

THE DYNAMICS OF LAND MARKET AND FOOD SECURITY IN MALAWI

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ABSTRACT

This study analyzes factors associated with 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. A binary probit model was applied 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. 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, the study revealed that rental participation has significantly improved the tenant's food access in terms of staple food (maize) but has no positive significant effect on the landlords' maize output.

Keywords: Land market, Rental, population, Land rich-resource poor, Land poor-resource rich, Food security, Malawi

Contribution/ Originality

This is one of the very few studies which have investigated the link between land market and food security in Malawi. A rare research showing how land rental markets have been used to transfer land from land rich but resource poor to land poor but wealthy households.

1. INTRODUCTION

Land is one of the scarce natural resources that remains unequally distributed in Malawi. With rapid population growth resulting in increased land fragmentation, land holding is becoming smaller that it is unable to sustain the households¹ adequately. [World Bank \(2003\)](#) noted that majority of the rural population produces 84% of total agricultural output. This is from

¹ ...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 and De Janvry \(1995\)](#).

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). 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 1 hectare (Ministry of Agriculture Irrigation and Food Security Planning Division, 2003). This again undermines the desire to food self-sufficiency, improving agricultural income, and adoption of new farm technologies. The Ministry advocates for a minimum of at least 1.5 Ha of land to attain minimum levels of sustenance throughout the year. One of the major constraining factors to increase agricultural productivity and viability is thus insufficient land required for expansion. Despite such a constraint, land plays a critical role in the livelihoods of Malawians such that near landlessness in Malawi has been linked to poverty and food insecurity. 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. 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.

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 country's 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. Using both Statistical tools and Econometrics estimation, this study was designed to identify factors determining land rental participation among farming households and its implication on household food security. Two principal research questions were raised and these are:

Q₁. What are the determinants of land renting in Malawi?

Q2: Does land renting improve Food Security of the land rental participants?

2. REVIEW OF EMPIRICAL STUDIES

The value of land is derived from resources existing in/on it including its physical structure, location, size and quality, 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 has been broadened in economics and in popular use to as hiring any asset, such as renting a car. In this paper, the term "rent" should strictly mean the payment for the use of farm land. [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 Europe and Central Asia (ECA) land renting 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 and Tikabo, 2003](#); [Tikabo and Holden, 2004](#); [Holden et al., 2007](#); [Ballesteros and Bresciani, 2008](#)). 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 \(2008\)](#) described rental activities in Philippine agriculture whereby both sharecropped and fixed rent arrangements represent one fourth of the country's cultivated areas. 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 common. Moreover, the study also identified that credit access and land endowment plays a role in determining the probability of land market participation ([Ballesteros and Bresciani, 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 that higher average female wage rate and large farm size holdings significantly reduce 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, etc. For instance, in the highlands 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 in Ethiopia increases efficiencies in creating additional wealth if it contributes to use of more purchased inputs, improved labor mobility/participation in non-farm activities and high participation in extension package programs. 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 are usually tenured 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, Deninger 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 (Deninger and Mpunga, 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) established 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. A study by Lunduka *et al.* (2006), shows that husband in matrilineal residence will have only user rights to land, which are gained at marriage, and wife in a patrilineal 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 matrilineal 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). Using household data collected during 2008/2009 season, the study focuses on identifying determinants of land market participation and its welfare implication on the participants through food security variable. 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. METHODOLOGY AND DATA REQUIREMENTS

3.1. Theoretical Model

Expression of the relationship

Two functional relationship are specified as:

$$(i) \quad A = h(A^*)$$

Where, 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 (\bar{L}), non land assets (A^{no}) and own land (\bar{A}) size. DCA is increasing in both \bar{L} and A^{no} (real value and tropical livestock units).

$$(ii) \quad A^i = DCA - Land \text{ endowment}$$

$$\bar{A}f(\bar{L}, A^{no}) - \bar{A} = Land \text{ leased in} - land \text{ leased out} = NLI$$

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):

$$(iii) \quad A_i^i = c_o + h'f_1\bar{L}_i + h'f_2A_i^{no} - h'\bar{A}_i = c_o + c_1\bar{L}_i + c_2A_i^{no} + c_3\bar{A}_i$$

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

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

Considering additional variable into equation (iii), the general reduced linear model for land rental market (net land leased) can be formulated as:

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

Where, subscript i -represents individual household, c_o -constant, \bar{L} -family labor, A^{no} -non land resources (livestock units & household assets), \bar{A} -Own farm size in Ha, R - agro-ecology (regional/district level), S -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.

Assuming that household decision is sequential, and in order to test hypothesis H₁, H₂, and H₃, two subsequent models are constructed as follows:

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

$$(v) A^{i*} = \beta_o + \sum_{i=1}^k \beta_i X_i + \xi_i$$

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;

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

The log-likelihood function and its derivation can be obtained and optimization can be done based on Green (2003). The explanatory variables used in each model are presented in appendix-1.

3.2. Hypotheses

Based on the functional forms, we postulate the following hypotheses:

H₁: 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.

H₂: Land renting improves household food security in rural households of Malawi.

These hypotheses were constructed 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.

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 (Q2) and test the hypothesis (H2) in the paper. The food security equation is inferred 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.

Functionally,

$$Q = f(\bar{L}_i, A_i) \dots\dots\dots(a)$$

$$A_i = A_i + \bar{A}_i \dots\dots\dots (b)$$

$A_i = \gamma_i (\bar{L}, A^{no}) \Rightarrow$ rental participation as function of labor and other non-land factors.

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

Therefore, the quantity of maize produced is described as;

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

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_i) model can be represented by:

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

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

$$\max_{A_i} K_i = \left(\frac{\partial Q}{\partial A} \right) \left(\frac{\partial A}{\partial A^i} \right)$$

where, $\frac{\partial A^i}{\partial A} = \frac{\partial \gamma_i}{\partial \bar{L}_i} + \frac{\partial \gamma_i}{\partial A^{no}}$; 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) through land rental participation (A^r) 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, ($K_i \geq < 0$), that characterizes the household as net seller, self sufficient, or net buyer of food respectively. Its Econometric Estimation set up is;

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

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)

ϕ_o = constant, ϕ_i 's are parameters to be estimated

X_i = vector of household characteristics and other variables

\hat{A}^r_i = the predicted value of participation. This is a variable determined in the rental model and is our treatment variable for land market participation across households.

The model is treatment effect model where the treatment function is done manually.

3.4. Data Sources

The study used secondary data collected from six districts of Malawi, namely: Thyolo, Chiradzulu, Zomba, and Machinga, in the southern region and Lilongwe and Kasungu in the central region of Malawi. 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 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 of Malawi, 2008). Zomba and Machinga are not so populated but 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 also have matrilineal land inheritance system and were selected because of proximity to the city in the case of Lilongwe hence easy market for farmers, and large land sizes and estates in the case of Kasungu. These are also relatively low density as compared to the southern districts.

4. RESULTS AND DISCUSSIONS

4.1. Household Characteristics

From the total land market participants, 84% of the tenants and 78% of the landlords are male headed. Their age statistics show that tenants are younger (96%) relative to landlords of whom 20% fall within what is considered 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 tenants and landlords respectively. The resource endowments vary among tenants, landlords and non-participants. It is noted in Table 1 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).

Table-1. Household Socio-economic Characteristics

Characteristics	Tenants	Landlords	Non Participants
Old aged (Age years >=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

Likewise, 6.8% of the tenants were landless whereas 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.

Figure1 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.

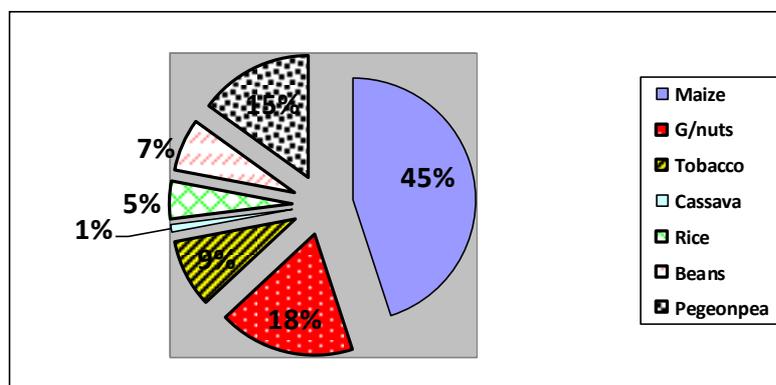


Figure-1. Crops Grown by Households on Rented-in Land

Maize	G/nuts	Tobacco	Cassava	Rice	Beans	Pigeon pea
45%	18%	9%	1%	5%	7%	15%

Depending on the staple food (maize) 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, it was possible to distinguish that most tenants were excess maize suppliers over their consumption level.

Households' production level is affected by land size, use of other inputs 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 level, Table 2.

Table-2. Maize Availability amongst Tenants and Landlords

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

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 increase 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 throughout the year. On the other hand, landlords enter into the land market for low competence in non-land resources that would have been employed for own cultivation and/or serve instead of capital markets, and hence decide to rent out what would otherwise be fallow land. If credit and other input markets had operated well, smallholders could better utilize their plots and smooth household consumption demand.

4.2. Land Market Participation

The likelihood of participation in the land market is driven 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, Table 3 and renting-out land, Table 4. It is evident from Table 3 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 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 the hypothesis that older households are less likely to rent in land. But the variable is not significant in the landlord model.

Table-3. Probit Estimates of Renting-in Land

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 R ² =0.12	Loglikelihood=-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, Table 1. 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.

Table-4. Probit Estimates of Renting out land

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 R ² =0.26	Loglikelihood=-57.76	prob>chi2=0.0039

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

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, Table 4. It was also described that landlords had faced frequent family health shocks that required and consumed most of their agricultural labor, and hence driven 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 the hypothesis that households enter into 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 result from the difficulty in cultivating fragmented and distant plots that would seek time to travel. The regression results from the land rental market participation and extent of participation equations did not confirm the hypothesis on female headed households renting out land relative to male counter parts. 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.

4.3. Does Land Market Participation Improve Food Security?

Further investigations were made by constructing marketed maize surplus model as an indicator of household food security. This is used to test the hypothesis on whether land market participation improves access to food, and answer research question Q2. Treatment effect model (manually) was applied 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 helped to overcome endogeneity problem with the treatment variable. Bootstrapping at 300 replications was used to get corrected standard errors in the model. The results for landlords and tenants are presented in Tables 5 and 6, respectively. The analysis revealed that apart from other variables that landlords' participation in land market has no significant effect on their marketed maize surplus. It was shown in Table 1 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 (2008) 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'.

Table-5. 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
R ²		0.2247
Prob>F		0.0715
Wald chi2		23.64
Replications		300

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

Asset poor households with poor credit market use land as a security for cash at the time of shocks by choosing fixed rental contract, which has got no positive implication on their current food production. But we discovered that rented out plots have benefitted tenants in terms of production. Production of maize on the rented land by the tenants has significantly improved the household food access. Landlords with excess land have not significantly contributed to their food production upon renting it out. This may be due to the fact that there was no input shifting that took place to the self operated land upon rental participation that would have promoted efficiency. Hence, we failed to accept the hypothesis 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 5. Treatment (the predicted participation) variable was not statistically significant in the landlord model Table 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 that would 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 into distress rental in order to wrap up the cash deficit at time of needy. Whereas tenants are land poor relative to their non-land assets and are therefore able to cultivate additional land that leads to surplus production.

Table-6. 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=male, female=0)	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 to have 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.

5. CONCLUSIONS

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. From the marketed maize surplus estimation, it was found that most self-sufficient and market surplus households (64%) in form of staple food- maize were those who participated in land rental market. They 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 was positive and significantly

associated to probability and extent of participation as landlord. 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 bargaining power under distress rental state. This finding could bring into being 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 paper suggests that land market participation and degree of participation 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 for spending 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-1. Description and Summary of Main Variables Used in the Analysis

Variable Name	Description of Variables (1a) variable label	Summary Statistics (1b)			
		Mean	Standard. Error	Min	Max
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 For more than two weeks in the last season	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

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