Determinants of Land Renting and Its Implication on Food Security of Rural Farming Households in Malawi

Boja Tesfaye Garedow

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Department of Economics and Resource Management

Norwegian University of Life Sciences

Ås, Norway

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Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

MGDS   Malawi Growth and Development Strategy

MPRS   Malawi Poverty Reduction Strategy

NSO   National Statistical Office

EA   Enumeration Area

ECA   Europe and Central Asia

FAO   Food and Agriculture Organizations of the United Nations

FGD   Focus Group Discussion

GDP   Gross Domestic Product

GoM   Government of Malawi

GPS   Geographical Positioning System

Ha   Hectare

Kg   Kilogram

NLI   Net Land Leased

Mkw   Malawian Kwacha

PSU   Primary Sampling Unit

Abstract

Land in Malawi is a basic source of livelihoods and accumulation of wealth. Due to the key role that the land plays, access to this resource through land market is closely related to household food security. This study analyzes factors associated to land rental market and its implication on food security in rural households of Malawi. Land rental markets transfer land from land rich but resource poor to land poor but wealthy households. It is also a remedy to scarcity of land due to soaring population growth and hence high pressure on farm land. We employed binary probit for participation, and censored (tobit) for degree of participation for both tenants and landlords to pin down socio-economic factors affecting the land rental market using 450 randomly sampled households across six districts. We found that fixed rental contracts are dominating while sharecropping was rare. Reverse tenancy contracts where tenants are richer than landlords in non-land assets were common. Own land and non-land resources (family labor, assets, tropical livestock units and others), and household poor health conditions, are found to be significantly associated to the land market participation and degree of participation. Treatment effect model was used to test whether land market participation improves food security of the participants. After controlling for soil characteristics and agro ecological factors, we found that the rental participation has significantly improved the tenant's food access in terms of staple food in form of maize but has no positive significant effect on the landlords' maize output. This is may be due to the fact that the landlords enter into distress fixed rental contract for short term capital constraint in response to frequent health shocks that would be spent on the hospital bills, assistance of others, and non-farm input purchases.

Keywords

Fixed rental, reverse tenancy, Health Shocks, Food Security, Malawi

1. INTRODUCTION

Land is one of the scarce natural resources that remains unequally distributed in Malawi. With rapid population growth resulting in increasing land fragmentation, land holding is becoming smaller so that it is unable to sustain the households[3] adequately. World Bank (2003) notes that the majority of the rural population produces 84% of agriculture value added. This is from 1.8 to 2 million smallholder farmers who on average own only 1 hectare of land. The per capita land holdings have declined from 1.53 hectares in 1968 to 0.8 hectares in 2000 (Government of Malawi, 2001). Nonetheless, land plays a critical role in the livelihood of Malawians. Near landlessness in Malawi has been linked to poverty and food insecurity.

Recent estimates by the Malawi's Ministry of Agriculture and food security indicate that 55% of households have an average land holding size of less than 1hectare (Ministry of Agriculture, 2003). This again undermines the desire to food self sufficiency, improving agricultural income, and adoption of new farm technologies. To the Ministry, a smallholder should have at least 1.5 Ha of land to attain the minimum levels of sustenance throughout the year. One of the major constraining factors to increase agricultural productivity and viability is thus insufficient land required to expand on.

Land constraint coupled with low productivity and land tenure which does not favor better economic conditions has contributed much to food insecurity among rural households. 'Food insecurity exists when all people, at all times, are unable to have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996). This is mainly the case for smallholders in developing countries like Malawi. From the perspective of high level of poverty, high population growth, diminishing arable land, and low agricultural productivity, the food security question becomes a question of food production and availability. It is not surprising that most policy initiatives that have a bearing on food security centers around the provision of basic agricultural inputs especially farm land to the small holder farmers.

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[3] …group that shares the same abode or hearth. Unequal bargaining strength where single household member decides on behalf of the other or there is enough consensus among members to treat internal decisions. (Sadoulet & de Janvry (1995:pp.144))

Pressure on land is severe in densely populated areas of the southern region of Malawi due to increased migration from the land scarce areas in Mulanje and Thyolo in to the upland catchment areas. Land pressure is also becoming acute in the central region where the capital city is situated (Greenwell, 2007).With growing population pressure on land, there is a need to develop an alternative means to improve land access in order to increase production and productivity at household level. Land rental market would be one alternative, which is not well developed in Malawi. Land rental market is an important institution in agriculture. Inter household resource exchange fostered in social networks and association membership provides an opportunity to combine labor during farmland preparations and harvest seasons among rural dwellers. This kind of resource sharing, to certain extent, reflects in plots of land in Malawi where the relatively land rich households lend for free to the neighbor and/or relatives who need to produce food for home consumption.

In Malawi, renting and borrowing are practiced but they are not legally recognized (GoM, MGDS, 2005). It is one of the countries where land market remains inactive. The limited land market prevails itself in fixed rental form followed by borrowing contracts. Crop sharing, which dominates the Eastern part of Africa like Ethiopia, and sales market (common in Uganda) are scarcely observed or lacking in Malawi. This is mainly due to higher transaction costs, limited household resources required to contribute in crop sharing contracts and/or legal prohibition in land sales as land use and access is closely monitored by the village chiefs in rural parts of the country (FGD report).

The land rental market has got due attention in agriculture based economies due to the issues of equity, production, and productivity associated to it. This factor market is found to have prominent feature in transferring land from less productive households constrained by socio-economic factors to more productive households as evidenced by Holden, Deininger, and Ghebru, (2007). Even with major imperfections in credits, labor, and insurance markets, land renting provides asset of benefits to the poor people-by temporarily renting out land they can get additional income without losing their rights to their land. Transfer of land through rental provides access to land to those with high agriculture ability but own little land or no land (Ballesteros and Bresciani, 2008). Thus the rental market allows for more efficient farm size and provides an opportunity for the land less to climb up the agricultural ladder. Moreover, as the off-farm economy develops, the rental market provides mechanisms for farm operations without change in land ownership.

For the benefit of appropriate policy formulation, knowledge in both distribution of land, and determinants of land rental market would guide policy makers in approximating implications of skewed land holdings on the economic performance across the agrarian community. It would also be the rationale for redistribution or designing market oriented land policy regulations which facilitate the opportunity to transfer land from land rich but less capable to the land poor and/or capable to cultivate households. This in turn has a welfare effect by improving the food access and reducing poverty at household level in particular and the economy wide in general.

This study is therefore designed to identify factors determining land rental participation among farming households and its implication on household food security using both Statistical tools and Econometrics estimation with an attempt to answer three principal research questions. Those are:

Q_1. What are the determinants of land renting in Malawi?

Q_2. Is there strong reverse tenancy contract in Malawi?

Q_3. Does land renting improve Food Security of the land rental participants? It also highlights theoretical and empirical reviews related to land rental activity. The rest of this paper is organized as follows. The next section presents background of the study. Section Three reviews related literature. Section Four describes data and methodology of the study. Section Five will present data analysis and discussion. The last section concludes the paper.

2. BACKGROUND

Land Access and Agriculture in Malawi

Like most sub-Sahara African countries, Malawi's economy is highly reliant on agriculture which accounts for about 90% of its export earnings and 45% of its Gross Domestic Product. The sector employs about 85% of labor force (GoM, 2005). This explains the importance of agricultural land to the economy of this country. However, it is constrained by limited resources and rapidly expanding population. All Malawians rely up on access to land in one way or another. The country has a diversity of cultures, and major ethnic groups[4] which have their own rules for the transfer of land to persons and generations. For all groups, land is generally regarded as the main basis for social security. (Gondwe et al., 2008).

In Malawi different land allocation systems have been developed to supply the population with land. The basic objective is to satisfy growing population with enough space for food production and shelter (Ericsson, 1999). The process of economic growth is one of continuous structural transformation channeled through various linkages between the individual sectors of the domestic economy. Crucial for this process and poverty alleviation are markets that operate efficiently to accommodate decisions within and across households and sectors that lead to efficient use of inputs and outputs of agriculture.

The government allows all customary land to be registered and protected by law against arbitrary conversion to public land. All customary land[5] holders, defined to include entire communities, families or individuals are encouraged to register their holdings as private customary states with land tenure rights that preserve the advantages of customary ownership and ensures security of tenure. Private lease hold estates are created as subsidiary interests out of any private land, including registered customary estates without relinquishing the ownership of the customary landholder. This provision allows traditional leaders, family heads and individual holders of registered customary land to grant leases (GoM, Presidential Commission on Land Policy Reform, 2002). That is, land under the customary tenure is considered to belong to a village, and individuals in the community who have the right to

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[4] Includes both Patrilineal & Matrilineal :(inheritance system in which land is received through the father's side and   mother's side respectively)

[5] land held or used under customary law (see Lunduka et al., 2006)

cultivate the land and use it, and to dispose of it with the limits set up by the customary law of the tribe or clan. In this case, therefore, the individual does own the land with limited right when comes to exchange of land. The chiefs, sub-chiefs, and village head men protect the customary land against outsiders (Nathole, 1985). This institutional set up has inhibited optimal land marketing that may shift land towards more productive households.

The Agriculture sector of the country is dually structured consisting of the smallholder and the state sub-sectors. The sub-sectors are distinguished according to legal and institutional rules regulating crop production, land tenure, and marketing and pricing arrangement for agricultural commodities. Agricultural production on the traditional tenure or customary land is defined as that of smallholders, whereas state production occurs on leasehold (freehold) land. There are important interdependent elements that exist between and within the estate and smallholder sub-sectors. A dual approach was adopted after independence in 1964 (GoM, 1998).

The country's agricultural output is derived from both estate and smallholder sub-sectors. The smallholder sub-sector is primarily subsistence-oriented, providing almost 80% food production. It involves some 1.6 million families operating under customary tenure on approximately 1.8 million hectares. About 56% households cultivate less than 1 ha, 31% between1-2 ha, and 13% above 2 ha. Maize of local low yielding varieties dominates the smallholder farming system accounting for about 75% of the cropped areas (GoM, 1998). Production for subsistence from the combined efforts of small farm holdings is highly constrained by unimproved varieties, land, and non-land inputs that contributed to low productivity. On the other hand, estates operate primarily under leasehold tenure. The producers mostly export commodities notably tobacco followed by tea, sugar, coffee and grain legumes (Edriss, 2003). As indicated in Nankumba (1988), accessibility to reasonably sufficient land (at least 3 Ha) is necessarily a precondition for the improvement of rural smallholders in Malawi.

The national food self-sufficiency approach concentrates on raising food production, mainly by hybrid maize. As a landlocked country, with most of its population engaged in smallholder agriculture, Government has found it logical for Malawi to at least meet its basic food requirements through domestic production. Food deficits expose Malawi to high costs

in foreign exchange for importing food and the risks associated with dependence on world markets or food aid from donors. The drive for self-sufficiency has been a feature of Government food security policy since the colonial period (Devereux, 1996). Until recently, food security has always meant self-sufficiency in maize production for the Government of Malawi. As population increases, self-sufficiency can be achieved mainly through hybrid maize, which offers superior yields over local and composite varieties. Food security is measured by quantity of average food reserves in the household despite its nutrient content (Ministry of Agriculture and Food Security, 2003). According to the Malawi Ministry of Agriculture, food security is said to be achieved at the household level if there exists about 270 kilogram of Maize per adult equivalent per year.

3. REVIEW OF RELEVANT LITERATURES

3.1 The Economics of Land Rental Markets

The value of land is derived from resources existing (including it physical structure, location, size and quality) in/on it and the summation of their individual values calculated on monetary basis. This is often based on the future variations of these components. The meaning of rent as the return to land[6] has been broadened in economics and in popular use to including hiring any asset, such as renting a car. But in this paper, the term "rent" should strictly mean the payment for the use of farm land. David Ricardo (1809) is credited with the first clear and comprehensive analysis of differential land rent and the associated economic relationships.

Renting of land appears to be more widespread and may be the most important form of land exchange. In ECA (Europe and Central Asia) it has been expanding in terms of participation and scale of participation. For example, in Bulgaria in 2003, only 3% of rural households had sold agricultural land, while 80% of them were renting land in or out. Ad hoc evidence also indicates that land rental plays an important role in the consolidation of farms (Swinnen et al., 2006). Many literatures confirm that rental markets can be an effective instrument to transfer land to the most efficient users and stimulate investment, if a number of conditions are fulfilled, in particular, sufficient tenure security(Skoufias, 1995; Holden, Deininger, and Ghebru, 2007; Alemu et al., 2007; Tikabo et al., 2008; Bresciani, 2008; Holden et al., 2009). Among other factors, this has to go with the type of rental contracts used and the regulations of the tenure system and lower transaction costs. In addition to efficiency effects, rental markets may also have positive equity impacts.

The market is also widely practiced in Philippine agriculture. The study by Ballesteros and Bresciani (2008) describes rental activities, both sharecropped and fixed rent arrangements, represent one fourth of the cultivated areas of the country. According to the study, share cropping is the preferred contract in all regions with an average of 80% of total rented area under tenancy. It appears that corporate farms play a major role in the market. Where they dominate, rental market is active and lease contacts are more

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[6] Farm value- added plus rental income from leasing out. See Rasmus Hertberg (1998.pp1807 vol.26,no.10)

common. Moreover, it also identified that credit access and land endowment plays a role in determining the probability of land market participation (*Ibid, 2008*).

Reviews of land market in India verify that the market is affected by certain factors and found to be inefficient in adjusting the desired cultivable area by the household. Skoufias (1995), using panel data from six villages in India identified certain determinants of the market. Higher average female wage rate and large farm size holdings reduce significantly the probability of leasing in land. While, number of children in the household and higher values of farming implements have negative signs on the supply side of the market (Skoufias 1995).

Studies have been conducted in different countries of Africa with different motives on the land rental markets, including its determinants, land reform and tenure security and their implication for access to land, land investment, equity and efficiency aspect of the activity, impact of certain institutional changes on the market participation and etc. For instance, in the high lands of Eretria endowments of the non-land factors like male labor force, oxen, and farm experience are found to be greatly affecting the probability of participation as well as the degree of participation in the land rental market. Households poor in these factors tended to rent out land while households rich in these non-land factors tended to rent in land (Tikabo and Holden, 2004). Shiferaw et al., (2001) reports that land rental market increases efficiencies in creating additional wealth if it contributes for use of more purchased inputs, improved labor mobility/participation in non-farm activities and high participation in extension package programs in Ethiopia.

Holden et al., (2010) assesses effects on the allocative efficiency of the land rental market of the low-cost approach to land registration and certification of restricted property rights implemented in Tigray region, Ethiopia. The study found that low cost land certification promoted participation of female landlords to the rental market relative to male counterparts. This was mainly due to the fact that female headed households are constrained with male labor force in order to till the land and had been tenure insecure because of their lower bargaining power before the official use right certification.

The land market, in the form of sales and rental is also relevant in the Ugandan and Kenyan rural economies. In Uganda, Dininger K., and Mpunga (2002), using panel data (1999-2000) assessed the determinants of land rental participation and systematic differences between sales and rental markets. The study identified, among others, that young and better educated households are more likely to purchase land, and it was more difficult for the

landless, those with few assets, and for households headed by widows to acquire land through purchase markets in Uganda. With regards to the land rental, it was found that rental markets are more effective than sales markets in transferring land to larger households with younger heads, thus providing an opportunity to employ relatively abundant family labor(*ibid*, 2002). Accordingly, it is much easier for landless households to gain access to land through rental than through sales markets. The report came up with the fact that land rental market improved productivity in a pro-poor way and helped to provide land access to those in need, especially landless households.

On the other hand, based on cross-sectional household data from two different places of Kenya, Yamano et.al, (2005) identified that those households with greater number of women, educated, and asset wealth purchase land. In addition, number of oxen, and number of adult women are found to be positively related to participation in the market whereas the number of adult men is positively related to the size of rented in land. This study marked the importance of land sales to those unable to inherit land though not used for minor adjustment of landholdings. As such, rental market is tended to be used by the participants for short-term adjustments in factor ratios. The paper indicated the existence of inverse farm size- productivity relation for which it concludes as a base may be, potential landlords are reluctant to rent out land for fear of losing it.

We also have reviewed limited literatures relevant to this study from Malawi. We came across some studies concerned on land in the country conducted on farm size and productivity in smallholder agriculture (by Andrew Dorward,1999),Customary Land Tenure, Taxes and Service Delivery in Rural Malawi(Cross,2002), and very few focusing on the land market; such as study by Gondwe I., and Moyo (2008): under "Factors influencing sales and renting out traditional land where customary laws normally have regulated land transactions", which is concerned on the probability of renting and selling land based on cross sectional data. The study by Smette (2008)-Renting of Land in two villages using data from 30 households based on qualitative approach, and the study by Lunduka et al., (2006) under "Land Rental Market Participation and Tenure Security in Malawi" is worth reviewing.

Among these the study by Lunduka, shows that husband in matrilocal residence will have only user rights to land, which are gained at marriage, and wife in a patrilocal residence have only user rights while the husband has extra rights such as to sell, subdivide, rent out and borrow land. In the study, the security variable is found to determine land market

participation only in the matrilineal areas and thus is not more important factor for renting out. i.e., households in patrilocal rent in more land than matrilocal households. Further, it has declared that number of female labor force is positively related to renting in decision which is a reflection of imperfection in the labor market, and the land exchange in the country is from land rich to land poor (Lunduka et al.,2006).

This study, using the same households for data source during 2008/2009 survey, is focused on identifying determinants of land market participation and its welfare implication on the participants through food security variable. We emphasized less on the security variable in our analysis. We verify that this study is different in its content and objectives from those reviews. We are also not aware of any more studies so far in Malawi with the same objectives, and therefore, claim that this paper is our original output by its nature.

3.2 Conceptual Framework

Developments of land markets are related to rapidly changing deriving forces such as population pressure and commercialization, to policy reforms and incentives, and to conditioning factors such as land distribution, agro-ecology, customary tenure institutions and cultural norms. Our general theoretical framework illustrated in fig 2.1 is adopted from Holden et al., (2009, pp.21). Non-land factors of production are important in households' decisions to adjust the desired size for cultivation to meet household consumption demand. The development of other markets also has a major influence on the land market, as they may be able to substitute, at least to a degree for land markets (*ibid.* 2009). For instance, Market activities in output, factors and insurance markets influence the development of the land market and the decision of participation in the form of share cropping, fixed rental or sales market.
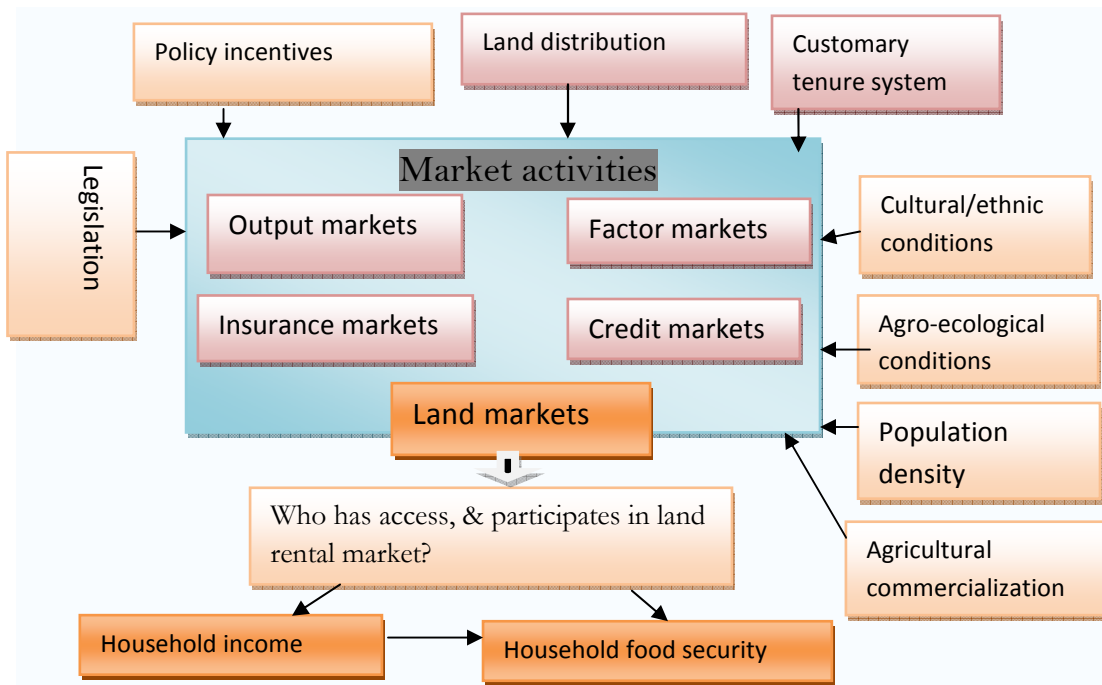
Figure 2.1. Theoretical Framework

Therefore, based on the above general framework, we have developed an interdependent linkages of household desired cultivated area (DCA), given own farm size, to food production as follows;
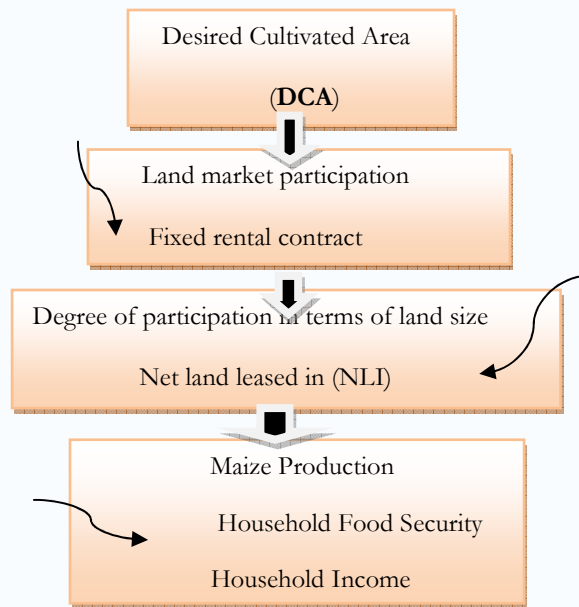
Figure 2.2 Representative Framework for Malawi; where fixed rental dominates and maize is staple food.

In Malawi, smallholder farmers face food insecurity due to several factors. These include erratic rainfall, degraded and marginal soils, high agricultural input prices, less efficient credit markets and lack of enough farming land. Low per-capital land holdings in highly populated areas of Malawi make food security policies hard to achieve (Greenwell, 2007). Figure 2.2 depicts those households with various non-land resource endowments motivated to adjust their DCA through fixed rental market. The degree of participation in terms of the rented size is expected to affect the participants' welfare through increasing their operational holding and hence crop (maize) yield. The thin arrows indicate some exogenous factors affecting households' sequential decisions at each stage.

3.3 Theoretical Model

This paper examined the land rental market participation of households based on the theoretical model developed by Bliss and Stern (1982) and Skoufias (1995) that focused on the extent to which land rented in or out by households adjusts to ensure that operational land holding is adjusted towards the desired land area. Bliss and Stern(1982) studied the land rental market in Planpur village in India using a theoretical model to assess whether the land adjustment in the rental market was complete(desired) or less than desired due to transaction cost in the market. The model by Bliss and Stern (1982) depict that the rationale of land rental (leasing) can be explained by imperfections in the rural labor and credit markets. These imperfections arise from indivisibility of labor, lack of off-farm opportunities and credit constraints in the agricultural sector.

We found this model important as a theoretical baseline in order to identify factors determining the land market operation for adjusting the DCA in imperfect non land market situations among rural households. Assuming the absence of transaction cost in the household rental market, the household obtains the notional demand for net land leased in, A^*. However, in the presence of transaction cost the amount leased in would amount to A. The functional relationship is specified as (i) $A = h(A^*)$; h is the adjustment function which is affected by the presence of transaction cost. Given that A^* is unobservable, it is assumed that households have a desired cultivated area (DCA) which is associated to agricultural ability, i.e., family labor $((\overline{L})$, non land assets (A^{no}) and own land $(\overline{A})$ size. DCA is increasing in both $\overline{L}$ and A^{no} (real value and tropical livestock units). From this hence, we can construct an

hypothesis that better off households (in assets and surplus labor relative to their land size) would choose to rent in land and may produce more output that would influence their food reserve and agricultural income, while households poor in assets but own more land relative to their labor capacity would rent out their excess land that they could not self-cultivate.

Expression of the relationship is given as follows;

$$(ii) \quad A^i = DCA - land \quad endowment \quad (\overline{A}) = f(\overline{L}, A^{no}) - \overline{A}$$

$$= land\ leased\ in\text{-}\ land\ leased\ out = NLI$$

DCA can depend on other variables aside from labor and other household assets. Like off-farm employment, and household characteristics (age, education, sex) and agro-ecological factors. Combining (i) and (ii) using first order Taylor series expansion yields the linear equation (iii):

$$(iii)\ A_i^i = c_o + h'f_1\overline{L}i + h'f_2 A_i^{no} - h'\overline{A_i} = c_o + c_1\overline{L_i} + c_2 A_i^{no} + c_3\overline{A_i}$$

Where c_o=constant term, $h' = \partial h / \partial A^*$, the slope of adjustment function.

And, $f_1 = \dfrac{\partial f}{\partial Ai^{no}}$ and $f_2 = \dfrac{\partial f}{\partial \overline{L}i}$, which imply marginal change in adjustment(DCA) with respect to labor and other household assets.

If adjustment is done perfectly, the coefficient of own land $(\overline{A})$ is equal to one. i.e., if $h'=1 or c_3 = -1$, the actual cultivated area, A is equal to the DCA and the transactional costs in the land rental market are insignificant. On the other hand, if it is significantly different from -1, it is a sign of significant non-linear transaction costs. This theoretical postulate is based on the assumption that both sides of the market are opted to adjust operational holding relative to their non land farm inputs. However, this may not hold particularly from the landlord side in case when land rental is made in response to shocks in the absence of substitutes like credit and insurance markets. Table1.7 highlights this facts. In such situations, household do rent out not for resource adjustment rather to overcome immediate cash

requirements under fixed contract arrangement with more likely lower bargaining power to wards actual rental value.

Hypothesis

H$_1$. Female headed households rent out while male headed households rent in farm land in rural Malawi.

This is with best guess that female headed households face short of family labor, have less access to credits for immediate cash needs due to poor social relations, and vulnerable to diseases to self cultivate the land relative to male headed households.

H$_2$. Old aged household heads rent out land while young heads rent in land in rural Malawi.

This is with a proposition that the old aged are economically inactive-physically unable to work, and are in poor health condition for cultivating as compared to the young physically fit heads and therefore rent out their land.

H$_3$. There exist stronger reverse tenancy contract in rural households of Malawi.

The hypothesis is developed with a presumption that non land resource rich households are better off to employ/purchase farm inputs in order to cultivate extra land than their counter parts who are capital constrained to do so. Hence, land rental direction is from land rich but asset poor to wealthier households.

H$_4$.Distress contracts take place for poor landlords with poor bargaining power and lead to less favorable contracts.

This is the fact that in the absence /or poorly functioning credit markets and off farm businesses, the means to overcome cash constraint is through selling/ renting out of household assets. Landlords are poor in non-land assets and they therefore as last resort rent out their land for immediate cash needs that undermine their bargaining power in determining the rental price of land.

H$_5$. Land renting improves household food security in rural households of Malawi.

We have constructed this hypothesis from the fact that in the land scarce areas (southern followed by central regions of the country), poverty and subsequent food insecurity are most

severe. Typically, the most vulnerable households have less than 1 Ha of land to cultivate. Therefore, rental participation would give an opportunity to increase operational holding for the tenants, and purchasing power of landlords that would improve their production and food security.

H_1 and H_2 were tested in the tenant and landlord participation and degree of participation using binary probit and censored tobit (under 4.3.1 and 4.3.2) models respectively. Hypothesis (H_3) is tested using household assets (real asset values deflated using 2006 price, tropical livestock units and family labor) as proxies for wealth in the two models. It was found that these variables are positive and significant in tenant model but negative and significant in the landlord model. This shows that land rent transfer land from poorer households to wealthier households. H_4 was tested using descriptive analysis on the frequency of household ill-health status, and using the variable (timeill) as health shock indicator in the landlord model. Reason for renting out (dummy) in the estimation of rental revenue model was also useful to test this hypothesis.

The 'timeill' variable is found to be positive and significant in the landlord model implying that landlords' decision to fixed rental is to substitute for capital constraint at the time of health shocks, whereas the reason dummy variable was negative and significant in the rental revenue estimation. This implies the existence of strong distress rental results in weak bargaining power of landlords at the time of shocks. The fifth (H_5) hypothesis was tested in the food security treatment effect model constructed using the predicted values of the rental participation as independent variable. We have controlled agro-ecological and demographic factors (by region/district dummies), soil characteristics, and household characteristics that are directly associated to marketed maize surplus in the model. The predicted participation variable was positive and significant in the tenant model but insignificant in the landlord model.

4. DATA AND METHODS

4.1 Data Source for the Study

The data used in this paper is collected in June and July, 2009 from six districts: Thyolo, Chiradzulu, Zomba, and Machinga, in the southern region and Lilongwe and Kasungu in the central region of Malawi (map in appendix 3). These districts were purposively selected to capture vital land market issues in Malawi. Thyolo and Chiradzulu were selected because they are the most populated districts in Malawi. They have the highest rural population's density of 343 and 379 people per square kilometer respectively. The average population density for the southern region is 185 people per square kilometer (National Statistical Office, 2008). Zomba and Machinga are in the south but not as populate so were selected to represent the medium density. These four districts are all in the matrilineal land inheritance society. The central region districts of Lilongwe and Kasungu are in patrilineal land inheritance society and were selected because of close proximity to the city for the case of Lilongwe hence easy market for farmers and large land sizes and estates for the case of Kasungu. These are also relatively low density as compared to the southern region districts.

The primary sampling units (PSU) were the Enumeration areas (EAs) following the integrated household survey of 2004 by the National Statistical Office, Malawi. In each EA, 30 households were randomly selected giving a total of 450 households. Appendix- 1 shows the districts and the main villages in the EAs selected for the study, and appendix-2 shows the study sites.

In 2008/2009 growing season household surveys were conducted in the six districts. These were done at the end of agricultural seasons in June and July. Two data collection methods were used. First, focus group discussions were conducted with randomly selected groups in each of the enumeration areas. This saved to gather information related to land rights, land market, and maize production and reserves. The second method was a detailed questionnaire which was administered to the 450 households on household and plots information. A plot was defined based on major crop grown. Physical measurement of the plot size was done using Geographical Positioning System (GPS) equipment. The variables on which data collection was concerned are shown in appendix-2.

4.2 Econometric Estimation Concerns

We have derived our different estimation models from the theoretical model discussed in section 3.3. Considering additional variable in to equation (iii) in section 3.3, the general reduced linear model for land rental market (net land leased) can be formulated as:

(iv) $A^i{}_i = c_o + c_1 \overline{L} i + c_2 A_i{}^{no} - c_3 \overline{A}_i + c_4 R + c_5 S_i + c_6 Z_i{}^h + \eta_i$

Where, subscript i-represents individual household, c_o-constant, $\overline{L}$ –family labor force, A^{no} - non land resources (livestock units and household assets), $\overline{A}$ -Own farm size (Ha), R- agro-ecology (regional/district level), S_i-plot characteristics and Z^h- household characteristics (age, sex, education), η_i =the error term. This expression can be reformulated for participation and degree of participation as discussed below.

Assuming that household decision is sequential, in order to answer questions Q_1, Q_2 and test hypothesis H_1, H_2, H_3 and H_4, we have established two subsequent models as follows:

4.3.1 Participation Model-Binary Probit

Binary Probit (latent) model in the manner discussed in (Green, 2003) is built for land market participation as:

$A^i* = \beta_o +_i \beta_i X_i + \xi_i$

Where, β_o is constant, β's are coefficients, X is vector of explanatory variables, ξ_i is the random disturbance term. The probability model for participation is described as;

$A^i = \begin{cases} 1 \text{ if } A^{i*} > 0, & \text{Participating as Tenant or Landlord} \\ 0 \text{ if } A^{i*} <= 0, & \text{No Participation either as tenant or landlord} \end{cases}$

We have estimated the model for both tenants and landlords separately against the non participants. The log-likelihood function and its derivation can be obtained and optimization can be done based on Green (Green, 2003; pp.689). The explanatory variables used in each model (presented in appendix-2) include; family labor (male, female), plot characteristics (fertility, slope, soil type), household characteristics (age, sex, education, health status), household deflated asset values (2006 as base year), tropical livestock units, agro-ecological zones (region/district dummies), and own farm size ($\overline{A}$).

4.3.2 How much to participate?-Degree of Participation

The degree of participation in terms of NLI would help to understand the extent of adjustment subsequent to participation decision. This variable is considered as positive for tenants but negative for landlord households. Referring to Wooldridge (2009, 481-493), we have derived Censored Tobit model from equation (iv) and its set up as follows:

$$A^i_i = \max(0, c_o + c_1\overline{L}_i + c_2 A^{no} + c_4 R^s + c_5 S_i + c6Z^h - c_3\overline{A}_i + \eta_i)$$
$$\overline{L}, A^{no}$$

Assuming $\eta_i \mid \overline{L}_i, R, A^{no}, Z^h, \overline{A}_i \sim iid(0, \sigma^2)$

Unlike Linear Probability Model, Probit model results in non-negative predicted value for the dependent variable and have sensible partial effects for the range of explanatory variables (Madalla, 1983). That is why tobit (censored) model is preferred for this estimation.

4.3.3 Food Security Model

The relationship between land rental participation and the household marketed maize surplus was derived through input-output function. Since rental participation is endogenous, we have treated their predicted value in the model. Under this, treatment effect model was used to answer the underlined research question (Q_3) and test the hypothesis (H_5) in the paper. Our food security equation is inferred from the conceptual framework with the fact that smallholder subsistence producers are induced to adjust land size through renting in or out plots to meet their cereal requirements, and smooth their consumption as presented in chart (2.1 & 2.2).

Functionally,

$$Q = f(\overline{L}_i, Ai)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(a)$$

$$Ai = A^i_i + \overline{A}_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (b)$$

$A^i_i = (\overline{L}, A^{no}) \Rightarrow$ rental participation is function of labor and other non land factors.

$\rightarrow Ai = A^i(\overline{L}, A_i^{no}) + \overline{A}_i \Rightarrow$ Operational holding (Ai) is the sum of rented land (A^i) & own land ($\overline{A}$).

Therefore, the quantity of maize produced is described as;

$Q_i = f(\overline{L}_i, \gamma_i(\overline{L}_i, A_i^{no}) + \overline{A}_i)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(c)$

Given household consumption level (C_i) is determined by the household characteristics and composition; by including some factors in to the output function (Q_i), the marketed maize surplus *(K)* model can be represented by:

$$K_i = Q_i\{\overline{L}, \gamma_i(\overline{L}, A^{no}) + \overline{A}, R^s, Z^h, P^d, S\} - C_i(Z^h)$$

Assuming households are provoked to optimize their marketed surplus upon land rental participation, we maximize the positive K_i function with respect to land rental participation as follows;

$$\max_{A_i} \quad K_i = (\partial Q/\partial A)(\partial A/\partial A^i)$$

where , $\partial A^i = \partial \gamma_i / \partial \overline{L}_i + \partial \gamma_i / \partial A^{no}$; A^{no} *is (real value of assets & tropical livestock)*

The right hand side components are assumed positive for the tenants but negative for the landlords.

This description is that the rental participation is affected by household labor (female, male) and asset endowments. The change in quantity produced (Q_i) due to change in operational holding (A_i) through land rental participation (A^i) can be as a result of labor and non-labor endowment (livestock units, real value of assets).

K_i, can be positive, zero or negative, ($Ki >= <0$), that characterizes the household as net seller, self sufficient, or net buyer of food respectively (see table1.8).

Its Econometric Estimation set up is;

(v) $K_i = \phi_o + X_i\phi_i + \hat{A}^i_i + \varepsilon_i$

With an assumption that the error terms are normally distributed i.e. $\varepsilon_i \sim i.i.d.N(0, \sigma^2)$.

where ; K_i = *marketed maize surplus (gross production* − *consumption level)*
Xi = *vector of household characteristics and other* var *iables*
$\hat{A}^i_i$ = *the predicted value of participation . This is a* var *iable* det *er* min *ed in the rental* mod *el and is our treatment* var *iable for land market participation across households .*
The mod *el is treatment effect* mod *el where the treatment function is done manually .*

5. RESULTS AND DISCUSSION

5.1 Descriptive Analysis

5.1.1 Household Characteristics

From the total land market participants, 84% of the tenants and 78% of the landlords are male headed. Their age statistics shows that tenants are younger (96%) relative to landlords of whom 20% carved up in the old age. The average household size is about 6 for the tenants and 5 for the landlords. The education level varies across the participants. The years in school of the household heads, on average, is 6 and 4.4 for the tenants and the landlords respectively. The resource endowments vary among tenants, landlords and non participants. It is reported (inTable1) that tenants own less land (0.82Ha) than the landlords (1.3Ha) and non participants (1.25Ha) both in its physical size and relative to family labor. 59.8% tenants own less than average (0.82 Ha) land size. However, 38% of landlords own more than average (1.3Ha).

Table1.1. Household characteristics and Socio-economic variables

Characteristics	Tenants	Landlords	Non Participants
Old aged number (Age year>=65 (%)	4	20	16
Male headed households in (%)	83.9	78.3	76.8
Male Labor in Adult Equivalent	1.97(0.97)	1.65(0.97)	1.74(1.05)
Female Labor Force in Adult Equivalent	1.43(0.73)	1.38(0.78)	1.45(0.76)
Family Size	5.76(1.89)	5.16(2.13)	5.45(2.04)
Number of Children	2.8(1.50)	2.4(1.51)	2.7(1.63)
School years	5.95(3.41)	4.4(3.9)	5.28(4.02)
Own land size(Ha)	0.82(0.65)	1.3(0.84)	1.25(1.3)
Real value of Assets (in 1000MKw)	6.3(16.4)	2.8(4.7)	3.9(11.5)
Tropical livestock units(mean)	2.22(2.67)	1.12(1.84)	1.56(2.7)
Net Land Leased (in Ha)	0.37(0.34)	0.35(0.42)	0
Without land (%)	6.8	Min(0.12Ha)	min(0.034)
Member of household fall ill in 2009(%)	11.86	20	23.7
Mean maize productivity(in kg)	1210.4(1152.6)	432.7(350)	768.1
Maize productivity Per Hectare	2250.3	650	1131.7

Note: The bracket values represent the standard errors

Source: Own Calculation from 2009 survey

Likewise, 6.8% of the tenants were landless where as the minimum land holding size of the land lords is 0.12Ha. It is also noticeable that tenants are found to be 1600 kg more maize productive per hectare than the landlords on their own land. This implies that land is transferred to more efficient /or productive farmers.

Table1.2. Main Occupation of Land Market Participants

Occupation	Tenants (%)	Landlords (%)
Without Occupation	0	3.33
Farming	82.2	85
Business	4.24	6.67
Ganyu labor	3.39	1.67
Salaried worker	8.47	3.33
Schooling	0.85	0
Others	0.85	0
total(118,60)	100	100

Source: Own Calculation from 2009 survey

The major occupation of both tenants (82.2%) and landlords (85%) is farming (table1.3). Apart from this, tenants are participating in other income generating activities such as business, Ganyu[7] labor and salaried jobs which may give them an opportunity to access fund for financing rented in land on fixed contract. This can substitute operational capital for rental participation that could either be accessed if credit market had been functioning. We found that 3.3% of the landlords were without any occupation, who might be the old aged and living on the rental revenue from leasing out their farm land or else dependent due to physical disability. Full time Schooling occupation is very few (0.85%) which would have affected tenancy negatively.

5.1.2 Land Market and Household Resource Variation across Districts

In the table below, own land size (ownland), (NLI), tropical livestock units(tlunits), household labor (hhlabour) total maize produce in 2009 (totmaizpro09), and real value of assets(realvalue) on average are reported from six districts for comparative assessment of those variables among tenants, landlords, and non participants. This also helps to extract, on the basis of these variables, whether the nonparticipants would have equally likely to participate on either side of the market but are rationed out because of intolerable transaction

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[7] Chichewa word for short term agricultural piece work contract either for food or for cash

costs. Standing on simple statistical tests by constructing confidence interval for each variable, we could identify the resource variation among households across districts.

For instance, in Thyolo district, landlords are richer in land. Where, average tropical livestock units, real asset values, and household labor are significantly greater for the tenants as compared to both landlords and non participants. Non participants were poor in land and household labor relative to both tenants and landlords. But they are found to be rich in livestock and asset values relative to landlords. In Zomba district, tenants were wealthier in labor, asset values, and tropical livestock units but poorer in land than nonparticipants. Tenants in Machinga district owned significantly more land and non land (livestock, real assets, and household labor) resources. But still some tenancy is taking place that could be for non land resource adjustment.

Further, in Kasungu-Central region, both landlords and non participants hold a greater and significant land size than tenants. However; tenants enjoy significantly higher labor and livestock units relative to landlords and non participants. Furthermore, in Lilongwe (central), non participants have significantly higher farm size while tenants enjoy more household labor. Consequently, it is perceived that non participants were expected to participate in either side of the market, especially in Zomba (poor in non land), and Lilongwe(less labor) districts as landlords with regards to their land size. Net land leased size (NLI) varies across districts. This might be due to the variation in the land endowments and non land resources that limit the leased land size.

Table1.3. land market and resource endowment variation across districts among households

District	Variable	Tenants Mean	N	se(mean)	Nonparticipants Mean	N	se(mean)	Land lords mean	N	se(mean)
Southern										
Thyolo	Own land size(Ha)	0.51	17	0.17	0.64	126	0.05	0.94	5	0.24
	Net Land leased	0.16	17	0.037	0	126	0	-0.15	5	0.03
	Rent in land(1=yes0=no)	1	17	0	0	126	0	1	5	0
	Tropical livestock unit	1.21	17	0.23	0.78	123	0.07	0.57	5	0.37
	Household labor adult equiva.	3.45	17	0.33	2.9	126	0.11	3.3	5	0.32
	Total maize produce in 09	1135.3	17	207.1	978.5	126	111.5	496	5	127.1
	Real valued Asset(1000Mkw)	11.5	17	8.45	5.02	126	1.98	1.21	5	0.74
Zomba	Own land size(Ha)	0.79	25	0.14	0.89	204	0.037	0.83	10	0.12
	Net Land leased(Ha)	0.57	25	0.1	0	214	0	-0.22	10	0.045
	Rent in land(1=yes0=no)	1	26	0	0	214	0	1	10	0
	Tropical livestock unit	1.95	26	0.37	1.28	210	0.1	0.67	10	0.14
	Household labor adult equiva.	3.01	26	0.2	2.98	210	0.09	2.49	10	0.43
	Total maize produce in 09	1835.4	13	461.9	752.4	136	95.76	202	5	31.7
	Real valued Asset(1000Mkw)	4.89	26	0.9	2.82	210	0.41	1.65	10	0.97
Chiradzulu	Own land size(Ha)	0.67	11	0.13	0.76	94	0.045	0.42	1	.
	Net Land leased(Ha)	0.18	11	0.03	0	98	0	-0.32	1	.
	Rent in land (1=yes0=no)	1	11	0	0	98	0	1	1	.
	Tropical livestock unit	2.1	10	0.53	1.2	88	0.13	0.59	1	.
	Household labor	3.91	11	0.42	3.23	94	0.14	2.8	1	.
	Total maize produce in 09	960.5	11	180.9	575.9	94	43.17	400	1	.
	Real valued Asset(1000Mkw)	0	11	0	0	94	0	0	1	.
Machinga	Own land size(Ha)	0.69	13	0.21	1.25	132	0.05	1.32	13	0.15
	Net Land leased(Ha)	0.35	13	0.065	0	132	0	-0.40	13	0.09
	Rent in land(1=yes0=no)	1	13	0	0	132	0	1	13	0
	Tropical livestock unit	2.16	13	0.99	1.87	132	0.24	1.51	13	0.76
	Household labor	3.63	13	0.43	3.2	132	0.13	2.8	13	0.36
	Total maize produce in 09	350	6	108.8	547.2	73	65.3	337.8	9	95
	Real valued Asset(1000Mkw)	3.23	13	2.65	2.85	132	0.56	2.29	13	1.02
Central										
Kasungu	Own land size(Ha)	1.13	27	0.10	2.08	294	0.12	1.78	20	0.24
	Net Land leased(Ha)	0.42	27	0.06	0	297	0	-0.37	20	0.098
	Rent in(1=yes0=no)	1	27	0	0	297	0	1	20	0
	Tropical livestock unit	3.6	27	0.72	2.28	293	0.24	1.33	20	0.41
	Household labor	3.53	27	0.3	3.58	297	0.09	3.63	20	0.34
	totmaizproduce09	.	0	.	.	0	.	.	0	.
	Real valued Asset(1000Mkw)	7.54	27	1.74	5.27	297	0.64	4.97	20	1.46
Lilongwe	Own land size(Ha)	0.86	24	0.13	1.043	161	0.05	0.92	11	0.2
	Net Land leased(Ha)	0.32	24	0.05	0	161	0	-0.45	11	0.07
	Rent in(1=yes0=no)	1	24	0	0	161	0	1	11	0
	Tropical livestock unit	1.77	24	0.44	1.46	161	0.16	0.98	11	0.56
	Household labor	3.27	24	0.2	3.05	161	0.08	2.6	11	0.29
	totmaizproduce09	1254.6	24	247.2	747.4	160	63.22	605	10	145.38
	Real valued Asset(1000Mkw)	7.45	24	3.66	5.76	161	1.03	1.29	11	0.85

The assessment of district distribution and concentration of land market in order to describe the cultural, geographical and demographic pressure related to land rights on market participation decision is indicated in table1.4 below. It was found that 22.3% are tenants renting in while 14.6% are landlords over all districts. 10% of the sampled plots are either rented in or out over the survey areas. District wise, We found more tenants in

Kasungu(23%) followed by Zomba(22%). The disparity is may be fear of relevant consequences in some areas of Malawi where renting out land is the signal that the owner need no more the land and unable to cultivate (socially tied to poverty).

Table1.4. Land market Participants Across six Districts of Malawi form Plot Level Data

Participants (%)	Tyolo	Zomba	Chiradzulu	Machinga	Kasungu	Lilongwe	Total
Tenants(%samples)	11.7	10.2	9.7	8.1	7.9	11.9	9.64
Tenants(of 118)	14.4	22	9.3	11	22.9	20.3	100
Landlord(%samples)	3.4	3.9	0.9	8.1	6	5.9	4.95
Landlords(out of 60)	8.3	16.7	1.7	21.7	33.3	18.3	100

Source: Own calculation from 2009 survey

More landlords are located in Kasungu (33%) followed by Machinga (22%). Region wise, central part (Lilongwe and kasungu) accounts for about 52% of the landlords while the southern region accounts for higher percentage of the tenants (57%). Hence we can deduce that renting out is more in the central region and renting in is higher in the southern region. This is due to the fact that central region is characterized by better infrastructure and less population density where as the southern is populate and hence high pressure on farm land in which renting out is not feasible to them. Moreover, the land tenure security issue related to the inheritance and control over land system in the two regions contribute to the extent of land market participation.

Rental participation also varies in the household residential places within each district. Table below presents the distribution of participants with residence.

Table1.5. Distribution of Participants with respect to their residence across Districts.

District	Matrilocal		Patrilocal		Neolocal		Total	
	Tenants	Landlord	Tenant	Landlord	Tenant	Landlord	Tenant	Landlord
Tyolo	14	2	3	2	0	1	17	5
Zomba	16	6	9	3	1	0	26	9
Chiradzulu	10	1	1	0	0	0	11	1
Machinga	4	10	3	3	6	0	13	13
Kasungu	3	4	23	16	0	0	26	20
Lilongwe	11	3	13	9	0	0	24	11
Total	58	25	52	33	7	1	117	59

Renting out is more common in patrilocal society, where around 56% of the landlords are located. This is related to the fact that land belongs to the husband side and gives confidence on the security of the plots in renting out as compared to the matrilineal system of land possession. Renting in land is denser in Southern region (57.3%) for couples residing in the wife's village (75.9%) as compared to the central region which accounts for 42.6% of the tenants and 69.2% from Patrilocal village. Whereas the renting out is higher in the Central region (52.5%) for the couples living in the husband's village (75.8%).

Table1.6. Land Market Contracts in Malawi in 2008/2009 Season

Contract Type	Percent(%) of Total Plots
Fixed Rent	9.5
Sales	1.86
Share Cropping	0.32
Borrowing	2.1
Total	**13.78**

Calculated from 2009 survey in Malawi

From the 1237 total plots surveyed, we found 9.5% of the plots are in fixed rental market, and 2.1% are borrowed. The kind of rental contract next to fixed rent and borrowing types is the land sales market (1.9%). This verifies that the land sales market is the second best option to fixed rental in exchange for cash. However, sales market data was difficult to obtain as it is highly associated with risk of losing land due to the fact that selling land is strictly forbidden.
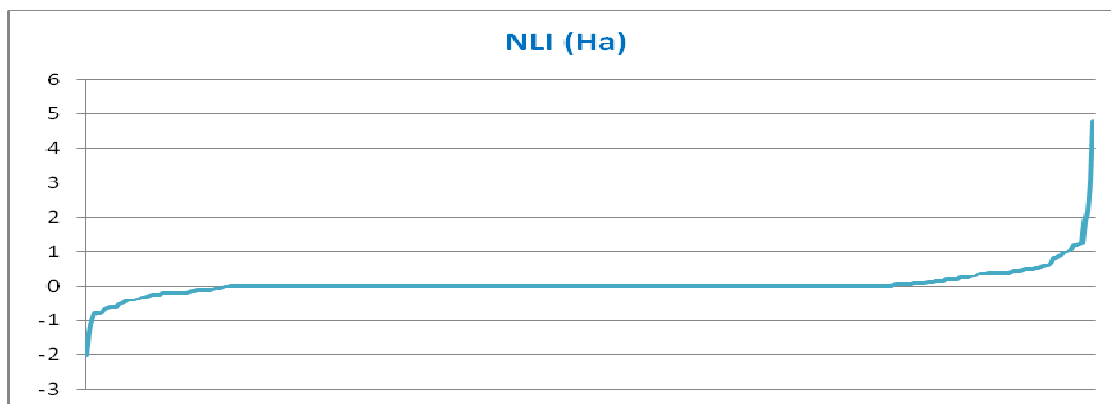

Figure 1. Ranked households by Net Land Leased (NLI) =Net leased in- Net leased out

NLI (net land leased) is negative for the landlords, zero for the non-participants and positive for the tenants. Households are ordered by the size of NLI, illustrating the relative size of the three categories of households relative to the land size rented in or out. The horizontal part of NLI represents smallholders rationed out (higher transaction costs) or unwilling (already have enough land) to participate in the market. This is an indicative to categorize households in to tenants, non participants and landlords. The fraction of landlords' is less than the tenants' and far more less than non participants. This may demonstrate how insecure it is to describe oneself as landlord than tenant.
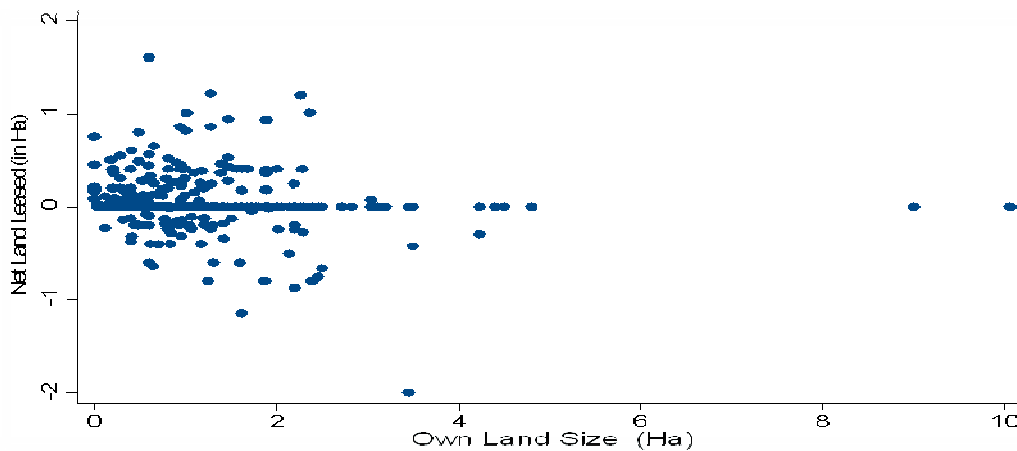
Figure 2. The Net Land leased Vs. Own Land Size.

NLI for the tenants is positive and concentrated at a lower own land size. This points out that the smaller own land size derives to rent in land and higher land ownership forces landlords to rent out. i.e., the negative NLI increases as the own land size rises along the x-axis as can be observed from the downward sloping scatter plots. This may also indicate that there are no economies of scale due to lumpiness of some inputs. 'This is may be due to hoe-based cultivation' in Malawi (Lunduka. et al, 2006). One can observe that land less/land poor households could access land through rental market. The land rental market to some extent reallocates land from land-rich to land poor households leading to more egalitarian land distribution. Landless households are located vertically perpendicular to the zero value.

The leasing contract among households is on temporary basis, which on average, is less than two seasons. The contract would not be renewed among 54% of the participants (Table1.7). This can probably be due to the case that renting land for more seasons is a signal

26

for excess ownership of land and probably no more interest to the holding and/or poor for self cultivation of the land (FGD report). This can also build threat of encroachment by the village chief and relocate to landless houses. For that doubt, the contract is mostly hidden in which the two parties agree to exchange with no consent of the village chief. Yet, the owner may also need for self cultivation afterwards. Some reviews describe that under secured property right over the land, contract duration is being increasing based on the reputation and trust build over time between the two parties. This, however, has no absolvent implication in the case of Malawi where land is under customary tenure system and smallholder farmers have user rights but deprived of it when comes to its transaction end.

Table1.7. Tenant's perception of land rental contract renewal status.

Contract Renewal	Tenants (%)
Yes (renew)	32.8
No (terminate)	53.5
may be (not yet sure)	12.9
Others	0.9
total(116)	100

Note: Tenants were asked in June/July 2009 (after harvest)

Only 33% of the parties would renew the agreement which mainly is towards its second season. However, few of the same participants may stay in market for more than average seasons. Unlike sales, rental market increases access to land for the landless maintaining the owner's property right. This is worth analyzing in this country where share cropping is very rare that would have relieved household resource constraints where land holding is more squashed.

The next question we need to answer was 'why households enter into fixed rental contracts?' The rationale for land rental participation by households in the country varies among the participants. It was identified (Table1.8) that the majority of the tenants (76%) have acknowledged that undersized own land relative to other inputs escorted them to the market in order to increase their operational holdings. Majority of the leased in plots were used for maize cultivation (figure3), while only 15% of tenants rented land to grow cash crops.

Table1.8. Reasons for land market participation

Reasons	Tenants (%)	Reasons	Landlords (%)
Increase land	76.1	Cash need	21.1
Grow cash crop	14.5	Assist other	38.6
Others	9.4	Has excess land	28.1
		Others	12.3

Source: Own calculation from 2009 survey

One can examine that 60% of landlords seem to rent out land for immediate cash needs that either goes for assistance or home spending. 28% of the landlords reported that they have excess land that they could rent out. Tenants had paid fixed rent of 30322Mk per hectare on average for most plots they transacted, and average rental return was 7740Mkw per hectare for landlords. The per hectare value varies among districts and even villages due to, given other factors, differences in land characteristics, location and bargaining power of the partners that may depend on the instance of cash need.

Figure3 indicates the percentage of crops surveyed on the rented in plots. The plot level information provides that most rented in plots were maize fields that the harvest would be for home consumption followed by ground nuts.

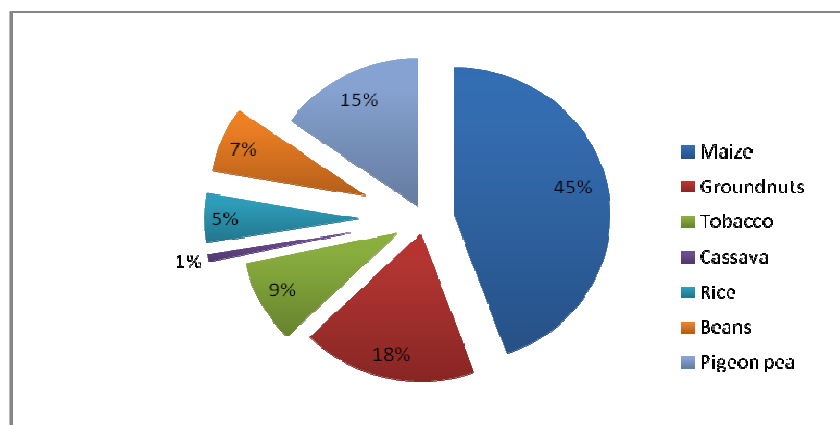**Figure 3.** Crops Grown by Households on Rented in Land

The figure illustrates that Maize production dominates the rural sector of Malawi. Our analysis is depending on this stable food predominantly produced by small holder farmers in Malawi. Marketed maize surplus (K_i) is used as an indicator of household food security. Households' production level is affected by land size, other inputs use and agro-ecological

factors. Based on the amount of harvest over the consumption demand, we could distinguish that most tenants were excess maize suppliers over their consumption demand.

Table1.9. Marketed Maize Surplus of Participants

	Participants	
Household maize surplus Status	**Tenants (%)**	**Landlords (%)**
Food Deficit	36.6	66.7
Self Sufficient	15.5	10
Net Seller	48.9	23.3
Total	100	100

Source: own calculation from 2009 survey

The marketed surplus (48.9%) households are assumed to be net sellers that might be due to their productive capacity on own and leased in land. Households utilize their non land resources to cultivate their operational holdings through rental market. They are, however, constrained by input and credit markets that cushion their productivity. We found that tenants are more productive than landlords on their own land. This may help to produce surplus output and remain food secure all through the year. On the other hand, landlords enter in to the land market for low competence in non land resources that would have been employed for self cultivation and/or serve instead of capital markets, and hence decide to rent out that would otherwise more likely be fallowed. If credit and other input markets had operated well, smallholders could better utilize their plots and smooth household consumption demand. It is thus described that 64% tenants are surplus producers of maize and self-sufficient in the rural households of Malawi.

5.2 Econometric Estimation Results

5.2.1 Factors Associated to Land Market Participation and Degree of Participation

5.2.1.1 Land Market Participation

The likelihood of participation in the land market is derived by the desire to adjust operational holding against own land size and other inputs. We have presented factors associated to the probability of renting in (in table.2.1) and renting out land (in table 2.2) below. It was identified in table2.1 that resource endowments in terms of total tropical livestock units and real asset values (each significant at 1% level) increase the probability of

renting in land. This is in line with our hypothesis (H₃) that strong reverse tenancy contract holds in Malawi, whereas own land size significantly (1% level) reduces the probability of renting in farm land. Hence, albeit different, tenants are found to be those relatively rich in non-land resources and socially better off but poor in land endowment and decide to adjust it. Higher number of dependents in terms of consumer-worker ratio significantly (at 5% level) reduces the likelihood of leasing in land. Furthermore, older households (statistically significant at 1%) are less likely to rent in land. This is because they may not be able to manage excess land for cultivation up on renting in. This finding is in line with our hypothesis (H₂) that older households are less likely to rent in land. But the variable is not significant in the landlord model.

Table2.1. Probability Estimates of Renting in Land: Tobit Regression Result

Variables	Coefficient	Robust Std. Err.
Age of household head	-0.017***	0.005
School Years Household Head	-0.006	0.021
Number of times family fall ill	0.044	0.102
Sex of household head (1=female,0=male)	0.118	0.200
Male family labour	0.14*	0.083
Female family labour	0.03	0.106
Consumer worker ratio	-0.725**	0.356
Real value of assets	0.00002***	5.73E-06
Tropical livestock units	0.19***	0.044
Own land size(Ha)	-0.53***	0.000013
Region dummy(1= south,0=central)	-0.111	0.162
Constant	0.854	0.638
Numb.obs=366	Wald chi2=46.3	
Pseudo R²=0.12	Log likelihood=-172.9	Prob>chi2=0.000

Significance level:***1%, **5%, *10%

On the other hand, landlords seem richer in land with relatively more number of plots, but less in labor endowment (discussed in table1.1 & 1.2). Own land size significantly (at 10% level) increases the rent out decision. Besides, they are also characterized by old age, poor in livestock units, and household assets. The other variable of interest in the landlord model is ill-health condition of household members. It is positive and significantly (at 1% level) increases the chance of renting out land (table2.2).

It was also described that landlords had faced frequent family health shocks that required and consumed most of their agricultural labor, and hence drive to rent out farm land. Moreover,

health shock does push households to distress rental to retrieve immediate shortages in cash (handling capital). This is in order to cover hospital bills, given lack of insurance and poor functioning credit markets in the rural sector. This is hence in line with our hypothesis (H4) that households enter in to distress fixed rental contract that affect their bargaining power in response to capital constraint at the time of shocks. Endowments in both female and male labor forces negatively and significantly (at 1% and 5% level respectively) reduce the probability of renting out land. This is mainly due to the fact that family labor is important to plow land using hand hoe for cultivation in Malawi unlike the oxen power for traction in Ethiopia. Renting out is also positively affected by the number of plots. The higher the number of plots (significant at 1%), the greater would be the renting out decision. This might be resulted from the difficulty in cultivating fragmented and distant plots that would seek time to travel to it. The regression results from the land rental market participation and extent of participation equations did not confirm the hypothesis (H₁) that female headed households rent out land relative to male counter parts.

Table2.2. Probability Estimates of Renting out land: Probit Regression

Variables	Coefficient	Robust Std. Err.
Age of household head	0.013	0.01
School Years Household Head	0.0004	0.04
Number of times family fall ill	0.408***	0.15
Household head sex(1=female,0=male)	-0.303	0.39
Male family Labour	-0.414**	0.17
Female family Labour	-1.055***	0.32
Consumer worker ratio	-1.023	0.64
Real Value of Assets(in 1000)	-0.008*	0.004
Tropical livestock units	-0.13	0.10
Own land size(Ha)	0.53*	0.26
Region dummy(1= south,0=central)	-0.79**	0.35
Number of plots owned	0.415***	0.114
Total fertilizer used in 2008	-0.002	0.002
Constant	0.59	1.27
Numb.obs=203	wald chi2=30.54	
pseudo R²=0.26	Loglikelihood=-57.76	prob>chi2=0.0039
significance level:***1%, **5%, *10%		

Households located in the Southern region are less likely to rent out land because of high land demand due to population pressure and hence lower per capital land holdings, and/or tenure insecurity in the matrilineal society for renting out land.

5.2.1.2 Degree of Participation

The degree of land market participation was estimate based on the amount of net land leased (NLI) for both tenants and landlords using censored (tobit) model set under section 4.3.2. The estimation results are reported below. Table 2.3 presents factors associated to NLI by tenants and table 2.4 NLI by landlords. We have controlled the household characteristics, ecological and demographic factors (by region and district dummies), and household non-land endowments (livestock units, real valued assets, female and male labor forces) and own farm size.

Table 2.3. Estimation of Net land leased (NLI) in by Tenants: Censored (Tobit) Regression

	District level(A1)		Regional level(A2)	
Variables	Coefficient	Standard Error	Coefficient.	Standard. Error.
Age of household head	-147.9***	57.99	-152.64****	58.66
School Years	212.36	209.35	207.88	211.06
Sex(1=female 0=male)	914.19	1960.48	1020.23	1970.92
Male Labour	2163.4***	786.54	2101.01***	785.42
Female Labour	152.87	1023.48	25.65	1025.67
Real value of assets	0.09*	0.053	0.093*	0.053
Tropical livestock unit	1958.54***	400.78	1898.64***	397.67
Own land size(Ha)	-0.46***	0.141	-0.456***	0.140
Region(1=south 0=center)			-696.99	1560.32
District Dummy				
Tyolo	-2075.86	2238.59		
Chiradzulu	-3052.11	2686.61		
Machinga	-3811.67	2597.75		
Kasungu	-1053.61	1977.53		
Constant	-4834.14	3320.67	-5200.58	3396.85
Number of Obs.		370		370
R^2		0.028		0.026
Log likelihood		-931.12		-932.74
left censored observations		291		291
Uncensored observations		79		79
Right censored observant		0		0

Statistical significance level: ***1%, **5%, *10%. Note: A1 and A2 are censored tobit with robust standard error

As can be seen under columnA_1 and A_2, the extent of participation by the tenants is mainly affected by the non land endowments that indicate the capacity to cultivate additional land. It

was found that tropical livestock units and male labor force are significantly (both at 1% level of significance) important to lease in additional units of farm land. Older households (significant at 1%) were found to rent in less land. This is in line with our hypothesis (H2) that older households do not rent in relative to their counter parts. They are rather, more likely to rent out land. The household asset possession in terms of real monetary value is important and statistically significant (10% level) for leasing in more land. Whereas, the size of own land (significant at 1% level) is found to be negatively affecting the size of land leased in. This is due to the fact that the operational land size is positively associated to non land endowments that complement for cultivating extra land. The model could help to inspect the fact that the relatively wealthier households in terms non land assets are more likely rent in land, and these factors are highly correlated to fixed rental contracts. We could distinguish that the coefficient of own land size is negative but significantly less than unity. This shows the existence of imperfect land market in the rural Malawi and hence higher transaction costs impeding the operation of the market.

On the other hand, the extent of renting out is negatively affected by more non land resource endowments (wealth indicators) and positively by the higher own land size as shown in (table 2.4). In the table, the dependent variable (net land leased) is negative and thus the parameters have to be multiplied by -1 in order to interpret the direction of factors' influence. As per the result, own land size is positively and significantly (at 1% level) affecting the net land leased out. This might be due to different reasons that are directly or indirectly associated to utilizing the land for oneself. The explicit and commonly realized reason in most developing countries is the excess land above the size that cannot be cultivated. This would be the case in certain countries where lack of other inputs to complement with the land is mainly correlated to rental participation. However, most rural households may use their land as the source of cash at time of shocks. Our estimation result demonstrates the fact that households rent out land as the last option in the absence of other liquid assets or access credit markets.

Table 2.4. Estimates of net Land Leased out by Landlords: Censored (Tobit)

Variables	Coef.	Std. Err.	Coefficient	Std. Err.
Age of household head	-46.79	35.71	-42.18	36.024
Number of times family fall ill	-1976.67***	636.01	-1808.5***	629.88
School Years	115.39	147.90	169.41	146.97
Sex(1=female 0=male)	1899.24	1379.88	2159.59	1398.12
Male Labour	501.86	579.62	557.77	587.78
Female Labour	202.87	703.14	154.91	716.59
Real value of assets	0.07	0.079	0.067	0.075
Tropical livestock unit	360.05	286.34	331.48	291.85
Own land size(Ha)	-0.14***	0.052	-0.16***	0.052
Region(1=south 0=center)			1822.601*	1120.9
District level Dummy				
Tyolo	3689.87*	2100.87		
Zomba	2830.64*	1732.61		
Chiradzulu	5615.18*	2963.61		
Machinga	-1314.36	1649.25		
Kasungu	29.36	1582.59		
Constant	6882.06***	2472.84	6916.35***	2516.78
/sigma	6289.032	704.76	6522.89	735.06
Number of obs.		369		369
prob>chi2		0.0006		0.0025
PseudoR2		0.028		0.0205
Log likelihood		-643.41		-648.59
Left censored Observations		0		0
Uncensored observations		55		55
Right censored observations		314		314

Significance   level:***1%,**5%, *10%.

As it was in the participation model (table2.2), family illness variable is positive and statistically significant at 1% level indicating that families who faced frequent health shocks rent out more land. Thus, this supports our hypothesis (H4). The districts in the south (Thyolo, Zomba and Chiradzulu each significant at 10% level) are negatively affecting the size of land leased out. This is due to the land shortage because of dense population and lower per-capital land holding in the region relative to the central part. Holden *et al*., (2006) discussed that the large tea estates in Thyolo contribute to the severe shortage of land. Moreover, it is most densely populated (267persons/km2) district in Malawi. We discovered that land rental markets transfer land to more efficient and land poor or landless households.

This rental participation requires initial asset endowments as startup capital. The variation in the degree of participation can due to the higher transaction costs and /or resource constraints that lead to slow growth in resource exchange. These also affect productivity among households.

5.2.2 Is There Strong Distress Fixed Rental[8] Contract in Rural Malawi?

Under this section, we have tested the hypothesis (H_4) that Distress contracts take place for poor landlords with poor bargaining power and lead to less favorable contracts. To that effect, we controlled the household bargaining power by the reason to rent out land as an explanatory variable. The response was captured in dummy form for (1=self cash need and/or assisting others, 0=excess land and borrowing for free) as described in table1.7 before. The estimation result is presented in the table2.5 below. It seems that the reason for renting out land has negative and significant (at 10% significance level) effect on the rental revenue/price. This therefore, help not to reject our hypothesis (H_4), and it would also confirm the strong existence of distress rental contract under poor functioning credit markets.

Land rental market provides a temporary solution when insurance and credit markets do not work and when family networks are insufficient as safety net (Tikabo et al., 2003). This also may create a situation for exploitation by one party. Because at the time households are in urgent need of cash for own use or/and assist others, they would have less bargaining power in fixing the rental price for their plots and hence reduce the rental revenue. This is also true in the case of commodity markets but it could probably be stronger in land market as it is immobile to transport it to where it is better valued unlike goods and services. This kind of land exchange is at the expense of future income because of higher discount rates associated to it. Soil fertility (significant at 10% level) reduces the rental price of the transacted land. This implies that lower land quality in terms of its fertility reduces its market value.

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[8] Distress rental is defined as situation where property is rented to an urgent need (eg. Cash to buy food, cover medical expenses): Tikabo and Holden (2003). The case holds in Malawi among asset poor, weak social networks, and sick households to retrieve urgent cash demand. The rent is paid before harvest.

Table2.5. Estimates of Fixed Rental Revenue by Landlords: Linear Regression

Variables	Coefficient	Robust Std. Err.
Reason for renting out dummy(1=cash need,0 =excess land)	-2009.43*	1119.83
Age of household head	-39.15	37.34
Sex of house hold head(1=female,0=male)	661.07	773.39
Real value of assets	0.12	0.10
Plot area(meter s.q)	-0.08	0.26
Slope(1=flat 2=slight 3=cliff)	955.09	1061.51
Soil type (1=sandy 2= loam 3=clay)	-2034.38	1095.85
School years	-88.28	153.41
Region south dummy(1=south 0=central)	-2389.84***	728.90
Plot fertility(1very fertile,2 average)	-2127.23**	1071.72
Consumer to worker ratio	-1546.74	1762.98
Constant	16232.29**	6984.76
N		46
F(11,34)		2.09
Prob >F		0.049
R²		0.43

Significance level: *10%, **5%, ***1% Note:

We could also investigate from the estimation that being in the south (significantly at 1%) reduces the rental price. Even though land is scarce in the region; this is may be due to the fact that plots in the south are of less quality due to frequent depletion of its fertility as a result of over cultivation and /or people in the south are relatively poor to pay higher price for land. This finding is in line with Datar (2009). The study has identified higher and extreme land pressure in southern Malawi, and he has also discovered strong soil erosion and nutrient depletion in the region.   The very infertile land would remain fallow for the next season. Further, the higher climate risk for agriculture in southern part might have affected the willingness and ability to pay for land.

5.2.3 Does Land Market Participation Improve Food Security?

We have examined further, by constructing marketed maize surplus model as an indicator of household food security, to test (H5) whether land market participation improves access to food, and answer the above research question (Q3). We have used treatment effect

model (manually) to estimate marketed maize surplus, given other controlled variables, against predicted value of the estimated land market participation. i.e., probit model of rental participation for both tenants and landlords were estimated and their predicted values were captured as regressors in the food security model. This was done for tenants (by dropping real value of asset and tropical livestock units that can be easily converted to cash to pay fixed rent/or for other inputs from the second stage), and landlords (by dropping times ill and real value of assets variables that are highly correlated to renting out decision from the second stage). This procedure helps to overcome endogeniety problem with the treatment variable. We did bootstrapping at 300 replications to get corrected standard errors in the model. The results are presented for tenants' and landlords' subsequently in table 2.5 and table2.6.

Table 2.6. Estimates of Marketed Maize Surplus for the Landlord: Linear Regression

Variables	Coefficient	Bootstrap Std. Err.
Age of household head	-3.72	5.38
School years of the head	14.6	15.62
Household head sex (1=male 0=female)	174.17	167.93
Male labor force	26.59	67.27
Female labor force	25.02	116.99
Children	-34.13	51.63
Operational Holding(Ha)	-0.55	0.011
Tropical livestock units	149.4***	46.51
Predicted rent out participation	2169.9	1448.58
Consumer worker ratio	-13.25	240.89
Region dummy(1=south 0=central)	376.05***	143.14
Soil type(1=sandy 2= loam 3=clay)	199.99**	98.94
Slope(1=flat 2=slight 3 cliff)	100.59	126.63
Soil fertility(1=very fertile,2 =average)	-253.29**	129.94
Constant	-685.32	639.66
Number of obs.		154
R²		0.2247
Prob>F		0.0715
Wald chi2		23.64
Replications		300

Significance ***1%, **5% *10%

We found apart from other variables that landlords' participation in land market has no significant effect on the marketed maize surplus of the landlords. It was described (table 1.9) that most landlords are net buyers of food. This may reveal that renting out of land is one of

the coping mechanisms for the households exposed to shocks. And the rental return in one way or the other might not be used for input purchases as most of it was consumed and spent for the immediate cash needs like for medical costs and assisting of families. Hence, it does not seem that rental market participation on landlord side is for farm land adjustment. Gebregziabher in Ethiopia distinguished that 'Households' coping strategies differ based on their resource base, which may have implications on the use of land renting as safety net' (Gebregziabher et al., 2008). We have inspected that landlords are poor in non land assets that may substitute their capital constraint and thus, they prefer fixed rental contracts that would ease short-term consumption pressure in terms of capital.

Asset poor households with poor credit market use land as a security for cash at the time of shocks by choosing distress rental contract discussed under section (5.2.2) which has got no positive implication on their current food production. But we discovered that rented out plots has benefitted tenants in terms of production. Production of maize on the rented land by the tenants has significantly improved the household food demand. The excess land holding landlords reported in (table1.7) has not significantly contributed to their food production up on renting it out. This is may be due to the fact that there was no input shifting took place to the self operated land up on rental participation that would have promoted efficiency. Hence, we failed to accept our hypothesis (H4) that rental participation improves household food security from the landlord side but accept from the tenant side as shown in the regression results in table 2.6.

We found our treatment (the predicted participation) variable to be insignificant in the landlord model (table 2.5) in which it was expected not to be with the proposition that landlords rent out their excess land relative to their household labor and adjust their farm inputs on the remaining land in order to improve their productivity. However, it was proved that landlords participate in the land rental market due to lack of enough labor supply, lower assets, tropical livestock units, and enter in to distress rental(table2.2 and 2.4) in order to wrap up the cash deficit at time of shocks. Whereas tenants are land poor relative to their non-land assets (table1.2) and are therefore able to cultivate additional land that leads to surplus production.

Table2.7. Estimates of Marketed Maize Surplus for the Tenants: Linear Regression

Variables	Coefficient	Bootstrapped Std. Err.
Age of household head	7.06	6.81
School years of the head	30.119*	16.79
H head sex(1=male0=female)	340.59	313.43
Male labor force	-222.79**	107.43
Female labor force	-59.49	105.55
Children	35.31	59.19
Operational Holding(Ha)	0.046**	0.02
Predicted rent in participation	5116.74***	2002.12
Consumer worker ratio	-15.34	435.48
Region dummy(1=south 0=central)	350.53***	150.98
Soil type(1=sandy 2= loam 3=clay)	77.84	155.83
Slope(1=flat 2=slight 3 cliff)	23.46	143.69
Soil fertility(1very fertile,2 average)	-269.49	182.67
Constant	-1263.98	807.83
Number of obs.		175
R^2		0.2517
Wald chi2		53.1
Replications		300

Significance level: ***1%, **5%, *10%.

This helps in smoothing household consumption by empowering their intensity of self sufficiency. Land rental market participation seems significantly (statistically at 1% level) improved the productivity of land poor or/and landless households by increasing their access to land and make more productive use of their non land assets. But it has no any productive implication on the landlord side during the given season. This kind of one time conclusion however, may undermine the future effect of fixed rental participation as insurance for the next production season in which the beneficiaries could help to cover agricultural labor shortage.

6. CONCLUSION

This paper examines the land rental market, its determinants and implication on household food security in Malawi. The country's economy is agriculture dominated where other means like off-farm and small scale businesses do not back up the livelihood of the majority in rural the sector. Land market in the form of fixed rental and sales contracts is emerging and growing in Malawi. Land and non-land asset variations have derived rural households to enter into land rental market in order to adjust their operational holdings. The momentarily transfer of land via the rental market is an important mechanism to allow the poor and land less to access land for agriculture, and obtain cash for landlords. This is however, found to be limited in sharecropping form. The usual farming system- using hand hoe requires more labor time that is susceptible to health risks. This would affects household food production. Thus, family labor is found to be one of the most important factors affecting land market participation and extent of participation.

It was found that landless and land-poor Malawians relative to their family labor rented in land. The demand for land increases for households owning more non-land assets. These factors have brought about strong reverse tenancy contract in the country. Fixed rental market is dominant and mainly associated to male labor force, household asset, tropical livestock units, household health, and age status. We found that renting out of land may be a response to short-term stress when other alternative resources have been depleted. Family health shocks make land more important because the illness tends to narrow other possible livelihood base and ultimately make land the only source to depend on.

Furthermore, from the marketed maize surplus(as food security indictor) estimation result, it was found that most self sufficient and market surplus households(64%) in form of staple maize output are those who participated in land rental market, and produce more due to their productive capacity and better off in non land assets used for farm implementation. Majority of landlords are found to be food deficit (66.7%) supplying plots to rental market in order to adjust their cash demand in the face of shocks. Health shock experienced by 20% of landlords is negative and more significantly associated to leasing out and extent of participation. This is because of cash constraint, or the household's inability to cultivate due to labor shortage. Consequently, this had a paramount effect on the rental return due to weak

40

bargaining power under distress rental state. This finding could bring about the fact that, on one hand the imperfection in other input markets like labor, and credit market operation (as an alternative) would lift up the transaction costs. On the other hand, poor asset possession (poverty status) that would substitute land rental return for safety net has highly contributed to the fixed rental contract.

In general, this study suggests that land market participation and degree of participation in fixed rental form is found to be highly associated to land and non-land asset endowments, and household characteristics. This market temporarily transfers land to more productive houses. It has positive and significant effect on food security of tenants, and aggregate maize supply in the rural Malawi. Furthermore, it gives an opportunity for the landless to climb up the agricultural ladder. It has been the means for the landlords to overcome urgent cash needs particularly at the time of shocks that is spent on non-farm input purchases. Hence, it has no significant implication on their food security. It is an empirical question and research area for development economists whether formalizing land rental market in the country would maintain long-term welfare of the participants by alleviating poverty in poor/or non functional capital market and off-farm businesses.

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Appendix

Appendix 1: Districts, main villages in enumeration areas, and number of households sampled

Region	District	No of Enumeration areas	Main Village in enumeration area	No of households
Southern	**Thyolo**	2	Chimbalanga	30
			Kapyepye	30
	Chiradzulu	2	Kasani	30
			Matikiti	30
	Zomba	3	Mtutuma	30
			Mayaka	30
			Chirombo	30
	Machinga	2	Kawinga	30
			Namanja	30
Central	**Lilongwe**	3	Mpingu	30
			Mtengenji	30
			Mpingira	30
	Kasungu	3	Kadifula	30
			Kankhande	30
			Kwengwere	30
Total				450

Appendix-2. Description and Summary of Main Variables Used in the Analysis

Variable Name	variable label	Mean	Standard. Error	Min	Max
	Description of Variables (1a)	**Summary Statistics (1b)**			
District	1=thyolo 2= Zomba 3= Chiradzulu 4=Machinga 5=Kasungu 6=Lilongwe	3.74	1.6984	1	6
Region	1=South 2=central	1.45	0.4976	1	2
Age	Age Of The Household Member In Years	46.71	15.819	16	85
Schoolyears	Number Of Years In School For The Household Member	5.31	3.970	0	24
Highestclass	Highest Class Attained By Household Member	4.67	3.556	0	15
Timeill	Number Of Times Household Member Got Ill In The Year	0.24	0.6975	0	4
Malehh	Household Head Sex(1=Male, 0= Female)	0.78	0.4176	0	1
Consumer	(Sum) Consumer Units	3.99	1.56	0.8	9.2
Malelabour	(Sum) Male Labour Force	1.76	1.040	0	5.5
Femalelabour	(Sum) Female labour Force	1.45	0.756	0	4.2
Children	(Sum) Children	2.7	1.61	0	7
Realvalue	Deflated Real Values Of Assets Using 2006 as base Year	4098	11868.14	0	144717
Tlunits	Total Tropical Livestock Units	1.6	2.64	0	17.2
totmaizcon09	Total Maize Consumed In 2009 In Kg	803.6	783.76	12	8200
totmaizpro09	Total Maize Produced In 2009 In Kg	797.8	990.67	20	7000
Marketi	Did You Rent In? 1=Yes 0=No	0.096	0.295	0	1
Market	Did You Rent Out Plot Last Year? 1=Yes, 0=No	0.049	0.2165	0	1
Plotdistance	Plot Distance From Home(M)	1167.7	2947.9	0	30000
Soiltype	General Soil Texture 1=Sandy 2=Loam 3=Clay	2.027	0.736	1	3
Slope	Slope of The Plot 1=Flat 2=Slight 3=Clay	1.444	0.585	1	3
Plotfertility	Plot Fertility 1=Very Fertile 2=Average 3=Not Fertile	2.052	0.626	1	3
NLI	Net Land Leased(Ha)	169.165	1797.981	-2	1.6
Ownland	Owned Land Through Inheritance, Buying &/Or Grant(Ha)	12117.79	12290.18	0	10.06

Appendix 3. map of Malawi, showing districts and sites sampled

Figure 1: Map of Malawi showing, districts and sites sampled for in the study