuguna, K. H. and Baya, M. M. (2000). Land reforms in Kenya: An institution of surveyors. Institution of Surveyors of Kenya. Nairobi, Kenya.

Nyangena, W. (2010). Determinants of household participation in land rental markets in Rural Kenya. University of Nairobi, School of Economics. Nairobi, Kenya.

Nyoro, J. K. (2012) "Kenya's Competitiveness in Domestic Maize Production: Implications for Food Security." Paper presented at the African Study Centre, University of Leiden, Netherlands.

Ostrom, E. (2003). How types of goods and property rights jointly affect collective action. *Journal of Theoretical Politics*, 15(3): 239–270.

Otieno, L., Kamau, G. M., Njunie, M. N., Blokland, A., Munga, T. L. Kikuvi, B. M., Jefa, F., and Chege, P. (1994). Diagnostic survey using PRA Techniques of Roka Location, Bahari Division -Kilifi District. Internal Report, RRC- Mtwapa No. RRP/003/94.

Otsuka, K. and Hayami, Y. (1988). Theories for Share Tenancy: a Critical Survey. *Economic Development and Cultural Change*, 37: 31-68.

Place, F., Nkonya, E., Pender, J. and Benin, S. (2006). Land markets and agricultural land use efficiency and sustainability: evidence from East Africa. International Food Policy Research Institute and World Agroforestry Centre., Washington, DC, USA and Nairobi, Kenya.

Reddy, S. K. and Bhat, S. (1998). Symbolic and functional positioning of brands, *Journal of Consumer Marketing*, 15(1): 32-43.

Ricker, G. J. and Jayne, S. T. (2010). The Impact of Fertilizer Subsidies on National Fertilizer Use: An Example from Malawi. Selected Paper prepared for presentation at the *American Agricultural Economics Association* Annual Meeting, Orlando.

Sanzidur, R. (2010). Determinants of agricultural land rental market transactions in Bangladesh.Unpublished paper. Nairobi, Kenya.

Schlager, E. and Ostrom. E. (1992). Property rights regimes and natural resources: A conceptual analysis. *Land Economics*, 69(3): 249–262.Sjaastad, E., and D.W. Bromley. 2000. The prejudices of property rights: On individualism, specificity and security in property regimes. *Development Policy Review*, 18: 365 – 389.

Siriba, D. N. and Mwenda, J. N. (2011). Towards Kenya's profile of the land administration domain model. Kuala Lumpur, Malaysia: Land Administration Domain Model.

Skoufias, E. (1995). Household Resources, Transaction Costs and Adjustment Through Land Tenancy. *Land Economics* 71(1): 42-56.

Stock, J. and Staiger, D. (1997). Instrumental variables regression with weak instruments. Econometrica, 65: 557–586.

Swinnen, J. (2002). Political reforms, rural crises, and land tenure in Western Europe, *Food Policy*, 27(4): 371-394.

Swinnen, J. and Vranken, L. (2006). The development of rural land markets in transition countries, ECSSD Report, The World Bank, Washington, DC.

Tchale H, Sauer J (2007). The efficiency of maize farming in Malawi: A Bootstrapped Trans log frontier. *Cahiers d`économieet sociologie Rurales*, 82(83): 34-56.

Teklu, T. and Lemi, A. (2004). Factors Affecting Entry and Intensity in Informal Rental Land Markets in Southern Ethiopian Highlands. *Journal of Agricultural Economics*, 30(2): 117-128.

Tikabo, M. O. and Holden, S. T. (2004). Land tenancy and efficiency of land use in the Highlands of Eritrea. Norway: As, Norwegian University of Life Sciences

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica*, 26(1): 22-36.

Toulmin, C. and J. Quan. (2000). Evolving land rights and policy in sub-Saharan Africa. In:Evolving land rights, policy, and tenure in Africa, edited by Toulmin, C. and Quan, J., 12–48 DFID and London.

United Nations Development Programme (2015). Sustainable Development Goals. New York. USA.

Wangila, J. (1999). Socioeconomic characteristics of households in the soil fertility replenishment pilot project area in Vihiga and Siaya Districts. Nairobi: ICRAE.

Wooldridge, J. M. (2002). Econometric analysis of cross section and panel data. The MIT Press, Cambridge, M A, U.S.A.

Yamano, T., Place, F. M., Nyangena, W., Wanjiku J. and Otsuka, K. (2009). Efficiency and equity impacts of land markets in Kenya.

APPENDIX 1: QUESTIONNAIRE

Introduction

This study is conducted to find out the effect of small scale farmer's participation in land rental market on household income in Lunga Lunga Constituency, Kwale County, Kenya. The information you will provide will assist in formulation of policies and programs that will help to improve the livelihoods of small scale farmers in the Constituency. I assure you that the information will be treated as confidential as possible.

Questionnaire identification

Questionnaire Number …….

Ward…….

Location……..

Name of enumerator…….

Name of the household head…….Date……

1.0 Farmers' background information

1.1 Gender of the respondent: 1= Male, 0= Female ☐

1.2 Occupation of the head _____

1.3 Age of the head (in years) _____

1.4 The gender of the household head: 1= Male 2 =Female ☐

1.5 Education level of the household head (*Tick where appropriate*)

1.	None	☐
2.	Primary school	☐
3.	Secondary school	☐
4.	University	☐
5.	Others (*specify*)_____	

1.6. Household head's marital status. *Please tick as appropriate.*

1.	Married	[ ]
2.	Single (Never married)	[ ]
3.	Divorced	[ ]
4.	Widowed	[ ]

1.7.0 How many people are there in the household.....?

1.7.3 How many members participate actively in the farming activities ……?

2.0 ECONOMIC FACTORS

2.1 Do you have any other source of income apart from maize production?

1=Yes 0=Otherwise ☐

Income Source	**Average monthly income(Ksh)**
Production and sale of other crops	
Production and sale of livestock	
Other businesses	
Salaried employment	
Casual employment	
Pension	
Remittances	
Others(Specify)	

2.2 Farm assets

11.1 Do you possess any farm assets? 1=Yes 0=No ☐

If yes fill the table below

Name of the assets	**Value of the assets (Ksh)**

3.0 STRUCTURE OF LAND OWNERSHIP AND USE

3.1 Land tenure: 1= Private 2= Group ranch 3=Communal ☐

3.2 If you have individual land ownership do you possess a tittle deed)? 1=Yes 0=No….. ☐

Total size		**Land Ownership (Acres)**		
		Owned	**Rented in**	**Rented out**
Acres				

3.3 What is the rent price per acre……?

4.0: MAIZE PRODUCTION IN THE LAST SEASON

Area planted (acres)	**Rent price/acre(if rented in)**	**Seeds in kgs**	**Fertilizer applied 0=no 1=yes**	**If applied how many kgs**	**Yield or Production in 90 kg sack**	**Price per unit**

4.1 Other farm inputs

4 2 did you use any inputs (pesticides or any other) in maize production last season?

1=Yes, 0=No ☐

4.3 If yes which ones did you use and how much?

Pesticides	**Manure**
Quantity applied (ltrs or kg)	**Quantity applied (kg)**

4.4 Labour

4.5 Please fill the table below regarding the labour input in maize production.

4.6 Which type of labour did you use? 1= Family 2=Hired 3=Both ☐

Fill the table below

Activity e.g. ploughing	**Family labour(hours, days months/acre)**	**Hired labour(hours, day, months/acre)**
Totals		

4.7 What is the average cost of hired human labour (hours/days/ months/acre)

4.8 Did you hire a tractor (s)? 1=Yes 2=.No

4.9 If yes what was the cost per acres…….Ksh

5.0 MARKET ACCESS

5.1 Do you sell your produce to the market 1=Yes, 0=No ☐

5.2 What is the distance to the nearest market? ……. (Kilometres)

5.3 What is the state of the road to the market? 1=tarmac, 2=marram, 3=other (specify) ☐

6.0 FARMING EXPERIENCE

6.1 Do you have any experience in maize production 1=Yes 0=No ☐

If yes how many years of experience in maize production…….

7.0 ACCESS TO EXTENSION SERVICES

7.1 Did you any contact with an extension agent in the last season?

1=Yes, 0=No ☐

7.2 If yes, how many contacts did you ever have ……..?

8.0: MEMBERSHIP IN AN ORGANIZATION

8.1 Are you a member of any groups or organization dealing with maize production or marketing in your area?

1=Yes, 0=No ☐

9.0: ACCESS TO CREDIT

9.1 Did you have access to formal/informal credit last season?

1=Yes 0=No ☐

9.2 If yes, which sources of credit did you access the credit from?

Banks	☐	Traders	☐
Cooperatives	☐	Intermediaries	☐
NGOs	☐	Rotating savings and credit	☐
Moneylenders	☐	Others (Specify)…….	

9.3 If applied for, for what purpose was the credit applied for?

Maize production ☐

Livestock production ☐

Other specify…….

10.0 LIVESTOCK INFORMATION

10.1 Do you possess any domestic animal? 1= Yes 0= No ☐

If yes fill the table below

Livestock type	**Number of livestock**	**Benefits/Use**

11.0 IRRIGATION ACCESS

11.1 Do you have access to irrigation services 1=Yes 0=No ☐

11.2 Do you consider your land fertile 1= Yes 0=No ☐

Thank you for your patience and responses.

APPENDIX 2: TEST FOR ENDOGENEITY.

Log of agricincome	**Coef.**	**Std. Error.**	**P>t**
E	-0.788**	0.536	0.024
Rentingin	0.807*	0.478	0.094
Ownedfarmsize	0.067***	0.026	0.013
Log of assets	0.197***	0.079	0.014
Occupation	-0.280	0.186	0.136
Agehead	0.006	0.008	0.456
Genderhed	0.179	0.211	0.397
Educlev	0.187*	0.096	0.055
HHsize	0.118	0.089	0.189
Off-farm income activity	0.836***	0.325	0.011
Oxenownership	0.284	0.181	0.120
Marketaccess	0.189	0.179	0.295
Extensionaccess	-0.013	0.193	0.947
Groupmemb	-0.111	0.187	0.553
Creditacccess	0.553***	0.189	0.004
Irrigationfacility	-0.072	0.304	0.812
Landfertility	-0.035	0.175	0.840
Constant	6.197	0.925	0.000
F (17, 129) = 4.15	Prob > F = 0.0000	R-squared	= 0. 3533

Note: *, **, *** = significant at 10%, 5% and 1% level, respectively.

APPENDIX 3: CORRELATION BETWEEN RENTING IN AND PIN

Rentingin	**Coef.**	**Std. Error.**	**P>t**
Pin	0.983***	0.038	0.000
Ownedfarmsize	0.002	0.004	0.721
Log of assets	-0.025**	0.012	0.048
Occupation	-0.017	0.030	0.571
Agehead	-0.001	0.001	0.643
Genderhed	-0.017	0.033	0.609
Educlev	-0.009	0.015	0.562
HHsize	0.008	0.014	0.583
Off-farm income activity	0.005	0.033	0.890
Oxenownership	0.019	0.028	0.485
Marketaccess	-0.014	0.030	0.645
Extensionaccess	0.036	0.029	0.210
Groupmemb	-0.017	0.030	0.572
Creditaccess	-0.010	0.030	0.738
Irrigationfacility	0.050	0.045	0.268
Landfertility	-0.002	0.028	0.956
Constant	0.253	0.137	0.067
F (16, 159) = 92.68	Prob > F = 0.0000	R-squared	= 0. 9032

Note: **, *** = significant at 5% and 1% level, respectively.