Tenure insecurity and investment in soil conservation: evidence from Malawi

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(2016) Tenure insecurity and investment in soil conservation: evidence from Malawi. World Development, 78. pp. 219-229. ISSN 0305-750X doi: https://doi.org/10.1016/j.worlddev.2015.10.023 Available at https://centaur.reading.ac.uk/67264/

ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. 78, pp. 219–229, 2016

http://dx.doi.org/10.1016/j.worlddev.2015.10.023

Tenure Insecurity and Investment in Soil Conservation. Evidence from Malawi

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Summary. — Tenure insecurity can have important consequences for the conservation of natural resources. This paper focuses on two main sources of tenure insecurity, informal short-term tenancy contracts, and customary gender-biased inheritance practices. Using a large plot-level dataset from Malawi, the analysis employs a linear probability model with household fixed effects and finds that both sources of insecurity have a negative effect on soil conservation investments. These findings suggest that future land reforms should deal with the informality of the land rental market and address the gap between users and owners of land created by existing customary practices.

Key words — tenure insecurity, soil conservation, tenancy, inheritance systems, Malawi

1. INTRODUCTION

This paper analyzes the impact of tenure insecurity on the adoption of soil conservation measures in Malawi. Soil erosion is one of the principal causes of environmental degradation in Malawi and has been increasing due to population pressure, deforestation, and unsustainable agricultural practices. Malawi has experienced higher erosion rates; about 40% of the agricultural land considered in this study is subject to some levels of erosion, compared to other sub-Saharan African countries with similar levels of population density due to its specific topography (Drechsel, Gyiele, Kunze, & Cofie, 2001). Soil erosion has important consequences for agriculture and other economic sectors thereby threatening food security as well as downstream activities such as hydroelectric power generation and drinking water treatment services.

Soil erosion rates have been found to be significantly associated to climate change (O'Neal, Nearing, Vining, South worth, & Pfeifere, 2005). Soil conservation investment can, therefore, be considered an important climate change adaptation tool (Deressa, Hassan, Ringler, Alemu, & Yesuf, 2009) for farmers in Malawi. Moreover, because smallholders in Malawi are moving toward monoculture maize systems, this introduces an important trade-off between the economic benefits of specialization and maintaining soil quality in the face of weather-related agricultural risks (Chibwana, Fisher, & Shively, 2012). Adopting soil conversation measures is, therefore, crucial to guarantee the sustainability of such widespread agricultural practices.

Despite several government campaigns to promote soil and water conservation practices during the mid-1990s and the implementation of the National Environmental Policy in 1996, the extent of adoption of soil conservation measures is not yet satisfactory. More than 30% of the plots showing a high degree of erosion do not report any conservation measures. This paper provides new insights into why soil conservation measures are under-utilized with a focus on land tenure insecurity.

Most of the land in Malawi is under customary law. While use rights are well established, there is no formal market for land. Land is transferred through allocations by village headmen or, more predominantly nowadays, through inheritance. Given the increasing demand for land, an informal rental market has emerged and is expanding. Initially started as a form of land borrowing between relatives, it has evolved over the past 20 years into one-season-long informal renting agreements mostly between non-relatives (Peters, 2010). Land transfers through inheritance are governed by customary tenure systems that vary across villages and are based on a mixture of marriage and residency customary practices. In the south, for example, the dominant system is matrilineal–matrilocal where the husband moves to the wife's village and does not retain property rights on the land after death of the partner or divorce. The ultimate owners of the land are, therefore, the spouse's relatives. The northern part of the country mainly adopts a patrilineal–patrilocal system that applies similar principles to wives. The gender-biased nature of these inheritance systems and the short-term nature of tenancy contracts constitute sources of tenure insecurity and are the focus of this paper.

Empirical analyses of the effects of land tenure insecurity on investment have produced varying results, in particular for sub-Saharan Africa (Deininger & Jin, 2006). While tenure insecurity is expected to decrease investment, investment itself could lead to higher tenure security if it can be claimed by the land user (Besley, 1995). Which mechanism prevails depends on the type of investment and on the nature of tenure insecurity. The lack of generalizable results, therefore, calls for in-depth empirical investigations that take into account the local social, political, and economic circumstances and the specific sources of tenure insecurity and types of investment. This paper focuses on marriage and inheritance practices whose

* This research is part of the green growth program at the Grantham Research Institute on Climate Change and the Environment, which is funded by the Global Green Growth Institute, as well as the Grantham Foundation for the Protection of the Environment, and the Economic and Social Research Council through the Centre for Climate Change Economics and Policy. The author would like to thank Mintewab Bezabih, Antoine Dechezleprètre, Marcella Veronesi and the referees for their helpful comments. Final revision accepted: October 3, 2015.

impact on tenure insecurity has not been sufficiently studied in the economic literature (Berge, Kambewa, Munthali, & Wiig, 2014).

In particular, no existing empirical studies have focused on the effect of tenure insecurity on soil conservation investment in Malawi. Although Place and Otsuka's (2001b) research touches upon investment in terracing and water management structures, their results are inconclusive and the authors call for further research on the topic. This paper contributes to the literature by using a large plot-household-level dataset and employing an empirical strategy that takes advantage of the variation in tenure security across plots belonging to the same household. This approach offers an advantage over many of the existing empirical studies, often constrained by small sample sizes and limited geographical coverage, since it allows controlling for household-level unobserved heterogeneity using household fixed effects. The effects of tenure insecurity on erosion control investment are then compared to those on investment in trees and on the adoption of hybrid seeds. The comparison serves as robustness check since both production choices share some similarities but also show some differences with the adoption of conservation measures. Trees produce long-term benefits but, unlike conservation measures, exhibit stronger security-enhancing properties as they can mark a plot's boundaries in case of disputes. Therefore, we expect tenure insecurity to have a smaller (or even positive) effect on tree planting than on soil conservation investment. Hybrid seeds, instead, produce mostly short-term benefits and do not exhibit security-enhancing properties. We expect, therefore, tenure insecurity to not have a negative effect on the adoption of hybrid seeds since they do not produce long-term benefits that can potentially be expropriated by the ultimate owner of the land in case of end-of-contract for rented plots and death of the spouse or divorce for inherited plots.

Various failed attempts to implement a land reform in Malawi have put a new land policy high on the agenda of the Malawian government. The analysis presented in this paper can provide important insights for the development of the land reform process. In particular, it will shed light on the role of the land rental market, which was ignored by previous land reform attempts, and indicate whether additional interventions or compensation measures should be introduced together with land titling to sustain conservation.

The remainder of the paper is organized as follows: Section 2 describes the customary land tenure in Malawi. This is followed by a description of the existing empirical evidence on the relation between tenure insecurity and land-related investment. By reviewing the literature, the section provides the theoretical framework underpinning the empirical analysis presented in the paper. Section 3 presents the econometric approach, while Section 4 provides a description of the plot-household-level data used in the analysis. The results pertaining to the impact of tenure insecurity on soil conservation investment and other production choices are discussed in Section 5. Finally, the conclusions and policy implications are presented.

2. TENURE INSECURITY IN MALAWI

Most of the land in Malawi is under a traditional customary land system where cultivation rights are granted by traditional leaders. Nowadays, however, only a small proportion of plots are allocated by village headmen and most land is transferred through inheritance (Peters & Kambewa, 2007). A new land policy was formulated in 2002, mainly to allow farmers to register their customary land as private property. The necessary legislative changes needed to make the policy operational, however, were not implemented and the reform process came to a halt. The question of land reform, therefore, remains high on the agenda of the Malawian government and has been subject to extensive public debate. In particular, major debates have focused on inheritance laws and the need to address the concerns of both owners and tenants in the rapidly expanding informal rental market (Peters, 2010).

These latter pressing issues are the main focus of the present study. Although the lack of ownership rights is an important source of concern, individual use rights over agricultural land are well-established (Place & Otsuka, 2001a).The country's constitution prohibits arbitrary land deprivations of farmers and when land is required for public use the government should provide adequate notification and compensation.[1] Therefore, the absence of legal titles is unlikely to constitute a major impediment to investment unless it prevents household from accessing the credit market, which will not be considered in this paper. A major concern is, instead, the absence of legal forms of land transfer. Although land can only be officially transferred through inheritance, an informal rental market has emerged and has been in continuous expansion in response to the increasing scarcity of land (Holden, Otsuka, & Place, 2008). The informal rental market is, however, dominated by short-term (one season) contracts that introduce uncertainty about future renewals and can prevent the adoption of soil conservation measures due to the fear that the investment and maintenance effort will be expropriated by the landlord.

Tenure insecurity is also caused by the presence of gender-biased inheritance systems. There are different customary tenure systems in Malawi that are based on two main descendant practices: matrilineal and patrilineal, and residency practices: matrilocal, patrilocal and neolocal. In Malawi, marriage is almost ubiquitous and the customary system in place determines residency and inheritance. To better understand land tenure it is important to consider both inheritance and residency practices. In a matrilineal–matrilocal system, the husband moves to the wife's village and cultivates the land that his wife inherited from her relatives (such as her parents or an uncle). In a patrilineal–patrilocal system the wife moves to the husband's village who has inherited the land from his relatives so that a family is an integral part of the husband's lineage. Divorce or death of a spouse under these two practices effectively renders the non-local partner landless and he/she will have to return to the village of origin without any form of compensation for the investment made into the land. In particular, in case of death the land will return to the relatives of the local deceased person (usually a brother or uncle). Berge *et al.* (2014) found that the belief in the rights of the lineage is strong in both matrilineal and patrilineal villages. Moreover, due to increasing land scarcity, evictions of non-lineage residents are becoming more frequent. For men in matrilineal households, for example, the most basic form of security is provided by stable marital relations (Kishindo, 2010). It is worth noting that the probability of divorce in Malawi is among the highest within sub-Saharan Africa countries with almost half of all first marriages ending in divorce within 20 years (Reniers, 2003). This is combined with a high prevalence of HIV/AIDS among the adult population. Moreover, because land might be bequeathed from uncle to nephew, bypassing the children, customary inheritance practices provide additional disincentives for investment with longer term benefits.

The matrilineal–matrilocal (or Chikamwini) system is practiced mainly by three large tribes: Chewa, Lomwe and Yao,

the most populous ethnic groups in Malawi located mainly in the south of the country. In this part of the country, a man is said to be expected to "leave with his blanket", meaning that he cannot claim any material goods from the household after a divorce or death of the spouse (Reniers, 2003). Due to increasing land scarcity in Chikamwini villages, however, the system is slowly being replaced by the matrilineal–patrilocal system (Chitengwa). In these villages and in matrilineal–neolocal villages, a male land-user is not very secure because women are expected to own the land; however he may opt to invest more in order to be able to claim ownership of the land in the future (Lunduka, 2009). In the north of the country, instead, the most common practice is the patrilineal–patrilocal system where the land is received through the father's side and couples live in the husband's village.

(a) *Tenure insecurity and land-related investment*

The relationship between tenure insecurity and land-related investment has been widely studied in the literature (Place, 2009). The sources of tenure security considered range from lack of land titles (Bezabih, Holden, & Mannberg, 2012), short-term tenancy contracts (Bandiera, 2007), lack of transferability (Besley, 1995) and risk of expropriation (Deininger & Jin, 2006). Fewer studies have considered the relationship between tenure insecurity and investments in soil conservation (Gebremedhin & Swinton, 2003). Ali, Deininger, and Goldstein (2011), for example, find that the implementation of the land regularization program in Rwanda has notably increased investment in soil conservation in particular for women. Similarly, Holden, Deininger, and Ghebru (2009) show that the Ethiopian low-cost land certification program had a positive impact on investment and maintenance of soil conservation structures. In general, however, the results have been mixed, in particular for sub-Saharan Africa. While tenure security can positively affect investment by ensuring longer term stability or favouring access to credit (Besley, Burchardi, & Ghatak, 2012), empirical studies have also found that land-related investments can enhance security and therefore suggest a causal relationship that works in the opposite direction (Brasselle, Gaspart, & Platteau, 2002). Underinvestment in conservation measures has also been linked to other aspects such as pervasive market imperfections, for example liquidity and subsistence constraints, poverty, and high rates of time preference (Shiferaw & Holden, 1999).

Deininger and Jin (2006) summarize the major difficulties encountered by most empirical studies. Many studies, for example, rely on small samples with limited geographical representativeness. Of major concern are the difficulties in discerning the security-enhancing properties of investment from the negative effect of insecurity on productivity-enhancing investments. The authors employ a theoretical model where investment can potentially have both properties. The solutions of the model predict that when tenure security is exogenous, insecurity has a negative effect on investment (pure productivity-enhancement mechanism). On the other hand, when tenure security is increased by investment and investment does not enhance productivity, tenure insecurity will lead to more investment (pure security-enhancing mechanism). Finally, when an investment exhibits both properties, the impact of tenure security is ambiguous (mixed mechanism). In Malawi, investment in soil conservation can, in principle, exhibit both properties. Soil conservation measures can help preserve soil nutrients and prevent productivity losses in the future (productivity-enhancing mechanism). On the other hand, conservation investment could help consolidate the tenure security of land-users. This is more likely to occur if tenants' good farming practices increase the chances of contract renewals. This is, on the other hand, less likely to occur in the case of strictly gender-biased inheritance customary rules, commonly adopted in the south and north of the country that are likely to be unaffected by the actions of the land-user, but more likely to affect land-users in mixed-systems where investment can potentially enhance security. Whether the security-enhancing effect prevails over the other depends on the source of tenure insecurity and will be investigated below.

Previous studies on the relationship between tenure insecurity and investment in Malawi have found some mixed effects. Place and Otsuka (2001b), for example, find that the investment incentives provided by the matrilineal–matrilocal tenure arrangement are generally weaker than those in tenure systems where patrilineal descent patterns prevail. The study focuses mainly on the adoption and extension of tobacco production. The study does not find a significant negative relationship between tenure-insecurity and terracing or water managing. As suggested by the authors, however, the results are likely to be influenced by the lack of controls for plot-specific characteristics and the small sample size. Lunduka (2009) finds that households in matrilocal villages tend to underinvest in tree planting. On the other hand, households in matrilineal–neolocal villages are found to invest more suggesting that in these systems investment in trees can help increase security in the future. Finally, a study by Place and Otsuka (2001a) explores the relationship between customary land tenure and natural resource management. Using data from 57 communities, the authors do not find evidence for a relationship between tenure insecurity and the long-term management of woodland. The analysis presented below contributes to this literature by focusing on another form of resource management, soil conservation, and by exploiting a larger and more comprehensive sample of households across the entire country.

3. EMPIRICAL STRATEGY

The effect of tenure insecurity on the adoption of soil conservation measures is analyzed by estimating the following equation:

$$inv_{ij} = \alpha + \beta d_{ij} + \gamma z_{ij} + \delta x_i + \varepsilon_{ij} \quad (1)$$

The dependent variable, inv_{ij} is a binary variable and indicates the presence of soil conservation measures on plot j belonging to household i. Tenure insecurity variables are indicated by the vector d_{ij}. They are all binary variables that indicate different levels of tenure security. In the first set of regressions these binary indicators represent different methods of land acquisition (allocated, inherited, purchased, and rented land) while in the second part of the analysis they indicate different levels of tenure insecurity depending on the gender of the decision maker and the inheritance system in place in the community. In particular, male decision makers are classified into three different levels of security. The most secure male decision makers are those living in a patrilineal–patrilocal system (category a), while the most insecure are those that moved to a matrilineal–matrilocal village because of marriage (category c). Finally, a third category includes male decision makers residing in other mixed systems (matrilineal–patrilocal and matrilineal–neolocal) including those living in matrilineal–matrilocal villages but that did not move there because of marriage (category b). Female decision makers are categorized only into two levels of security.[2] Women are considered to

have a stronger land security in matrilineal–matrilocal villages (category d) while all other female decision makers are grouped into one less secure category (category e). It should be noted, however, that land transactions do not necessarily follow these idealized models of customary land tenure. Actual transactions are likely to be more complex and flexible than these generalized rules, which, however, offer a reasonable proxy for the most common customary practice in a village (Takane, 2008).

All specifications include a constant α, district dummies, and a dummy indicating whether the household is located in the lower Shiver valley where soil condition tend to be adverse to the use of soil conservation measures.[3] The vectors x_i and z_{ij} contain the household and plot-level variables described below, while ε_{ij} is the error term which is assumed to be normally distributed.

Although the survey offers a rich set of household and plot characteristics, these might not account for all the unobservable characteristics that may be associated with tenure insecurity. To address this concern, the specification above is also estimated including household fixed effects, b_i, i.e., by comparing plots belonging to the same household:

$$inv_{ij} = \alpha + \beta d_{ij} + \gamma z_{ij} + b_i + \varepsilon_{ij} \quad (2)$$

This is possible given the large sample size provided by the survey and the variability of tenure insecurity across a household's plots, which are features that are seldom available in other studies (Holden *et al.*, 2009; Place & Otsuka, 2001b). The main advantage of the latter specification is that estimates do not suffer from selection bias on household-level unobservables. On the other hand, by definition, it is not possible to analyze the impact of household-level characteristics on investment decisions. Moreover, the sub-sample of households included in the fixed effects estimations, i.e., those with multiple plots and different levels of tenure insecurity, might differ from the excluded ones under particular characteristics that will be discussed in the next sections.

All specifications are estimated using a linear probability model. Despite the binary nature of the dependent variable, a linear probability model is preferred because the inclusion of household fixed effects does not bias the estimates (Bandiera, 2007). Linear probability models provide good estimates of the partial effects for average values of the explanatory variables and the coefficients allow for a straightforward interpretation of the effects (Wooldridge, 2002). Measurement errors also cause a smaller bias in linear models than in discrete choice models. Because the residuals of a linear probability model are heteroskedastic by definition, all estimations report robust standard errors.

4. DATA

The empirical analysis uses plot-household-level data provided by the third Agricultural Integrated Household Living Standard (LSMS-ISA) survey that was conducted in 2010 by the Government of Malawi through the National Statistical Office. The survey collects information on more than 9,000 households across the entire country. The survey data have been geocoded. However, to protect the confidentiality of the sampled households and communities, the geographical positioning system (GPS) coordinates were averaged at the enumeration area (EA) level. An EA comprises, on average, around 200 households. All geographical characteristics, therefore, are provided at this level of aggregation and include average rainfall precipitations, maximum and minimum temperatures, elevation, distance from the population center, majority of land cover class and terrain roughness. The survey also provides a rich set of plot-specific information that can help control for plot-level heterogeneity. Variables include plot size, soil quality (farmer's opinion), soil type (clay or sandy), distance of the plot from the household, slope and whether the plot is in a wetland. The majority of the households in the sample have access to more than one plot (2 on average) and the average plot size is 0.4 hectares (plot size was measured using the GPS technology).

Table 1 reports some descriptive statistics for the different methods of land acquisition. Most households in the sample have acquired land through inheritance (78%). The smaller share of households that was allocated land by local leaders

Table 1. *Average household characteristics by land acquisition method*

Method of acquisition	Total	Allocated	Inherited	Purchased	Short-term tenancy
Soil conservation (%)	41.4	39.6	42.4	42.7	33.4
	(49.3)	(48.9)	(49.4)	(49.5)	(47.2)
Age*	43.2	49.3	42.5	44.8	39.6
	(16.0)	(16.9)	(15.9)	(14.4)	(12.6)
Education (years)*	5.2	4.7	5	6.1	7
	(4.0)	(4.0)	(3.8)	(4.3)	(4.6)
Household size	4.9	4.9	4.9	5.4	5.3
	(2.2)	(2.4)	(2.2)	(2.4)	(2.2)
Plot size (hectares)	0.4	0.4	0.4	0.5	0.4
	(0.3)	(0.4)	(0.3)	(0.5)	(0.3)
Number of plots	2.5	2.5	2.5	2.4	2.4
	(1.2)	(1.2)	(1.2)	(1.2)	(1.3)
Distance to population center (in km)	39	41.8	39.3	36.2	32.6
	(20.8)	(21.4)	(20.5)	(20.7)	(21.2)
Steep (%)	2.9	7.7	2.4	1.8	1.2
	(16.9)	(26.6)	(15.4)	(13.5)	(10.7)
Consumption per capita (in MK)	51,130	48,633	48,827	79,550	69,584
	(51,520.6)	(48,647.9)	(40,064.9)	(15,7860.6)	(71,975.0)
Observations	17,267	2,051	13,515	487	1,214

Author's calculations from the LSMS-ISA survey. The table reports mean values, standard deviations are in parenthesis.
* Refers to the decision maker.

(11%) is indicative of the increasing scarcity of land. Although only 7% of the plots in the entire sample were acquired through an informal rental market, this form of acquisition is likely to become a more popular way to reallocate land from land-rich households to those demanding access to land. Contracts are short-term, usually for one season, and might involve a monetary and/or an in kind payment.

Encouraged by several government campaigns, farmers have adopt a range of soil management measures that include the planting of vetiver grass (*Vetiveria zizanioides*/*Vetiveria nigritana*) and the construction of soil bunds, contour box ridges and terraces. Vetiver grass is planted on contour lines to form a thin but dense hedge line to control runoff and improves moisture retention. Soil bunds are ridges and ditches made of soil across the slope and along the contour. Box ridges or tied ridges are made across the furrows from one crop ridge to the next and are spaced approximately every 2 m; they help crop ridges infiltrate more water into the soil (Government of Malawi, 1995). Soil conservation is practiced by about 40% of the households in the sample. Unfortunately, it is not possible to observe whether the investment was made by the current or previous land users. The most common measures (75%) are soil bunds and vetiver grass. Table 1 shows that the likelihood of adopting conservation measures is lower among rented plots than for any other form of acquisition (the difference is statistically significant at 1%). Rented plots are on average closer to population centers and less likely to be located in steep areas. Moreover, households renting plots tend to be younger, more educated and to have higher average consumption per capita. All differences are statistically significant at 1%.

In defining the level of tenure insecurity based on a gender-biased inheritance system, I combined information on the gender of the decision maker and on the village of residency. For each plot the survey asks about who makes the decisions about crop planting, use of inputs and timing and, therefore, allows to identify the gender and other characteristics of the decision maker. Unfortunately, the dataset does not allow inferring from who the plot was inherited, as available in Place and Otsuka (2001b) and Lunduka (2009). Nevertheless, the community-level survey provides information on the main inheritance system in place in the village, which constitutes a good proxy for how most land is likely to have been transferred. In villages with a matrilocal–matrilineal system, for example, land is likely to have been inherited from the wife's relatives. The survey reports five customary marriage systems: matrilineal–matrilocal, patrilineal–patrilocal, matrilineal–neolocal, patrilineal–neolocal, and matrilineal–patrilocal. It also contains an additional question on whether in the village descendants are commonly traced through their father or mother. This variable is also used to create a simplified measure of tenure insecurity. Table 2 reports the descriptive statistics of the main explanatory variables by levels of tenure insecurity and considers only inherited and allocated plots. Among secure decision makers, a higher share adopts soil conservation measures, although the differences are not statistically significant. No clear pattern emerges among other explanatory variables.

5. TENURE INSECURITY AND SOIL CONSERVATION INVESTMENT

This section presents the empirical results on the relationship between investment in soil conservation and tenure insecurity due to short-term tenancy contracts and gender-biased inheritance practices. It also considers additional production choices including investment in trees and the adoption of hybrid seeds.

(a) *Short-term tenancy and soil conservation investment*

The first set of results considers how different methods to acquire land interact with soil conservation investments. Table 3 reports the cross-section (OLS) and fixed-effects

Table 2. *Average household characteristics by decision maker status*

Tenure security	Total	Man			Woman	
		Secure patrilineal (a)	Mixed systems (b)	Insecure (c)	Secure (d)	Less secure (e)
Soil conservation (%)	40.1	44.8	42.6	38.4	40.7	34.8
	(17.9)	(15.4)	(17.2)	(22.1)	(18.7)	(14.8)
Age*	43.3	42.5	41.5	41.2	46.8	49.5
	(16.2)	(15.1)	(15.2)	(15.2)	(18.3)	(16.9)
Education (years)*	5	7.5	5.3	5.1	3.1	3.4
	(3.8)	(3.5)	(3.7)	(3.8)	(3.5)	(3.4)
Household size	4.9	5.5	5.1	5.1	4.2	4.5
	(2.2)	(2.5)	(2.1)	(2.0)	(2.1)	(2.4)
Plot size (hectares)	0.4	0.3	0.4	0.3	0.3	0.4
	(0.3)	(0.3)	(0.4)	(0.3)	(0.3)	(0.3)
Number of plots	2.5	2.8	2.6	2.5	2.2	2.3
	(1.2)	(1.3)	(1.2)	(1.2)	(1.2)	(1.1)
Distance to population center (in km)	39.7	49.3	38.7	37.6	34.9	43.3
	(20.6)	(25.0)	(19.0)	(18.5)	(19.1)	(23.4)
Steep (%)	3	7.5	2.4	2.1	2.3	3
	(17.1)	(26.3)	(15.2)	(14.4)	(15.0)	(17.0)
Consumption per capita (MK)	48,752.6	45,821.1	50,648.5	42,711.6	49,838.9	44,127.9
	(41,049.3)	(33,297.6)	(40,475.9)	(34,764.4)	(51,736.1)	(33,311.0)
Observations	16,410	2,023	8,832	1,174	2,896	1,485

Author's calculations from the LSMS-ISA survey.
Only inherited and allocated land. The table reports mean values, standard deviation are in parenthesis.
* Refers to the decision maker.

(FE) estimates and shows that land acquisition methods matter: households are less likely to invest in soil conservation measures when their plot was acquired through a short-term tenancy contract. In the cross-section specification (column 1), the probability of investing in conservation measures is 6 percentage points (15%) lower for rented plots. This effect is relevant and is equivalent to a decrease in per capita consumption of 1.6% or a reduction in plot size of 0.8 hectares. The fixed-effects results show that the probability of investing in conservation measures is 7.5 percentage points or 18% lower for rented plots than for other plots. Because all contracts are fixed-term agreements, sharecropping is not a common practice in Malawi (Holden *et al*., 2008); this effect is likely to indicate a commitment failure rather than a moral hazard problem. (Jacoby & Mansuri, 2008). Unfortunately, given the lack of data, it is not possible to test whether differences in the duration of the tenancy would induce different investment outcomes.

When considering all methods of acquisition separately (columns 2, 4, and 5), the cross-section and the fixed-effects specifications produce different results as far as the impact of allocated land is concerned. This can be partly attributed to the fact that the average observed characteristics of the households in the fixed-effects sub-sample differ from the overall average. The sub-sample includes only households that have multiple plots acquired through different methods. In particular, about 50% of these households have access to both inherited and rented plots, while about 20% have access to both inherited and allocated plots. Households in this sub-sample tend to have more members, greater wealth and a younger household head. This latter difference, in particular, suggests that household members are relatively younger and, therefore, had been allocated land rather recently. Compared to inherited land, which has been used by more than one generation, and given the increasing scarcity of land, individuals are less likely to perceive recently allocated land as their own property. The last column of Table 3 considers only households that have the same decision maker across all plots. These results are preferred to previous ones as they deal with most of the unobserved differences across households and decision makers within the household. They show that allocated land also provides weaker incentives to invest in conservation measures. There is no straightforward explanation for this difference. One possible explanation is that, although both inherited and allocated land fall under the customary law, inherited land has been cultivated for longer (by at least two generations) and, therefore, is more likely to be considered more secure. No significant differences are observed between purchased and inherited land.

The dependent variable considered so far indicates the presence of at least one type of erosion control measures. There are, however, differences among the various measures

Table 3. *Linear regression analysis of the effects of different land acquisition methods on investment in conservation*

Dep. variable: investment in conservation	Cross section		Household fixed effects			
	(1)	(2)	(3)	(4)	(5)[a]	(6)[b]
Short-term tenancy (dummy)	−0.063***		−0.075***			−0.056**
	(0.014)		(0.023)			(0.023)
Allocated (dummy)		0.064***		−0.025	−0.054	
		(0.017)		(0.045)	(0.042)	
Purchased (dummy)		0.075***		0.085**	0.071*	
		(0.026)		(0.041)	(0.041)	
Inherited (dummy)		0.063***		0.086***	0.083***	
		(0.014)		(0.023)	(0.023)	
Decision maker's education (years)	0.001	0.001	0.025	0.028		0.039
	(0.001)	(0.001)	(0.026)	(0.026)		(0.030)
Household's consumption per capita (log)	0.039***	0.039***				
	(0.007)	(0.007)				
Plot's slope = moderate (dummy)	0.241***	0.241***	0.231***	0.227***	0.235***	0.231***
	(0.008)	(0.008)	(0.047)	(0.047)	(0.049)	(0.048)
Plot's slope = steep (dummy)	0.315***	0.315***	0.287**	0.298**	0.330**	0.338**
	(0.023)	(0.023)	(0.133)	(0.133)	(0.144)	(0.153)
Plot size (ha)	0.050***	0.050***	0.099**	0.094**	0.080*	0.084**
	(0.012)	(0.012)	(0.041)	(0.041)	(0.042)	(0.039)
Max temperature (village-level)	−0.003***	−0.003***				
	(0.001)	(0.001)				
Household fixed effects	No	No	Yes	Yes	Yes	Yes
District fixed effects	Yes	Yes	No	No	No	No
Observations	17,153	17,153	1,721	1,721	1,616	1,595
Households			668	668	624	639

The table reports the results of a linear probability model of different land acquisition methods on investment in soil conservation. The coefficients represent marginal effects. Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Cross section and household fixed effects specifications include the following additional (not reported) variables: soil quality (good, fair, poor), soil type (clay, sandy). The cross section specifications include: number of plots, age, and gender of the decision maker and other village-level characteristics including: rainfall, elevation, minimum temperatures, majority of land cover and terrain roughness. Columns 1 and 3 compare short-term tenancy contract with all other methods; in columns 2, 4, and 5 acquisition methods are considered separately and the excluded dummy is short-term tenancy. In columns 3, 4, and 5, the household- and village-level variables are absorbed by household fixed effects and the specification compares plots within the same household.

[a] Excludes households with multiple decision makers.

[b] Considers only investment in contour barriers as dependent variable.

adopted. Tied ridging, for example, can deliver short-term benefits but must be renewed every crop season. Contour barriers (soil bunds and vegetation) survive longer but are not likely to deliver short-term benefits. As a robustness check in column 5 of Table 3 we consider only investment in contour barriers. The result concerning short-term tenancy is not statically different from previous findings.

As expected, soil conservation measures are more likely to be found in steep or moderately steep plots that are more prone to erosion. Larger plots are more likely to have erosion control measures while education does not matter.

(b) *Customary land tenure systems and soil conservation investment*

The results reported in Table 4 explore the relationship between customary land tenure systems and the adoption of soil conservation measures. The table reports both the cross-section and the household fixed-effects estimates.

The results reported in the first three columns are cross-section estimates. The first column shows that while a male decision maker is more likely to invest in soil-conservation measures than a female decision maker, this effect is offset when the household resides in a village with a matrilineal inheritance system. Column 2 considers a simplified measure of tenure insecurity that indicates whether a male decision maker resides in a matrilineal village or a female decision maker resides in a patrilineal village. The results indicate that insecure decision makers are 3.5 percentage points less likely to invest in soil conservation measures. The effect is larger when controlling for household fixed-effects (column 4). Insecure decision makers are on average 7.5 percentage points less likely to adopt conservation measures. The effect is comparable to that of having acquired the plot through a short-term tenancy contract.

Tenure insecurity is then disaggregated into different levels, as described in Section 2, which are included in the cross-section and fixed effects specifications reported respectively in columns 3 and 5. In both specifications the omitted categories are the most secure male and female decision makers (category a and d). Column 3 shows that insecure male decision makers are 8 percentage points less likely to adopt conservation measures. These results confirm the findings in Kishindo (2010) who conducted several targeted interviews in the Kachenga Village, Balaka district and observed that men in matrilineal-matrilocal villages are less willing to make long-term investments. Being a male decision maker in a mixed-system village also has a negative effect but the coefficient is halved. The fixed-effects estimations (columns 4 and 5) provide much larger estimates as they are obtained by comparing plots with different decision makers within the same household. These households tend to have characteristics that differ from the average household. Moreover, the majority of the households with multiple decision makers involve both a female and a male decision maker (usually husband and wife), i.e., there are no same-gender multiple-decision-maker households. These specifications, therefore, provide only cross-gender effects and de facto compare an insecure male decision maker with a secure female decision maker or an insecure female decision maker with a secure male decision maker. The sample size is considerably reduced; nevertheless, the effects are statistically significant. Insecure male decision makers are again found to invest less in conservation measures than their secure female counterparts. The marginal effect, 0.24, is very large compared to the sample average of 0.48. Furthermore, less insecure male decision makers (category b)

Table 4. *Linear regression analysis of the effect of insecurity due to marriage/inheritance practises on investment in conservation*

Dependent variable: investment in conservation	Cross section			Household fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)[a]
Gender of decision maker (DM) (dummy, 1 = male)	0.075***	0.037***	0.068***			
	(0.015)	(0.009)	(0.024)			
DM lives in matrilineal village (dummy)	0.097***					
	(0.019)					
(DM: male) × (Matrilineal)	−0.078***					
	(0.018)					
Insecure man or woman (b + c + e) (dummy)		−0.035***		−0.075**		
		(0.008)		(0.034)		
Insecure man (c) (dummy)			−0.080***		−0.244*	−0.357*
			(0.026)		(0.141)	(0.184)
Man in mixed systems (b) (dummy)			−0.036*		−0.095**	−0.096**
			(0.021)		(0.045)	(0.044)
Insecure woman (e) (dummy)			0.018		−0.135**	−0.103*
			(0.018)		(0.065)	(0.059)
Household fixed effects	No	No	No	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes	No	No	No
Observations	14,803	15,434	15,434	335	335	308
Households				143	143	137

The table reports the results of a linear probability model of tenure insecurity due to different marriage/inheritance systems on investment in conservation. The coefficients represent marginal effects. Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$ All specifications include the same control variables considered in previous table. Insecure men (c) are those that moved to a matrilineal–matrilocal village because of marriage. Dummy (b) indicates a man living in a matrilineal–patrilocal or matrilineal–neolocal village or a man living in a matrilineal–matrilocal village but that did not move there because of marriage. An insecure woman (e) lives in a non-matrilineal–matrilocal village. The omitted dummies are those indicating a secure man and woman. Columns 2 and 4 consider an aggregate category of insecure decision makers (categories b, c, and e). The household fixed effects specifications in columns 4 and 5 compares plots within the same household.

[a] Considers only investment in contour barriers as dependent variable.

are less likely to invest but the effect is again halved. Although this confirms that insecurity matters, the magnitude of these effects may not be generalized to the entire sample. Column 6 of Table 4 considers only investment in contour barriers. The results are not statistically different from previous findings. On the whole, the results suggest that tenure insecurity has a negative effect on soil conservation investment even in mixed systems where a security-enhancing mechanism could be at work.

When considering the impact of insecurity on female decision makers' investment it is important to notice that only 27% of the female decision makers considered in the cross-section specifications are married, the remainder is either widowed or divorced. Divorced or widowed women are likely to have returned to their village and cultivate the family's plots which could explain the non-negative coefficient reported in column 3. In this case, therefore, the rationale adopted before to explain the results might not apply. However, when considering the fixed-effects sub-sample about 90% of the female decision makers are married and, in almost all cases, the other decision maker is the husband. Insecure female decision makers invest less than their secure male counterpart. While the negative effect could be inflated by a pure gender effect, it may also capture the much more severe "property grabbing" by the husband's relatives which women are often subject to upon the death of their husband (Ligomeka, 2013). Some soil conservation measures could be complementary to the production model adopted by the household. Some households, for example, could engage in agroforestry where trees are grown among crops not for conservation purposes but for production purposes. To isolate the effect of tenure insecurity on conservation rather than on other production choices, the above specifications were applied to a sub-sample of households that produce only maize, and no other product from permanent or semi-permanent plantations. The results are almost unchanged.

Finally, it is worth noting that, although a particular marriage system might be predominant in a particular village, marriages can also be negotiated on neutral grounds and therefore using village-level information might not always provide a good measure of tenure insecurity. One potential problem could also arise if living in a village with a particular marriage system is an endogenous individual choice. Unfortunately, there is not enough information to address this problem. However, when individuals that moved to a village to look for a job, land or to start a new business (about 500 individuals, 6% of the sample) are removed from the sample the results remain almost unchanged.

(c) *The effects of tenure insecurity on investment in trees and the adoption of hybrid seeds*

The results discussed so far have shown that tenure insecurity provides disincentives to adopt soil conservation measures. While these measures have the potential to increase future productivity, they exhibit weaker security-enhancing properties. Their adoption is discouraged by the threat of contract non-renewal and of the loss of use rights due to a gender-biased inheritance system even in villages with a mixed inheritance system.

In this section, tenure insecurity is related to other production choices with various degrees of similarity to conservation measures. Similar to soil conservation measures, trees are another form of land-related investment that can increase productivity in the future but can also generate short-term profits. Growing a mix of trees and annual crops, in fact, is generally more profitable than only growing crops (Bandiera, 2007) but trees might take several years to reach maturity. In Malawi, boundary planting systems are popular ways of clearly define the area of landholding. Trees, therefore, have also the potential of consolidating tenure security, in particular, in villages with mixed-inheritance systems where, despite an unfavourable lineage system, the land user, who resides either in a neutral village or in the village of origin, can use tree boundaries as evidence in case of disputes (Lunduka, 2009).

The top panel of Table 5 reports the cross-section and fixed effects results when the dependent variable is the probability of growing trees. Similar to previous results, short-term tenancy contracts provide a disincentive to grow trees. The probability of investing in conservation measures is 2 percentage points (20%) lower for rented plots (the sample average of the dependent variable is 0.10). Inheritance-related insecurity produces mixed effects on the decision of planting trees. Considering the fixed-effects estimates in column 4, insecure male decision makers in matrilineal-matrilocal villages are less likely to invest in trees. On the other hand, the effect is positive for male decision makers in mixed systems. This latter result is in line with the findings of Lunduka (2009) where investment in trees in Malawi is found to be higher for those decision makers that can consolidate their tenure security by investing in tree boundaries. Similarly findings, although in a different context, are reported in Deininger and Jin (2006) where investment in trees in Ethiopia is found to be positively correlated with tenure insecurity as their visibility can be used to manifest property rights. These results suggest that soil conservation investment exhibit weaker security-enhancing properties than investment in trees and indicate that the adoption of soil conservation measures is more negatively affected by tenure insecurity than other forms of investment.

The second panel of Table 5 considers the decision of planting hybrid seeds. Hybrid seeds are in general more expensive but have higher average yields. They do not provide long-term benefits nor can they help consolidate tenure security. Therefore, the decision of adopting hybrid seeds is not expected to be affected by tenure insecurity in a similar way to conservation measures. The results show that male decision makers in mixed-system villages are more likely to plant hybrid seeds but the effect is not robust to the inclusion of household fixed effects. Therefore, as expected, tenure insecurity due to inheritance practices does not affect the adoption of hybrid seeds. The results also show that richer and more educated households are more likely to adopt hybrid seeds. Short-term tenancy contracts are positively related to the use of hybrid seeds suggesting that other mechanisms might be at work. This is in line with the findings of Chirwa (2005). The author suggests that rented plots are cultivated to generate commercial returns rather than to meet household subsistence needs and production decisions are, therefore, more heavily driven by short-term profitability concerns. However, this effect also becomes insignificant when household fixed-effects are included.

6. CONCLUSIONS

Soil erosion is a serious threat to the long-term sustainability of agriculture in Malawi. Tenure insecurity in Malawi arises from the emerging informal land rental market that only provides short-term contracts and from the gender-biased inheritance practices still adopted by the majority of the population.

Table 5. *Linear regression analysis of the effect of tenure insecurity on investment in trees and hybrid seeds*

Dependent variable: trees	Acquisition methods		Customary land tenure	
	Cross section (1)	Household Fixed effects (2)	Cross section (3)	Household Fixed effects (4)
Short-term tenancy (dummy)	−0.020**	−0.027*		
	(0.008)	(0.016)		
Gender of decision maker (DM) (dummy, 1 = male)	−0.004	0.177***	0.020	
	(0.007)	(0.054)	(0.019)	
Insecure man (c) (dummy)			−0.038*	−0.442**
			(0.021)	(0.175)
Man in mixed systems (b) (dummy)			−0.008	0.074*
			(0.016)	(0.044)
Insecure woman (e) (dummy)			−0.020	−0.024
			(0.014)	(0.042)
Decision maker's education (years)	0.000		0.002***	
	(0.000)		(0.001)	
Household fixed effects	No	Yes	No	Yes
District fixed effects	Yes	No	Yes	No
Observations	17,415	1,746	19,028	341
Households		669		143
Dependent variable: hybrid seeds	(5)	(6)	(7)	(8)
Short-term tenancy (dummy)	0.115***	0.043		
	(0.018)	(0.046)		
Insecure man (c) (dummy)			0.033	−0.295
			(0.034)	(0.381)
Man in mixed systems (b) (dummy)			0.050*	0.194
			(0.028)	(0.141)
Insecure woman (e) (dummy)			0.003	0.064
			(0.024)	(0.171)
Decision maker's education (years)	0.006***		0.005***	
	(0.001)		(0.001)	
Consumption per capita (log)	0.086***		0.079***	
	(0.009)		(0.009)	
Household fixed effects	No	Yes	No	Yes
District fixed effect	Yes	No	Yes	No
Observations	12,087	1,086	10,941	220
Households		653		67

The table reports the results of a linear probability model of different levels of tenure insecurity due to short-term tenancy and different marriage/inheritance systems on investment in conservation. The coefficients represent marginal effects. Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

All previously considered controls are included but not reported. Insecure men (c) are those that moved to a matrilineal–matrilocal village because of marriage. Dummy (b) indicates a man living in a matrilineal–patrilocal or matrilineal–neolocal village or a man living in a matrilineal–matrilocal village but that did not move there because of marriage. An insecure woman (e) lives in a non-matrilineal–matrilocal village. The omitted dummies are those indicating a secure man and woman. The household fixed effects specifications in columns 4 and 5 compare plots within the same household.

Land tenure insecurity has important consequences for investment in soil conversation. The probability of investing in conservation measures is found to be around 6 percentage points (about 14%) lower for rented plots than for inherited and purchased plots. No differences are, instead, found with allocated plots. Considering insecurity from unfavourable marriage/inheritance practices, the results also indicate a relevant effect of tenure insecurity. Investment in conservation is more than 8 percentage points lower for men in matrilineal-matrilocal societies, those with highest tenure insecurity, and more than 3.5 percentage points lower for men in mixed systems. A back-of-the-envelope calculation suggests that overall soil conservation investment would increase by 9 percentage points if both sources of insecurity are tackled.

The nature of land transactions in Malawi is very complex and the simplification of tenure insecurity used in this paper, which is based solely on the matrilineal/patrilineal and matrilocal/patrilocal dichotomies, might neglect some of this complexity. Matchaya (2009), for example, discusses how tenure insecurity can also vary within a village depending on the indigenous or non-indigenous status of a person's parents. Moreover, it would also be interesting to analyze whether a spouse's heir (usually a brother or uncle), who ultimately safeguard the land, do undertake conservation investments on the plots. Unfortunately, the available data do not allow such extensive analysis of cross-household interactions, nevertheless, the results are useful in raising important concerns that are relevant for the on-going land reform process in Malawi.

The findings of this study indicate that an effective land reform should consider introducing land rights in conjunction with addressing the distortive role of existing customary inheritance/marriage practices. In the presence of gendered-bias inheritance practices, land-related investment is discouraged

since the land user can be dispossessed of the land without compensation by the spouse's relatives who ultimately possess the land. In this context, merely securing ownership rights might not produce the desire effects on investment in conservation because ownership and use still remain separate entities. A possible solution would be ensuring inheritance rights for children and surviving spouse in both patrilineal and matrilineal systems. The New Land Policy proposed in 2002 pointed in this direction, but was not implemented due to the lack of the required institutional framework (Holden, Kaarhus, & Lunduka, 2006).

The results also suggest the need for a reform of the land rental market that should introduce formal longer term contracts and more secure rights for both owners and tenants, issues that have not been taken seriously in previous attempt to reform the land market (Peters & Kambewa, 2007).

Gender-biased inheritance and marriage practices are in place in various sub-Saharan African countries. In Zambia, for example, some ethnics groups share similar customary practices to the Chewa group in Malawi. Inheritance and marriage practices vary across and within countries and have not been sufficiently studied in the economic literature. This study shows the importance of acknowledging the crucial role that such customary practices have in affecting tenure security and, consequently, the influence they have on land-related decision making.

NOTES

1. The fairness of the expropriation process is also confirmed in a World Bank's assessment of land governance in Malawi (Jere, 2014).

2. There are only few female decision makers under the most insecure system (patrilineal–patrilocal), therefore, women in the patrilineal–patrilocal system are considered together with those in mixed systems, the aggregated category is labeled "less secure".

3. This is due to poor drainage in the area. Farmers in these areas are aware that contour ridging is not a suitable practice because the reduced infiltration leads to increased runoff and consequently frequent ridge breakage.

REFERENCES

Ali, D. A., Deininger, K., & Goldstein, M. (2011). *Environmental and gender impacts of land tenure regularization in Africa: Pilot evidence from Rwanda* Policy research working paper series 5765. The World Bank.

Bandiera, O. (2007). Land tenure, investment incentives, and the choice of techniques: Evidence from Nicaragua. *The World Bank Economic Review, 21*(3), 487–508.

Berge, E., Kambewa, D., Munthali, A., & Wiig, H. (2014). Lineage and land reforms in Malawi: Do matrilineal and patrilineal landholding systems represent a problem for land reforms in Malawi?. *Land Use Policy, 41*, 61–69.

Besley, T. (1995). Property rights and investment incentives: Theory and evidence from Ghana. *Journal of Political Economy, 103*(5), 903–937.

Besley, T. J., Burchardi, K. B., & Ghatak, M. (2012). Incentives and the De Soto effect. *The Quarterly Journal of Economics, 127*(1), 237–282.

Bezabih, M., Holden, S., & Mannberg, A. (2012). *The role of land certification in reducing gender gaps in productivity in rural* Working paper. Centre for Land Tenure Studies, Norwegian University of Life Sciences.

Brasselle, A.-S., Gaspart, F., & Platteau, J.-P. (2002). Land tenure security and investment incentives: Puzzling evidence from Burkina Faso. *Journal of Development Economics, 67*(2), 373–418.

Chibwana, C., Fisher, M., & Shively, G. (2012). Cropland allocation effects of agricultural input subsidies in Malawi. *World Development, 40*(1), 124–133.

Chirwa, E. W. (2005). Adoption of fertiliser and hybrid seeds by smallholder maize farmers in southern Malawi. *Development Southern Africa, 22*(1), 1–12.

Deininger, K., & Jin, S. (2006). Tenure security and land-related investment: Evidence from Ethiopia. *European Economic Review, 50*(5), 1245–1277.

Deressa, T. T., Hassan, R. M., Ringler, C., Alemu, T., & Yesuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change, 19*(2), 248–255.

Drechsel, P., Gyiele, L., Kunze, D., & Cofie, O. (2001). Population density, soil nutrient depletion, and economic growth in sub-Saharan Africa. *Ecological Economics, 38*(2), 251–258.

Gebremedhin, B., & Swinton, S. M. (2003). Investment in soil conservation in northern Ethiopia: The role of land tenure security and public programs. *Agricultural Economics, 29*(1), 69–84.

Government of Malawi (1995). *The agricultural and livestock development strategy and action plan* Report. Lilongwe, Malawi: Ministry of Agriculture and Livestock Development.

Holden, S. T., Deininger, K., & Ghebru, H. (2009). Impacts of low-cost land certification on investment and productivity. *American Journal of Agricultural Economics, 91*(2), 359–373.

Holden, S. T., Kaarhus, R., & Lunduka, R. (2006). *Land policy reform: The role of land markets and women's land rights in Malawi* Noragric report no.36. Norwegian University of Life Sciences.

Holden, S., Otsuka, K., & Place, F. (2008). *The emergence of land markets in Africa: Impacts on poverty, equity and efficiency*. Washington. DC: Resources for the Future press.

Jacoby, H. G., & Mansuri, G. (2008). Land tenancy and non-contractible investment in rural Pakistan. *The Review of Economic Studies, 75*(3), 763–788.

Jere, P. (2014). *Improving land sector governance in Malawi, Report: Implementation of the land governance assessment framework*. World Bank.

Kishindo, P. (2010). The marital immigrant. Land, and agriculture: A Malawian case study. *African Sociological Review, 14*(2), 89–97.

Ligomeka, B. (2013). *Culture Malawi: Property grabbing impoverishes widows* News article. Inter Press Service News, 8 October 2003, Accessed: 28 march 2013.

Lunduka, R. W. (2009). *Land rental markets, investment and productivity* (Ph.D. thesis). Department of Economics and Resource Management, Norwegian University of Life Sciences.

Matchaya, G. (2009). Land ownership security in Malawi. *African Journal of Agricultural Research, 1*(4), 001–013.

O'Neal, M., Nearing, M., Vining, R. C., South worth, J., & Pfeifere, R. (2005). Climate change impacts on soil erosion in Midwest United States with changes in crop management. *Catena, 61*, 165–184.

Peters, P. E. (2010). "Our daughters inherit our land, but our sons use their wives' fields": Matrilineal–matrilocal land tenure and the new land policy in Malawi. *Journal of Eastern African Studies, 4*(1), 179–199.

Peters, P. E., & Kambewa, D. (2007). Whose security? Deepening social conflict over customary land in the shadow of land tenure reform in Malawi. *The Journal of Modern African Studies, 45*, 447–472.

Place, F. (2009). Land tenure and agricultural productivity in Africa: A comparative analysis of the economics literature and recent policy strategies and reforms. *World Development, 37*(8), 1326–1336.

Place, F., & Otsuka, K. (2001a). Population, tenure, and natural resource management: The case of customary land area in Malawi. *Journal of Environmental Economics and Management, 41*(1), 13–32.

Place, F., & Otsuka, K. (2001b). Tenure, agricultural investment, and productivity in the customary tenure sector of Malawi. *Economic Development and Cultural Change, 50*(1), 77–100.

Reniers, G. (2003). Divorce and remarriage in rural Malawi. *Demographic Research, S1*, 175–206.

Shiferaw, B., & Holden, S. (1999). Soil erosion and smallholders' conservation decisions in the highlands of Ethiopia. *World Development, 27*(4), 739–752.

Takane, T. (2008). Customary land tenure, inheritance rules, and smallholder farmers in Malawi. *Journal of Southern African Studies, 34*(2), 269–291.

Wooldridge, J. (2002). *Econometric analysis of cross section and panel data*. Cambridge, Massachusetts: The MIT Press