Investment Impacts of Gendered Land Rights in Customary Tenure Systems: Substantive and Methodological Insights from Malawi

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Invited Paper prepared for presentation at the
2022 AEA/ASSA Annual Meeting VIRTUAL, January 7-9, 2022

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Abstract: Although most of the world's agricultural land is cultivated under customary tenure regimes that tend to change over time in response to exogenous factors, the impact of customary rights on productivity and investment remains under-researched. Using unique data from an experiment in Malawi, we show that (i) parcel-level bequest and sale rights affect investment and cash crop adoption; (ii) impacts are gender-differentiated - women's rights affect investment and men's cash crop adoption- and vary by inheritance regime; and (iii) measurement error associated with traditional approaches to survey data collection easily obscures these effects. Beyond reinforcing the need for careful empirical research, this suggests that gradual erosion of women's customary rights may reduce land related investment and that measures other than titling (e.g. changes in family law or legal support) may enhance it.

JEL Codes: C83, J16, O13, Q15.

Keywords: Land rights, Gender, Agricultural growth, Survey methodology, Malawi

1. Introduction

While a large literature has discussed investment and productivity effects of land rights formalization, the impact of individuals' tenure security under traditional regimes received much less attention. This is a serious knowledge gaps particularly in Africa where most of rural land is managed under customary tenure and rights of vulnerable groups such as women, migrants or herders may be the first to be attenuated with increased competition for land. To help fill these gaps, we use unique survey data from Malawi to show that individuals' bequest and sale rights significantly affect investment and cash crop adoption; that the gender of right holders, together with local institutional arrangements, matters for such outcomes; and that these effects may be obscured by measurement error associated with traditional survey data collection methods.

How individuals can access land or exercise their land rights has far-reaching implications for their well-being and ability to take advantage of economic opportunities. While formally documented rights are the norm in developed countries, across the developing world -especially in rural Africa- formalization remains out of reach for the majority of the population. Instead, land is almost exclusively accessed through customary arrangements that are administered by traditional authorities. Individuals' land rights in such systems depend on societal status (Honig 2017), the strength of exiting social ties (Gochberg 2021) and relationships with local leaders (Goldstein and Udry 2008).

The literature has long highlighted that, as long as land is relatively abundant, customary systems' ability to flexibly adjust to changes in external conditions allows use of land as a social safety net (Andolfatto 2002) and for mutual insurance (Beck *et al.* 2019). Where risk is high and other mechanisms for insurance

are absent, this is a key advantage (Bruce and Migot-Adholla 1994) that may well lead land owners to prefer traditional arrangements to more formal alternatives (Atwood 1990).

Yet, once land becomes more scarce, conflicts that are difficult for traditional authorities to resolve in a predictable way may exacerbate insecurity (Eck 2014) and leaders may act in their own, rather than the group's, best interest (Greiner 2017). This can lead to a divergence between private and social benefits so that land may be privatized even if doing so reduces overall social welfare (Leeson and Harris 2018). It can also trigger shifts in land rights within the household that may disadvantage women even if legal provisions to protect their rights are in place (Djurfeldt 2020). Growing land demand, possibly exacerbated by exogenous shocks such as the 2007/08 food and financial crisis or the COVID-19 pandemic, may thus gradually erode land rights by groups such as women, migrants, and pastoralists. These changes may affect equity and, via their effect on investment incentives and the ability to transfer land, efficiency. Given the large amount of land under customary tenure globally and expected increase in demand for food in developing countries, documenting levels of and changes in individuals' land rights under customary tenure and exploring their productivity effects is thus of high policy and analytical relevance.

To provide substantive and methodological insights on the link between individuals' land rights and investment, this paper focuses on the case of Malawi, a poor and predominantly rural country that relies heavily on agriculture and that exhibits wide variation in institutional arrangements regulating land access. We rely on two nationally representative surveys, the Malawi Integrated Household Panel Survey (IHPS) and the Fourth Integrated Household Survey (IHS4), that were conducted in parallel in 2016/17 by the Malawi National Statistical Office. Both surveys elicited individual-disaggregated parcel-level data on reported, documented, and economic ownership and on rights to bequeath, sell, rent out, use as collateral, and invest. These data allow us to explore the extent to which such rights affect investment and diversification (proxied by organic manure application and cash crop planting) relying on within-household variation in rights for identification.

While the two surveys' instruments are virtually identical, they adopted fundamentally different approaches to respondent selection that allow us to explore impacts of data collection methodology on the subsequent empirical findings related to land rights and investment. The IHPS aimed to conduct private interviews with each adult household member to elicit information regarding their personal ownership and rights for each parcel. This is a higher cost approach that is likely to result in higher data quality. Conversely, the IHS4 followed the traditional approach to survey data collection using proxy respondents, i.e. interview the self-identified most knowledgeable household member for each parcel to identify owners and right holders within the household. By comparing results from analysis of both data sets, we are able to draw rigorous inferences on the impact of data collection methods on survey responses and measurement of land rights.

At a descriptive level, we demonstrate that the standard practice of obtaining data on individuals' land rights from proxy respondents -even if they profess to be knowledgeable- rather than directly interviewing (co-) owners under- (over)estimates the extent to which women (men) have (co-)ownership rights while exhibiting the opposite bias in terms of the type of rights female or male (co-)owners can exercise.

Regression analysis using the IHPS data as -reported by all individual parcel owners suggests that gender-specific rights to transfer land via bequest or sale -but not short-term rights to make decisions on investment or production- affect investment and diversification into cash crops. Right holders' gender matters on its own and in interactions with local norms: Female bequest and, in non-matrilineal inheritance regimes, sale rights affect investment in soil fertility (proxied by the use of organic manure) whereas male bequest rights increase the level of cash crop adoption.

These results cannot be replicated using the data from the IHS4 which relies on proxy reporting to elicit information on household members' parcel ownership and rights although the much larger IHS4 sample (more than six times that of the IHPS) should in principle generate more precise estimates. One explanation could be that information on (informal) land rights is not fully shared within the household, similar to what is observed for other types of assets (Ashraf 2009). The fact that attempts at replication fail also for the subset of parcels for which survey respondents claimed to be (co)-owner may also suggest that interviewees respond strategically -either by wrongly claiming rights they do not possess or by failing to mention other co-owners. Irrespectively of the reason -which could be explored by follow-up research- this suggests that measurement error due to information on land rights being provided by proxy respondents rather than owners directly could be one reason for insignificant or contradictory findings on the effect of informal land rights in the literature (Kang *et al.* 2020).

The evidence provided here contributes to several strands of the literature. First, we add to the literature on empowerment and productivity impacts of female land rights and asset ownership. Earlier studies documented the impact of individual asset ownership on women's agency, the relevance of land as a key asset in developing countries (Meinzen-Dick *et al.* 2019), and the importance of female inheritance rights for investment (Dillon and Voena 2018). We add to this by showing that, in contrast to short term management rights the fluidity of which is a key advantage of customary tenure, long-term individual rights to bequeath or sell affect land use and investment. Insofar as nature and strength of such rights may change with customary systems' evolution over time, it will be important for the analytical debate to transcend the dichotomy of statutory vs. customary and instead focus on individuals' ability to exercise specific rights.

Second, though earlier studies noted that male and female household members' perception of their rights to the same plot may differ from each other (Twyman *et al.* 2015), to the best of our knowledge,

ours is the first study to show that measurement error potentially inherent in how standard household surveys measure gender differences in land rights may affect the substantive conclusions derived from such data. This reinforces the importance of survey research to develop improved methods of microdata collection (see Carletto and Gourlay (2019) for a review) to assess and if needed revise or adjust relationships that have long been accepted as 'stylized facts' of development (Christiaensen 2017).

Third, evidence of considerable variation in informal rights across localities illustrates that customary institutions are neither static nor monolithic and that study of the incentive structures affecting customary leaders' behavior is likely to be a fruitful area for research. Such behavior and the resulting socio-economic outcomes are affected by factors including (i) traditional authorities' legal status (Henn 2020) and ability to interact with statutory institutions, in particular local government (de Kadt and Larreguy 2018); (ii) leaders' local presence and access to private information (Casey et al. 2019); and (iii) mechanisms to hold traditional leaders and local authorities to account (Baldwin 2018). Given exogenous changes affecting customary tenure systems, ways to strengthen individuals' rights by adopting governance arrangements and institutional mechanisms that incentivized effective land management in customary settings such as Mexico (de Janvry *et al.* 2015; Zepeda 2000) or Colombia (Vélez *et al.* 2020) will be of great importance.

Finally, our study contributes to the large literature on land rights regularization. We show that the size of estimated effects from improving tenure security is comparable to or in excess of those often attributed to land right formalization (Fenske 2011; Lawry *et al.* 2016). This suggests that, even if creation of functioning and viable land registries is a long-term goal, traditional models of individual titling may not be the only or the most expeditious and effective way to secure land rights. Legal and regulatory reforms to improve women's bequest rights, as implemented for example in Kenya (Harari 2019), might yield productivity benefits comparable in size to those from land titling more quickly and at lower cost. Legal support to resolve land disputes was similarly shown to increase security of property rights and investment (Aberra and Chemin 2021). Further study to explore the impact of such measures compared to land titling in rural areas and the scope for enhancing it -e.g. via awareness raising- is needed.

The rest of the paper is structured as follows. Section 2 discusses evidence regarding the effect of female rights to land and provides an overview of the salient characteristics of Malawi's land sector. Section 3 discusses data sources and descriptive statistics and introduces the empirical strategy. Section 4 discusses the results and section 5 five concludes with implications for data collection and future research.

2. Context and approach

A large body of evidence suggests that formally documenting land rights can improve investment incentives and operation of factor markets and female empowerment. However, despite their prevalence and recent far-reaching changes in the way they operate (Chimhowu 2019), much less is known about the nature of land rights and their impact on productivity in customary settings where formal documentation is absent. High land pressure, co-existence of matrilineal and patrilineal inheritance regimes, and a recently adopted land law make Malawi an interesting case. Moreover, we discuss methodological challenges with obtaining information on individual land rights and measuring investment impact in these circumstances.

2.1 Conceptual framework

The literature has long emphasized that formally documenting land rights can have multiple benefits. By reducing expropriation risk (Besley and Ghatak 2010) and making it easier to identify owners or boundaries (Ali *et al.* 2014; Deininger *et al.* 2008), it can create incentives for land investments; allow transactions with unrelated third parties; and free up resources that would otherwise have been spent on protecting claims (Goldstein *et al.* 2018). Providing reliable information on land ownership and contracts via public registries can also provide the basis for long-term transfers to improve the efficiency of resource allocation (Restuccia and Santaeulalia-Llopis 2015); encourage movement of labor between agriculture and non-agriculture (Chen 2017); and facilitate migration (de Janvry et al. 2015) in the context of economic transformation. Active land markets can furthermore permit the use of land as collateral for credit (Deininger and Goyal 2012).

In many cases, efforts to document individuals' land rights proved particularly advantageous for women, largely because in contrast to traditional settings where women's land rights are defined through their connections (Goldstein and Udry 2008) and relationships (Jayachandran 2015), written documents make it easier to enforce claims through formal channels. Consistent with the evidence on the impact of changes in female asset ownership,[2] registering women as land owners has been shown to reduce the need for female guarding labor (Field 2007; Goldstein *et al.* 2018); increase investment especially by female-headed households (Ali *et al.* 2014); enhance women's participation in land (Holden *et al.* 2011) and labor markets (Newman *et al.* 2015); and augment future generations' welfare (Menon *et al.* 2014). Such impacts were found even if certificates were not transferrable, as in Madagascar (Widman 2014) or land sales are legally prohibited, as in Ethiopia (Deininger *et al.* 2008; Kumar and Quisumbing 2015; Melesse *et al.* 2018; Muchomba 2017).[3]

[2] Interventions augmenting female asset ownership were shown to reduce consumption of male-favored goods (Wang 2014) and to increase girls' survival rates (Qian 2008), their anthropometric status (Duflo 2003), and their level of schooling (Deininger *et al.* 2013; Luke and Munshi 2011).
[3] In Ethiopia. investment and empowerment effects of land certification were amplified by family law reform (Kumar and Quisumbing 2015).

Yet, although recent technological developments reduced the costs of formalization by orders of magnitude, maintaining national land registries requires resources, organizational capabilities, and a suitable regulatory framework. Absence of one or more of these factors imply that in most of rural Africa land rights continue to be administered by traditional leaders under customary arrangements (Boone 2019). Such systems normally prohibit land transfers to outsiders and guarantee land access for lineage members (Baland and Francois 2005), thus preventing destitution (Andolfatto 2002). Appreciation of their risk-sharing benefits and cost advantages has traditionally led experts to view customary systems as the most viable option in many settings (Bruce and Migot-Adholla 1994). This prompted many countries to recognize customary tenure by law (Alden Wily 2018) although such provisions often have limited impact on the ground due to implementation gaps (Bubb 2013).

In the last decades, customary practices changed markedly (Berry 2017) in response to population growth (Greiner 2017), external land demands (Lentz 2010) and changes in chiefs' power relative to wealthy individuals (Chimhowu 2019), and social stratification (Yaro 2013). As a result, modern and traditional systems often co-exist in ways that increase contestability and insecurity (Eck 2014) and reduce customary systems' risk sharing advantages (Delpierre *et al.* 2019) with negative consequences especially for weaker groups such as migrants and women (Bambio and Bouayad Agha 2018).

A first indication of the erosion of vulnerable groups' longer-term rights can be an increase in land disputes, often linked to inheritance and disproportionately affecting women (Deininger and Castagnini 2006). As inheritance rights have been found to affect incentives for adopting productivity-enhancing practices (Dillon and Voena 2018), such changes in women's security could reduce productivity and female well-being more broadly.[4] In fact, reforms to equalize women's inheritance rights in Kenya -albeit not applied equally over the country (Linkow, 2019)- had multiple positive impacts on women's livelihoods (Harari 2019). However, whereas in formal systems the type of right associated with each document is defined by law and holders' names documented in writing, individual rights in customary systems are more fluid.

2.2 Nature and relevance of land rights in Malawi

Malawi is one of Africa's poorest and most densely populated countries with an economy that is heavily dependent on agriculture. Historically, land allocation in Malawi has been dualistic: land for cultivation of commercial crops was provided to estates under freehold or leasehold (Deininger and Xia 2017) while smallholders were left to produce food crops, mainly maize, under customary tenure. Although restrictions

[4] While access to inherited land increased women's level of self-employment and earnings in Ethiopia (Kumar and Quisumbing 2012), data from Demographic and Health Surveys for 15 African countries show that there are only two countries (Rwanda and Senegal) where widows and their children inherit most of a deceased's assets whereas in more than half of the countries (Benin, the Democratic Republic of Congo, Guinea, Mali, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda, Zambia and Zimbabwe), widows report no inheritance of assets whatsoever (Peterman 2012).

on small farmers' participation in cash crop cultivation were eliminated in the 1990s, smallholders' limited resources (Ricker-Gilbert *et al.* 2014) and vulnerability to risk, particularly in the face of climate-related shocks (Sesmero *et al.* 2018), constrained their ability to diversify into other crops or to adopt more demanding measures for managing soil fertility (Krah *et al.* 2019).

Malawi's agricultural production is thus still dominated by maize, a staple that has limited scope for value addition and employment generation. Despite unequal coverage, fertilizer subsidies may further have crowded out more sustainable practices (Khataza *et al.* 2017), such as use of organic manure (Holden and Lunduka 2012). Growing land scarcity also triggered land disputes (van Donge 1999), often centered around inheritance that can reduce tenure security and lead to quantitatively large productivity losses, especially for women (Deininger *et al.* 2019).[5]

An important characteristic of Malawi's land tenure system is the co-existence of matrilineal and patrilineal inheritance systems. These may affect land-attached investment and productivity of land use through several channels. First, to the extent that they give individuals control over assets, inheritance regimes may affect spouses' outside options.[6] Higher levels of household consumption in matrilineal as compared to patrilineal systems has also been attributed to differences in women's tenure security across inheritance regimes (Telalagic 2014). Also, in matrilineal systems support women may receive from their kin group can increase the cost of domestic violence for husbands and create incentives for investment in children's well-being and education as part of women's menu of outside options, (Lowes 2020). Conversely, women in patrilineal systems seem more vulnerable to climate shocks (Asfaw and Maggio 2018), possibly because of limited outside options and lower levels of tenure security,.

Second, as the ability to decide on transfers of land rights affects investment decisions (Deininger and Jin 2006), women's ability to influence the nature of intergenerational land transfers in matrilineal but not patrilineal systems could affect individuals' willingness to make land-attached investments. While some studies including Place and Otsuka (2001), Lunduka (2009) and Lovo (2016) suggest matrilineal systems may be associated with lower levels of agricultural investment, others such as Benjamin (2020) finds the opposite.

With the objective of integrating customary and statutory rights in innovative ways, Malawi passed a new land law in 2016. The law aims to demarcate territories controlled by individual traditional leaders and establish participatory and gender-balanced institutions that could help to improve enforcement as a pre-

[5] With 22% of farmers fearing potential land loss, annual losses due to tenure insecurity are estimated at US$14 million (Deininger *et al.* 2019).
[6] While historically, matrilineal inheritance regimes are related to the physical force required for food provision (BenYishay *et al.* 2017), there is some evidence of short-term changes in Malawi which are particularly relevant as divorce rates are high (Cherchye *et al.* 2016).

condition for documenting individuals' rights.[7] It also mandates land to be inherited equally among males and females, a suggestion that has been controversial with scholars who argue that, by adopting concepts alien to local culture, such change could disenfranchise women on a massive scale (Peters 2010).

2.3 Methodological considerations

To assess gender-differentiated investment impacts of land rights under customary tenure, reliable information on individual land rights needs to be obtained and paired with indicators for investment. Regarding the first point, a large body of survey research indeed highlights the importance of eliciting parcel-level information on individuals holding rights to bequeath, sell, rent, use as collateral, and make improvements/invest (Doss et al., 2019). Yet, very little is known on the extent to which survey respondent selection affects results: while asking all adult individuals in private about their personal ownership of and rights to assets is the most desirable and recommended approach, the high cost of doing so led most large-scale surveys to obtain this information from the 'most knowledgeable household member' as a proxy (Kilic et al., 2020).

To assess whether or to what extent data collection methods affect results, we make use of a unique survey experiment whereby Malawi's National Statistical Office conduced two nationally representative surveys that differed from each other only in the way in which information on key variables was obtained in parallel. These surveys are the Fourth Integrated Household Survey 2016/17 (IHS4), a cross-sectional survey of 12,447 households, and the Integrated Household Panel Survey 2016 (IHPS), a longitudinal survey of 2,508 households that had been followed since 2010.[8] The IHS4 asked the self-identified most knowledgeable household member to provide information on household members' ownership of and rights to agricultural parcels and other assets.[9] On the other hand, the IHPS aimed to conduct private interviews with each adult household member on his/her personal ownership of and rights to the residential and each agricultural parcel. First the roster of parcels was constructed at the household-level and then fed forward into each individual-level interview. In contrast to the IHS4, the IHPS questions on land rights for a parcel were asked only if the respondent identified him or herself as a (co)-owner.[10]

A second methodological issue of relevance for our analysis relates to the choice of the outcome variables to serve as a proxy for land-attached investment. Agronomic trials show that, similar to the 'green manure'

[7] The law aims to demarcate traditional land management areas (TLMAs) and establish customary land committees (CLCs) with at least 50% female participation, normally at Group Village Headman level.

[8] Data, questionnaires and basic information documents for the IHS4 2016/17 and the IHPS 2016 can be accessed here and here. Both surveys were implemented with technical and financial assistance from the World Bank Living Standards Measurement Study Integrated Surveys on Agriculture (LSMS-ISA) using the Surveys Solutions Computer-Assisted Personal Interviewing (CAPI) platform. Implementation of individual interviews as part of the IHPS 2016 received technical and financial support from the World Bank LSMS Plus (LSMS+) initiative, aiming to enhance the availability and quality of individual-disaggregated survey data collected in low- and middle-income countries on key dimensions of men's and women's economic opportunities and welfare.

[9] A parcel (referred to as 'garden' in Malawi) is a contiguous piece of land under a specific type of tenure that can comprise multiple plots, defined by the types of crop grown.

[10] The basic information document for the survey (https://microdata.worldbank.org/index.php/catalog/2939/download/47216) and Kilic et al. (2020) give more information on survey organization and implementation modalities for individual data collection under the IHPS.

added by fallowing (Paustian *et al.* 2019), the application of manure adds to the stock of soil organic carbon (Liu *et al.* 2013) which in turn is a key determinant of long-term soil fertility and productivity (Ng'ang'a *et al.* 2019). Evidence of long-lasting effects of manure on soil carbon led studies to suggest past fertilizer application be included routinely in yield regressions (Njoroge *et al.* 2019). Significant threshold effects - whereby a minimum level of soil carbon that is required for synthetic fertilizer to be effective- were found in Kenya (Marenya and Barrett 2009).

Application of organic manure at parcel level has been used as an indicator of long term investment by Gavian and Fafchamps (1996) for Niger, by Dillon and Voena (2018) in Zambia and by Bros *et al.* (2019) for Cote d'Ivoire and, beyond Africa, in studies of China (Jacoby *et al.* 2002) and Pakistan (Jacoby and Mansuri 2008). We follow this literature in using organic manure application as our main indicator of investment. An added advantage of this variable is that whether or not manure was applied is not readily observed. As such, we can rule out the presence of reverse causality that would have been a concern with the use of more "visible" visible investments (e.g. tree planting) that are often made to strengthen rights rather than improve soil fertility and future yields Brasselle *et al.* (2002).

Adoption of cash crops on a parcel has also been argued to depend on secure land rights in earlier studies from Malawi (Place and Otsuka 2001).[11] While land-related investment will have beneficial effects on any subsequent crops, realizing possible benefits from cash crop adoption requires integration into output and often also input markets. This is an area where their higher social position has been found to give Malawian men a distinct advantage (Bhaumik *et al.* 2016). We use this variable as another indicator for investment but note that, if the above is true, we might expect to see stronger land rights to increase cash crop adoption only for men who can more easily access other markets than women who tend to be responsible for food crops (Djurfeldt *et al.* 2018).

3. Data, descriptive statistics, and empirical approach

Descriptive analysis of our data shows that (co)-owners often do not have the full bundle of rights and that women lag men in all rights. Comparing descriptive statistics between surveys that rely on self-reporting (IHPS) or proxy responses (IHS4) suggests similar aggregate figures conceal important discrepancies at lower levels of aggregation. Compared to data provided by individuals directly, proxy respondents (i) overstate levels of male (co-)ownership, (ii) understate levels of female (co-)ownership, and (iii) for parcels that are reported as (co-)owned, introduce an upward bias as to the rights held by women and a corresponding downward bias regarding rights held by men. The latter could be consistent with either

[11] Cash crops also make a key contribution to gender differences in agricultural productivity in Malawi (Kilic *et al*., 2015).

informational imperfections or strategic response patterns. Econometric analysis to ascertain the net effects investment and land use is thus needed and we discuss the empirical framework to be used.

3.1 Data and descriptive statistics

The mean values for key variables at the household- and parcel-level from the analysis sample of parcels that were reported to be owned are provided in Table 1 for the IHPS (column 1) and the IHS4, split into the total sample (column 2) and the sample of respondents claiming to be owner or co-owner of the parcel in question (column 3). The average household has about 5 members, with a 44-year old head. Eighty percent of heads of households are Christian; approximately 30 percent are female; 70 percent can read and write Chichewa; and have an average of 5.5 years of education. The mean area for agricultural parcels is 0.4 hectare and the incidence of organic fertilizer application and cash crop cultivation is 23 percent and 6 percent, respectively. The residential parcels are smaller and dwellings on them have been occupied for an average of 7 years. 60 percent of household residential dwellings have improved roofs, walls, or floors.[12] As only 2.3 percent (in IHPS) or 1.6 percent (in IHS4) of households report to have formal documentation to agricultural land, or 3.6 percent or 1.6 percent, respectively, to residential land, we focus on individual (co)-owners' rights at the parcel level irrespective of whether or not formal documents exist.[13]

Data on rights for agricultural parcels in Table 2 reveals some interesting observations. First, at household-level, (co)-owners often can only exercise a subset of the rights generally associated with full ownership and the incidence of short-term rights is higher than that of long-term ones. The IHPS data in panel A suggest that members of (co)-owners' households can make cultivation decisions for 87 percent of parcels, followed by rights to invest (84 percent), to transfer/mortgage (75 percent), to bequeath (72 percent), and to sell (66 percent).[14] The same general pattern is observed for IHS4 data (panel B) that point to a similar share of parcels that can be sold (64%) and a slightly higher one (75%) that can be transferred via bequest.

Second, compared to individually reported information (from the IHPS), data provided by proxy-respondents (IHS4) overestimate the extent of (co)-ownership for men and underestimate it for women. The share of agricultural parcels reported to be (co)-owned by females in the IHPS is 4 percentage points higher than the comparable figure from the IHS4. In contrast, the share of agricultural parcels reported to be (co)-owned by males in the IHPS is 9 percentage points lower than the comparable figure from the IHS4.

[12] We define improved walls to be made of burnt bricks and/or concrete, improved roofs to be made of iron sheets, clay tiles, and/or concrete, and improved floors to be made of smooth cement, wood, and/or tiles. We compute an 'improvement index' by adding dummies for each of the indicators and dividing by 3.

[13] Evidence on formal rights suggests that, for agricultural land, individuals with formal rights are more likely to have the right to bequeath and sell, an outcome driven by men's rights as there is no significant difference for women. Similarly, men with formal documents are more likely to have bequest and sale rights but there is no difference in the aggregate.

[14] The share of parcels that can be bequeathed is, with 80%, highest in communities in which the dominant inheritance regime is patrilineal, followed by matrilineal (71%) and mixed (69%) inheritance regimes.

Finally, conditional on female (male) (co)-ownership, proxy reporting in the IHS4 seems to overstate the specific rights that can be exercised by female owners while understating the rights that can be exercised by male owners. For agricultural parcels that are (co)-owned by females, the IHS4 data indicate a much lower incidence of bequest rights (69 percent) vis-a-vis the IHPS (60 percent). This pattern is less pronounced for the right to sell. The opposite is true for parcels that are (co)-owned by males. The IHPS average parcel-level incidence of male rights to bequest and sell are 77 percent and 69 percent, respectively. The comparable estimates based on the IHS4 stand at 73 percent and 64 percent, respectively.

3.2 Empirical approach

We use parcel-level planting of organic fertilizer application and cultivation of cash crops (tobacco, cotton, sunflower, sugar cane, and pepper) in the current season as proxies for land investment. After aggregating plot-level survey data on manure application and cash crop cultivation to the parcel level,[15] we estimate:

$$Y_{ij} = \alpha_j + \beta R_{ij} + \gamma X_{ij} + \epsilon_{ij} \qquad (1)$$

where $Y_{ij}$is defined above; α_j controls for unobserved household fixed effects (e.g. risk-bearing capacity) that are invariant across parcels; R_{ij} is a vector of parcel-specific indicators of land rights for those who report or are reported as land owners; X_{ij} is a vector of parcel controls including size, soil type, slope, and location in a swamp/wetland that in some specifications also includes household labor days used;[16] and ϵ_{ij} is an error term. As public programs including input subsidies (Asfaw *et al.* 2017) are administered by any one of Malawi's 28 districts, we cluster errors at the district-level and use the wild cluster bootstrap (Roodman *et al.* 2018) to account for the small number of clusters. Ultimately, we are interested in β, the coefficient vector capturing the effect of different types of land rights on land-attached agricultural investment (i.e. manuring or cash crop adoption).

To allow for heterogeneity of effects by gender, we denote women's and men's land rights by R_{ij}^{f} and R_{ij}^{m}, respectively: R_{ij}^{f} is an indicator variable for women's land rights that equals one if at least one woman in household *j* reports (or, in the case of IHS4 data is reported as) having land rights of a certain type to parcel i. R_{ij}^{m} is the equivalent indicator variable for men's land rights that equals one if at least one man in household *j* has rights of a certain nature to parcel i. Formally, we modify (1) as follows

[15] Formally, we index plots by *s*, parcels by *i* and households by *j* and compute organic fertilizer application or plating of cash crops on parcel *i* of household *j* as $Y_{ij} = \frac{\sum_{s=1}^{S} y_{sij} \times a_{sij}}{\sum_{s=1}^{S} a_{sij}}, y_{sij} = \begin{cases} 1 & if\ organic\ ferilizer\ was\ applied\ or\ cash\ crops\ planted\ on\ plot\ s \\ 0 & otherwise \end{cases}$
where y_{sij} is an indicator variable for organic fertilizer application or planting of cash crops by household *j* on plot *s* of parcel *i*, and a_{sij} is the plot size in hectares.

[16] Parcel level characteristics, also aggregated from plot-level information weighting by plot size, includes size, soil type (sand, sandy/clay, or clay); inclination (flat, slightly sloped, moderately sloped, or hilly).

$$Y_{ij} = \alpha_j + \beta_1 R_{ij}^f + \beta_2 R_{ij}^m + \gamma X_{ij} + \epsilon_{ij} \qquad (2)$$

where β_1 and β_2 are estimated effects of land rights being held by women or men, respectively, and $\beta_1 + \beta_2$ denotes the estimated effect of rights being held jointly by male and female household members.

As the nature of rights and ability to enforce them can vary by inheritance regime, we let I_j be an indicator variable for household *j* living in a community with a patrilineal/mixed inheritance regime and estimate

$$Y_{ij} = \alpha_j + \beta_1 R_{ijc}^f + \beta_2 R_{ij}^m + \beta_3 R_{ij}^f * I_j + \beta_4 R_{ij}^m * I_j + \gamma X_{ij} + \epsilon_{ij} \qquad (3)$$

where β_1 and β_2 indicate estimated effects of women's and men's rights in matrilineal communities while β_3 and β_4 indicate if women's or men's rights affect outcomes differently in non-matrilineal communities.

4. Results

Analysis of the IHPS data suggests that rights to bequeath and sell -but not to make short-term decisions- affect land-attached investment. Women's right to bequeath land in matrilineal systems or to sell it in non-matrilineal ones affects organic manure use while men's bequest rights affect take-up of cash-crop production. Using the full IHS4 data or the subset of self-reported (co-)owners yields completely different and often counterintuitive results, suggesting that beyond measurement error due to respondents' lack of knowledge, reliance on proxy respondents may also encourage strategic behavior.

4.1 Evidence from self-reported IHPS data

The results from household fixed effects regressions for application of organic manure and planting of cash crops are presented in table 3 (with rights undifferentiated by gender), 4 (with gender differentiated rights), and 5 (with gender differentiated rights and interaction with inheritance regimes). In each of these tables, regression results without (with) parcel-level characteristics are in columns 1 and 4 (2 and 5) while results with household labor inputs as an additional right hand side variable are in columns 3 and 6.

In table 3, rights to make decisions or invest are consistently estimated to have insignificant effects regardless of the outcome variable. By contrast, transfer rights are highly significant in all specifications, similar to what was found in Ethiopia (Deininger and Jin 2006): the right to bequeath or sell land is estimated to significantly increase the likelihood of long-term investment via organic manure application. With 0.12 and 0.07 percentage points, the estimated effects are large; increasing bequest or sale rights by half a standard deviation (0.2) each would be expected to lead to an increase in organic manure application by 10 percent or 6 percent from the mean value of 0.23. The estimated effects are weaker for cash crop production where bequest rights are marginally significant at the 10% level if parcel characteristics are

controlled for. An estimate of 0.06 points suggests that increasing bequest rights by half a standard deviation would increase cash crop production by 17 percent.

Exploring differences by right holders' gender points towards marked differences between manure use and cash crop production (Table 4). Female bequest rights emerge as key determinants of long-term investment. The estimated coefficient of 0.16 is highly significant and large: an increase of women's bequest rights by half a standard deviation (0.2) each is estimated to increase manure application by 13 percent. This is consistent with evidence of inheritance rights as key determinants of long-term investment in the form of applying organic manure in Zambia (Dillon and Voena 2018) using a completely different specification.

By contrast, the adoption of cash crops is estimated to be enhanced by males' bequest rights with an increase of male bequest rights by half a standard deviation (0.2) predicted to increase cash crop production by 49 percent. This is consistent with the argument advanced by Bhaumik *et al.* (2016) that males have better access to markets for output and other factors of production, especially capital. It suggests that secure long-term rights to the land in question will be conducive to such cash crop adoption.

Interacting men's and women's rights with the prevalent inheritance regime leaves estimates of impacts of female bequest rights on organic manure use virtually unchanged (see Table 5) while pointing towards no significant difference between matrilineal and patrilineal systems. Significant coefficients on women's right to sell land in non-matrilineal systems suggest, however, that in such a regime, women's ability to sell land further increases the likelihood of long-term investment. With a point estimate of 0.24, the estimated effects of increasing sales rights are meaningful economically. By comparison, the significance of estimated effects of male bequest rights on cash crop adoption weaken slightly in this specification.

4.2 Comparing results from self-reporting to those from indirect reporting

As the size of the IHS4 sample exceeds that of the IHPS by an order of magnitude, it should, in the absence of measurement error, result in more precise coefficient estimates of the impact of land right variables that were included in both surveys. Inability to replicate results from the IHPS using the full or restricted IHS4 samples points towards presence of not only measurement error but also strategic response bias in most cases. Tables 6 through 8 report the results from estimating equations (1) to (3) with the IHS4 data, with a focus on the bequest and sale rights. Columns 2 and 5 of each table include the results based on the full IHS4 sample; columns 3 and 6 include the results based on the sample of IHS4 respondents who report to be (co-)owners; and columns 1 and 4 include the results based on the IHPS sample for comparison.

While both the IHPS and the full IHS4 samples point towards weakly significant positive effects of bequest rights on use of organic manure, the estimated coefficient is much smaller for the full IHS4 sample and loses significance if only owner-respondents are considered (Table 6). The estimated effects of land rights

on cash crop production are insignificant throughout. The loss of significance is consistent with the notion that relying on one respondent per household only increases measurement error that is not eliminated for those claiming to be a (co-)owner of a parcel.

Allowing for heterogeneous effects by gender (Table 7) accentuates the differences between the two surveys: compared to a point estimate of 0.16 for the impact of female bequest rights on manure use, estimates for both IHS4 samples are insignificantly different from zero for bequest and sale rights. For planting of cash crops, where the IHPS sample suggests a positive and significant coefficient on male bequest rights with an estimate of 0.19, the results from the full and restricted IHS4 samples imply insignificant effects of male rights and negative and significant effects of female bequest rights.

Finally, interacting gender-specific rights with inheritance regime indicators (Table 8) produces results that are similarly inconsistent with those obtained from the IHPS sample. While the estimated coefficients on women's or men's bequest rights for manure application and cash crops are insignificant in matrilineal communities, a negative and marginally significant effect of male bequest rights on cash crop adoption emerges from the restricted sample. Taken together, the IHS4-based estimates would suggest that bequest rights have either no effect or negative effect on investment, indicating systematic misreporting of bequest rights.

5. Conclusion and policy implications

We use the example of Malawi to show that, even in customary settings where formal documentation is absent, the nature and extent to which women and men have rights to land vary widely. Variation in bequest and to some extent sale but not other rights systematically affects land-based investment. Yet, standard household surveys may fail to capture such variation due to measurement error arising from reliance on proxy respondents rather than interviewing owners themselves. We conclude by drawing out implications from our findings for research and policy.

An important area for follow-up research is to assess the extent to which the findings presented here can be generalized beyond Malawi. Doing so would allow exploring if a failure to either include information on bequest rights or to collect such information directly from (co-)owners can explain the lack of clear results on the impact of individual land rights in the literature. Also, if results similar to those presented here are found in other countries, getting information on the right to bequeath or sell land from concerned individuals at least for a subset of sample respondents in national household surveys may be important. This could not only help identify impacts of specific land rights on socio-economic outcomes but is also important as a basis for understanding how individuals' rights may change in response to exogenous factors.

Our findings are relevant for Malawi in two respects. First, as our data were collected before the 2016 Land Act was assented to by the President in January 2017 and the awareness of the specific provisions of the Act remains low, it is unlikely to be affected by the new Land Act. Subsequent IHPS (or IHS) waves can help ascertain if land owners are aware of key provisions of the Land Act (including its attempts to modify inheritance patterns) and if such awareness results in behavioral change; how provisions are implemented at local level; and whether requirements in terms of gender balance for local bodies for land administration can protect or strengthen rights. Second, defining customary estates to implement the Land Act will require adjudication of rights. Our analysis suggests that strategic motives can bias responses even in low-stake responses to household surveys. To prevent such activities systematically disempowering weaker groups, information used to adjudicate rights in potential demarcation exercises will have to be carefully validated and cross-checked.

Beyond Malawi, the fact that investment impacts associated with bequest and transfer rights under informal regimes are of a size comparable to that often ascribed to formal title in the literature implies that laws or regulations affecting inheritance can have sizeable effects on individuals' ability to exercise their customary rights and thus impact productivity of land use. This does not negate the importance of formal registries to facilitate impersonal transactions and use of land as collateral but recognizes that, as centralized registries for rural land alone cannot be sustained,[17] establishing property registries is a long-term agenda that has to start in urban areas. Given the adverse and potentially irreversible equity and productivity impacts from a gradual erosion of individuals' customary land rights, more agile means to document changes in such rights and protect them as needed may be called for.

[17] Analysis shows that, with costs that exceed any imaginable benefits as well as available resources by orders of magnitude, provisions regarding customary rights in Uganda's 1998 Land Act are unlikely to be ever implementable (Hunt 2004). This has neither prevented donors from trying nor neighboring countries from passing similarly ambitious pieces of legislation. Ali *et al.* (2019) show that even in Rwanda, the only African country with a functioning national registry, sustaining rural registries will require efficient operation with a key role for IT; active engagement with the private sector (e.g. by using mobile phone providers as a first point of contact, and cross-subsidization from urban registry operations.

Table 1: Descriptive statistics across surveys and samples

	IHPS	IHS4	IHS4 restricted
Panel A: Household level information for owners of agricultural land			
Household size	5.010	4.457	4.410
Head's age (years)	44.382	44.824	44.838
Head female†	0.264	0.311	0.332
Head reads & writes Chichewa†	0.685	0.672	0.665
Head's education (years)	5.560	5.298	5.238
Somebody reads & writes Chichewa†	0.911	0.874	0.869
Highest educ.by any member (years)	7.881	7.332	7.236
Christian†	0.785	0.827	0.831
Household asset and dwelling wealth index	0.247	0.184	0.181
Household agricultural asset access index	0.208	0.195	0.195
Area of agricultural land (ha)	0.648	0.569	0.568
No. of parcels	1.537	1.399	1.402
Labor days	128	106	107
Uses org. manure†	0.310	0.269	0.273
Cultivates cash crop†	0.128	0.092	0.092
Has formal document to agric. land†	0.023	0.016	0.016
No. of households	1,308	8,203	7,236
Panel B: Parcel level information for owned agricultural land			
Parcel size (ha)	0.421	0.407	0.410
Labor days	83	76	76
Organic manure applied	0.233	0.214	0.216
Cash crop planted	0.070	0.055	0.055
Soil is sandy	0.197	0.188	0.189
Soil is between sandy and clay	0.527	0.566	0.570
Soil is clay	0.276	0.245	0.241
Slope is flat	0.502	0.56	0.562
Slope is small	0.370	0.334	0.331
Slope is moderate	0.097	0.070	0.070
Slope is steep	0.031	0.036	0.037
Parcel in swamp/wetland	0.131	0.124	0.124
No. of parcels	2,011	11,472	9,668
Panel C: Household level information for owned dwelling & residential land			
Property size (ha)	0.056	0.060	0.062
Years dwelling has been occupied	7.353	7.265	7.207
Improved dwelling†	0.589	0.630	0.627
Has formal document to non-agric. land†	0.036	0.016	0.015
No. of households	923	5,665	5,020

Source: Own computation from 2015/16 Malawi IHPS and IHS4.

Note: 'IHS4 restricted' refers to the subsample of respondents reporting to be owners or co-owners of the parcel or dwelling.

† Underlying variable is dichotomous variable.

Table 2: Descriptive statistics on rights for agricultural land

		Agricultural Land		
	All	**Matrilineal**	**Mixed**	**Patrilineal**
Panel A: IHPS				
Household level				
Parcel size (ha)	0.421	0.437	0.346	0.393
Member has right to make decision	0.870	0.860	0.922	0.904
Member has right to invest	0.839	0.835	0.810	0.904
Member has right to transfer/mortgage	0.747	0.737	0.749	0.829
Member has right to bequeath	0.724	0.713	0.693	0.797
Member has right to sell	0.656	0.660	0.575	0.679
Parcel level				
Parcel (co)-owned by female(s)	0.754	0.750	0.799	0.733
Females can decide on crop cultivation	0.846	0.832	0.923	0.883
Females have right to invest	0.758	0.747	0.734	0.839
Females can transfer/mortgage	0.625	0.618	0.573	0.672
Females can bequeath	0.602	0.593	0.517	0.679
Females can sell	0.534	0.543	0.399	0.511
Parcel (co)-owned by men	0.432	0.420	0.492	0.508
Males can decide on crop cultivation	0.884	0.875	0.864	0.937
Males can invest	0.884	0.894	0.807	0.926
Males can transfer/mortgage	0.793	0.802	0.761	0.832
Males can bequeath	0.774	0.772	0.739	0.884
Males can sell	0.694	0.713	0.602	0.726
No. of parcels	2,011	1,566	179	187
Panel B: IHS4				
Household level				
Parcel size (ha)	0.407	0.409	0.396	0.393
Member has right to bequeath	0.751	0.744	0.690	0.831
Member has right to sell	0.643	0.647	0.623	0.630
Parcel level				
Parcel (co)-owned by women	0.709	0.721	0.639	0.703
Females can bequeath	0.688	0.704	0.575	0.654
Females can sell	0.556	0.590	0.503	0.376
Parcel (co)-owned by males	0.517	0.463	0.655	0.750
Males can bequeath	0.726	0.700	0.689	0.839
Males can sell	0.637	0.629	0.644	0.658
No. of parcels	11,472	8,856	939	1,406

Source: Own computation from 2015/16 Malawi IHPS and IHS4.

Table 3: Effects of land rights on agricultural investment

	Organic manure applied			Cash crop planted		
Has right to decide on crop cultivation (β_{11})	0.029	0.030	0.027	0.035	0.036	0.033
	[0.631]	[0.558]	[0.612]	[0.325]	[0.284]	[0.358]
Has right to invest (β_{12})	-0.091	-0.083	-0.083	-0.037	-0.034	-0.033
	[0.299]	[0.333]	[0.343]	[0.647]	[0.686]	[0.656]
Has right to bequeath land (β_{13})	0.118**	0.121**	0.114**	0.059	0.059*	0.052
	[0.019]	[0.021]	[0.034]	[0.135]	[0.095]	[0.226]
Have right to sell land (β_{14})	0.078***	0.068**	0.071**	-0.018	-0.023	-0.019
	[0.006]	[0.029]	[0.044]	[0.791]	[0.745]	[0.772]
Parcel characteristics	No	Yes	Yes	No	Yes	Yes
Labor days (log)	No	No	Yes	No	No	Yes
No. of observations	2,011	2,011	2,011	2,011	2,011	2,011
R-squared	0.775	0.777	0.778	0.576	0.579	0.583
Mean of dependent variable	0.233	0.233	0.233	0.070	0.070	0.070
Sd. of dependent variable	(0.416)	(0.416)	(0.416)	(0.238)	(0.238)	(0.238)
Mean of right to bequeath land	0.724	0.724	0.724	0.724	0.724	0.724
Sd. of right to bequeath land	(0.447)	(0.447)	(0.447)	(0.447)	(0.447)	(0.447)
Mean of right to sell land	0.656	0.656	0.656	0.656	0.656	0.656
Sd. of right to sell land	(0.475)	(0.475)	(0.475)	(0.475)	(0.475)	(0.475)

Notes: IHPS data are used and the sample includes owned parcels only. Household fixed effects and parcel size are controlled for throughout. Parcel characteristics include soil type (sandy, between sandy and clay, or clay), land slope (flat, slight slope, moderate slope, or hilly), and whether land is in swamp/wetland. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

Table 4: Effects of gender-differentiated land rights on agricultural investment

	Organic manure applied			Cash crop planted		
Women have the right to make decisions	0.034	0.037	0.034	-0.004	-0.001	-0.003
on crop cultivation (β_{11})	[0.271]	[0.206]	[0.236]	[0.920]	[0.991]	[0.939]
Women have the right to invest (β_{12})	-0.014	-0.012	-0.012	-0.018	-0.015	-0.015
	[0.854]	[0.855]	[0.854]	[0.797]	[0.836]	[0.841]
Women have the right to bequeath (β_{13})	0.158***	0.164***	0.162***	0.046	0.049	0.047
	[0.001]	[0.000]	[0.001]	[0.393]	[0.394]	[0.457]
Women have the right to sell (β_{14})	0.052	0.051	0.051	-0.047	-0.047	-0.048
	[0.328]	[0.352]	[0.325]	[0.653]	[0.616]	[0.625]
Men have the right to make decisions	0.060	0.062	0.057	0.050	0.046	0.041
on crop cultivation (β_{21})	[0.552]	[0.567]	[0.609]	[0.502]	[0.524]	[0.575]
Men have the right to invest (β_{22})	-0.096	-0.084	-0.090	0.052	0.064	0.058
	[0.430]	[0.501]	[0.497]	[0.498]	[0.399]	[0.475]
Men have the right to bequeath (β_{23})	0.021	0.012	0.003	0.179**	0.177**	0.168**
	[0.858]	[0.916]	[0.985]	[0.015]	[0.014]	[0.012]
Men have the right to sell (β_{24})	0.053	0.033	0.037	0.026	0.019	0.024
	[0.564]	[0.704]	[0.635]	[0.690]	[0.739]	[0.756]
Parcel characteristics	No	Yes	Yes	No	Yes	Yes
Labor days (log)	No	No	Yes	No	No	Yes
Observations	2,011	2,011	2,011	2,011	2,011	2,011
R-squared	0.777	0.780	0.781	0.585	0.588	0.591
Mean of dependent variable	0.233	0.233	0.233	0.070	0.070	0.070
Sd. of dependent variable	(0.416)	(0.416)	(0.416)	(0.238)	(0.238)	(0.238)
Mean of women's right to bequeath	0.454	0.454	0.454	0.454	0.454	0.454
Sd. of women's right to bequeath	(0.498)	(0.498)	(0.498)	(0.498)	(0.498)	(0.498)
Mean of women's right to sell	0.402	0.402	0.402	0.402	0.402	0.402
Sd. of women's right to sell	(0.490)	(0.490)	(0.490)	(0.490)	(0.490)	(0.490)
Mean of men's right to bequeath	0.334	0.334	0.334	0.334	0.334	0.334
Sd. of men's right to bequeath	(0.472)	(0.472)	(0.472)	(0.472)	(0.472)	(0.472)
Mean of men's right to sell	0.299	0.299	0.299	0.299	0.299	0.299
Sd. of men's right to sell	(0.458)	(0.458)	(0.458)	(0.458)	(0.458)	(0.458)

Notes: IHPS data are used and the sample includes owned parcels only. Indicator variables for women' ownership or men's ownership are controlled for. Household fixed effects and parcel size are controlled for throughout. Parcel characteristics include soil type (sandy, between sandy and clay, or clay), land slope (flat, slight slope, moderate slope, or hilly), and whether land is in swamp/wetland. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

Table 5: Effects of land rights on agricultural investment by gender and inheritance regime

	Organic manure applied			Cash crop planted		
Women have right to make decision (β_{11})	0.033	0.038	0.036	-0.000	0.003	0.000
	[0.409]	[0.324]	[0.340]	[0.989]	[0.926]	[0.992]
Women have right to invest (β_{12})	0.052	0.059	0.057	-0.038	-0.033	-0.035
	[0.340]	[0.209]	[0.235]	[0.690]	[0.743]	[0.722]
Women have right to bequeath land (β_{13})	0.152**	0.160***	0.161***	0.072	0.074	0.075
	[0.014]	[0.009]	[0.005]	[0.219]	[0.255]	[0.236]
Women have right to sell land (β_{14})	0.005	0.005	0.002	-0.072	-0.071	-0.075
	[0.940]	[0.936]	[0.983]	[0.526]	[0.556]	[0.585]
Men have right to make decision (β_{21})	0.017	0.019	0.013	-0.004	-0.011	-0.017
	[0.858]	[0.870]	[0.897]	[0.962]	[0.898]	[0.841]
Men have right to invest (β_{22})	-0.036	-0.036	-0.039	0.095	0.105	0.102
	[0.754]	[0.750]	[0.718]	[0.397]	[0.347]	[0.391]
Men have right to bequeath land (β_{23})	-0.003	0.011	0.001	0.158*	0.163*	0.152*
	[0.992]	[0.956]	[0.996]	[0.095]	[0.096]	[0.082]
Men have right to sell land (β_{24})	0.064	0.040	0.049	0.048	0.046	0.057
	[0.611]	[0.756]	[0.675]	[0.440]	[0.517]	[0.438]
Women have right to make decision	-0.019	-0.042	-0.039	-0.203	-0.218	-0.215
*Non-matrilineal community (β_{31})	[0.686]	[0.367]	[0.339]	[0.131]	[0.127]	[0.109]
Women have right to invest	-0.270	-0.289	-0.287	0.086	0.080	0.082
*Non-matrilineal community (β_{32})	[0.246]	[0.102]	[0.127]	[0.455]	[0.481]	[0.440]
Women have right to bequeath land	-0.024	-0.031	-0.052	-0.114	-0.115	-0.139
*Non-matrilineal community (β_{33})	[0.799]	[0.766]	[0.626]	[0.365]	[0.370]	[0.301]
Women have right to sell land	0.244**	0.237**	0.254**	0.117	0.115	0.135
*Non-matrilineal community (β_{34})	[0.016]	[0.030]	[0.035]	[0.404]	[0.429]	[0.385]
Men have right to make decision	0.095	0.103	0.106	0.186	0.195	0.199
*Non-matrilineal community (β_{41})	[0.664]	[0.651]	[0.628]	[0.271]	[0.285]	[0.224]
Men have right to invest	0.139	0.180	0.187	-0.162	-0.159	-0.152
*Non-matrilineal community (β_{42})	[0.291]	[0.220]	[0.203]	[0.251]	[0.265]	[0.293]
Men have right to bequeath land	-0.030	-0.095	-0.096	-0.119	-0.139	-0.140
*Non-matrilineal community (β_{43})	[0.901]	[0.669]	[0.654]	[0.569]	[0.497]	[0.493]
Men have right to sell land	-0.076	-0.066	-0.095	0.051	0.048	0.015
*Non-matrilineal community (β_{44})	[0.699]	[0.743]	[0.628]	[0.851]	[0.836]	[0.944]
Parcel characteristics	No	Yes	Yes	No	Yes	Yes
Labor days (log)	No	No	Yes	No	No	Yes
Observations	1,932	1,932	1,932	1,932	1,932	1,932
R-squared	0.778	0.781	0.783	0.587	0.589	0.594
Mean of dependent variable	0.233	0.233	0.233	0.070	0.070	0.070
Means of independent variables:						
Female bequest in matrilineal com.	0.444	0.444	0.444	0.444	0.444	0.444
Female sale right in matrilineal com.	0.407	0.407	0.407	0.407	0.407	0.407
Male bequest right in matrilineal com.	0.324	0.324	0.324	0.324	0.324	0.324
Male sale right in matrilineal com.	0.299	0.299	0.299	0.299	0.299	0.299
Female bequest right in non-matrilineal community	0.456	0.456	0.456	0.456	0.456	0.456
Female sale right in non-matrilineal community	0.347	0.347	0.347	0.347	0.347	0.347
Male bequest right in non-matrilineal community	0.407	0.407	0.407	0.407	0.407	0.407
Male sale right in non-matrilineal community	0.333	0.333	0.333	0.333	0.333	0.333

Notes: IHPS data are used and the sample includes owned parcels only. Indicator variables for women' ownership or men's ownership and their interactions with non-matrilineal community are controlled for. Household fixed effects and parcel size are controlled for throughout. Parcel characteristics include soil type (sandy, between sandy and clay, or clay), land slope (flat, slight slope, moderate slope, or hilly), and whether land is in swamp/wetland. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

Table 6: Estimated effects of land rights on agricultural investment across surveys

	Organic manure applied			Cash crop planted		
	IHPS	**IHS4**	**IHS4 rest.**	**IHPS**	**IHS4**	**IHS4 rest.**
Has right to bequeath land (β_{11})	0.099*	0.059*	0.048	0.047	-0.036	-0.043
	[0.075]	[0.051]	[0.236]	[0.288]	[0.223]	[0.288]
Has right to sell land (β_{12})	0.053	-0.014	-0.011	-0.028	0.006	0.002
	[0.143]	[0.600]	[0.729]	[0.673]	[0.765]	[0.954]
Parcel characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Labor days (log)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,011	11,472	9,668	2,011	11,472	9,668
R-squared	0.778	0.817	0.834	0.582	0.623	0.638
Mean of dependent variable	0.233	0.214	0.216	0.070	0.055	0.055
Sd. of dependent variables:	(0.416)	(0.404)	(0.406)	(0.238)	(0.217)	(0.216)
Mean of right to bequeath land	0.724	0.751	0.727	0.724	0.751	0.727
Sd. of right to bequeath land	(0.447)	(0.433)	(0.445)	(0.447)	(0.433)	(0.445)
Mean of right to sell land	0.656	0.643	0.614	0.656	0.643	0.614
Sd. of right to sell land	(0.475)	(0.479)	(0.487)	(0.475)	(0.479)	(0.487)

Notes: Regressions are for owned parcels. Household fixed effects, parcel attributes including size, soil type (sandy, between sandy and clay, clay), slope (flat, slight slope, moderate slope, hilly), and whether land is in swamp/wetland are controlled for throughout. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

Table 7: Comparing estimated gendered land right effects on agricultural investment across surveys

	Organic manure applied			Cash crop planted		
	IHPS	**IHS4**	**IHS4 rest.**	**IHPS**	**IHS4**	**IHS4 rest.**
Women have the right to bequeath (β_{11})	0.163***	0.027	0.029	0.043	-0.039*	-0.084**
	[0.004]	[0.312]	[0.518]	[0.516]	[0.073]	[0.038]
Women have the right to sell (β_{12})	0.046	0.013	-0.008	-0.047	0.031	0.009
	[0.378]	[0.706]	[0.894]	[0.591]	[0.142]	[0.760]
Men have the right to bequeath (β_{21})	-0.023	0.045	0.068	0.188***	-0.008	-0.002
	[0.852]	[0.334]	[0.307]	[0.004]	[0.860]	[0.965]
Men have the right to sell (β_{22})	0.022	-0.024	-0.010	0.031	-0.012	-0.003
	[0.783]	[0.459]	[0.805]	[0.638]	[0.712]	[0.934]
Parcel characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Labor days (log)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,011	11,472	9,668	2,011	11,472	9,668
R-squared	0.780	0.817	0.834	0.591	0.624	0.639
Mean of dependent variable	0.233	0.214	0.216	0.070	0.055	0.055
Sd. of dependent variable	(0.416)	(0.404)	(0.406)	(0.238)	(0.217)	(0.216)
Mean of women's right to bequeath	0.454	0.488	0.407	0.454	0.488	0.407
Sd. of women's right to bequeath	(0.498)	(0.500)	(0.491)	(0.498)	(0.500)	(0.491)
Mean of women's right to sell	0.402	0.395	0.333	0.402	0.395	0.333
Sd. of women's right to sell	(0.490)	(0.489)	(0.471)	(0.490)	(0.489)	(0.471)
Mean of men's right to bequeath	0.334	0.375	0.321	0.334	0.375	0.321
Sd. of men's right to bequeath	(0.472)	(0.484)	(0.467)	(0.472)	(0.484)	(0.467)
Mean of men's right to sell	0.299	0.329	0.281	0.299	0.329	0.281
Sd. of men's right to sell	(0.458)	(0.470)	(0.449)	(0.458)	(0.470)	(0.449)

Notes: Regressions are for owned parcels. Household fixed effects, parcel attributes including size, soil type (sandy, between sandy and clay, clay), slope (flat, slight slope, moderate slope, hilly), and whether land is in swamp/wetland, and interactions between women' or men's ownership are controlled for throughout. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

Table 8: Comparing effects of land rights on agricultural investment by gender and inheritance regime across surveys

	Organic manure applied			Cash crop planted		
	IHPS	**IHS4**	**IHS4 rest.**	**IHPS**	**IHS4**	**IHS4 rest.**
Women have right to bequeath land (β_{11})	0.178***	0.047	0.016	0.062	-0.034	-0.070
	[0.008]	[0.119]	[0.751]	[0.454]	[0.215]	[0.167]
Women have right to sell land (β_{12})	0.005	0.022	0.005	-0.076	0.043*	0.038
	[0.939]	[0.548]	[0.917]	[0.555]	[0.062]	[0.303]
Men have right to bequeath land (β_{21})	-0.033	0.035	0.033	0.181**	0.003	0.046
	[0.825]	[0.523]	[0.700]	[0.012]	[0.926]	[0.276]
Men have right to sell land (β_{22})	0.048	-0.003	-0.008	0.065	-0.024	-0.006
	[0.691]	[0.955]	[0.901]	[0.353]	[0.326]	[0.899]
Women have right to bequeath land	-0.083	-0.106	-0.031	-0.131	-0.006	-0.073
*Non-matrilineal community (β_{31})	[0.436]	[0.162]	[0.666]	[0.346]	[0.906]	[0.640]
Women have right to sell land	0.217*	0.030	-0.011	0.162	-0.044	-0.120
*Non-matrilineal community (β_{32})	[0.078]	[0.696]	[0.910]	[0.279]	[0.385]	[0.149]
Men have right to bequeath land	0.065	0.057	0.161	-0.048	-0.050	-0.233*
*Non-matrilineal community (β_{41})	[0.781]	[0.375]	[0.169]	[0.674]	[0.598]	[0.076]
Men have right to sell land	-0.059	-0.095	-0.030	-0.044	0.069	0.069
*Non-matrilineal community (β_{42})	[0.728]	[0.212]	[0.723]	[0.784]	[0.520]	[0.472]
Parcel characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Labor days (log)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,932	11,201	9,439	1,932	11,201	9,439
R-squared	0.781	0.817	0.833	0.590	0.614	0.633
Mean of dependent variable	0.233	0.215	0.218	0.070	0.054	0.054
Means of independent variables:						
Female bequest in matrilineal com.	0.444	0.507	0.440	0.444	0.507	0.440
Female sale right in matrilineal com.	0.407	0.425	0.370	0.407	0.425	0.370
Male bequest right in matrilineal com.	0.324	0.324	0.284	0.324	0.324	0.284
Male sale right in matrilineal com.	0.299	0.291	0.255	0.299	0.291	0.255
Female bequest right in non-matrilineal community	0.456	0.423	0.293	0.456	0.423	0.293
Female sale right in non-matrilineal community	0.347	0.287	0.208	0.347	0.287	0.208
Male bequest right in non-matrilineal community	0.407	0.558	0.441	0.407	0.558	0.441
Male sale right in non-matrilineal community	0.333	0.465	0.365	0.333	0.465	0.365

Notes: Regressions are for owned parcels. Household fixed effects, parcel attributes including size, soil type (sandy, between sandy and clay, clay), slope (flat, slight slope, moderate slope, hilly), and whether land is in swamp/wetland, and interactions between women' or men's ownership with non-matrilineal community are controlled for throughout. Robust standard errors are clustered by district. Figures in square brackets are p-values from wild cluster bootstrap (Roodman, 2018) with Rademacher weights and 1000 replications. *** significant at 1%; significant at 5%; * significant at 10%.

References:

Aberra, A. and M. Chemin. 2021. "Does Legal Representation Increase Investment? Evidence from a Field Experiment in Kenya." *Journal of Development Economics*, ***150***, 102612.
Alden Wily, L. 2018. "Collective Land Ownership in the 21st Century: Overview of Global Trends." *Land*, ***7***(2), 68.
Ali, D. A., K. Deininger and M. Goldstein. 2014. "Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot Evidence from Rwanda." *Journal of Development Economics*, ***110***(0), 262-275.
Ali, D. A., K. Deininger, G. Mahofa and R. Nyakulama. 2019. "Sustaining Land Registration Benefits by Addressing the Challenges of Reversion to Informality in Rwanda." *Land Use Policy*, 104317.
Andersson Djurfeldt, A. 2020. "Gendered Land Rights, Legal Reform and Social Norms in the Context of Land Fragmentation - a Review of the Literature for Kenya, Rwanda and Uganda." *Land Use Policy*, ***90***, 104305.
Andolfatto, D. 2002. "A Theory of Inalienable Property Rights." *Journal of Political Economy*, ***110***(2), 382-393.
Asfaw, S., A. Cattaneo, G. Pallante and A. Palma. 2017. "Improving the Efficiency Targeting of Malawi's Farm Input Subsidy Programme: Big Pain, Small Gain?" *Food Policy*, ***73***, 104-118.
Asfaw, S. and G. Maggio. 2018. "Gender, Weather Shocks and Welfare: Evidence from Malawi." *Journal of Development Studies*, ***54***(2), 271-291.
Ashraf, N. 2009. "Spousal Control and Intra-Household Decision Making: An Experimental Study in the Philippines." *American Economic Review*, ***99***(4), 1245-1277.
Atwood, D. A. 1990. "Land Registration in Africa: The Impact on Agricultural Production." *World Development*, ***18***(5), 659-671.
Baland, J. M. and P. Francois. 2005. "Commons as Insurance and the Welfare Impact of Privatization." *Journal of Public Economics*, ***89***(2-3), 211-231.
Baldwin, K. 2018. "Elected Mps, Traditional Chiefs, and Local Public Goods: Evidence on the Role of Leaders in Co-Production from Rural Zambia." *Comparative Political Studies*, ***52***(12), 1925-1956.
Bambio, Y. and S. Bouayad Agha. 2018. "Land Tenure Security and Investment: Does Strength of Land Right Really Matter in Rural Burkina Faso?" *World Development*, ***111***, 130-147.
Beck, U., B. Bjerge and M. Fafchamps. 2019. "The Role of Social Ties in Factor Allocation." *World Bank Economic Review*, ***33***(3), 598-621.
Benjamin, E. O. 2020. "Smallholder Agricultural Investment and Productivity under Contract Farming and Customary Tenure System: A Malawian Perspective." *Land*, ***9***(8), 277.
BenYishay, A., P. Grosjean and J. Vecci. 2017. "The Fish Is the Friend of Matriliny: Reef Density and Matrilineal Inheritance." *Journal of Development Economics*, ***127***, 234-249.
Berry, S. 2017. "Struggles over Land and Authority in Africa." *African Studies Review*, ***60***(3), 105-125.
Besley, T. and M. Ghatak. 2010. "Property Rights and Economic Development." in M. R. Rosenzweig and D. Rodrik (eds.), *Handbook of Economic Development Vol 5*, Elsevier, Oxford and Amsterdam.
Bhaumik, S. K., R. Dimova and I. N. Gang. 2016. "Is Women's Ownership of Land a Panacea in Developing Countries? Evidence from Land-Owning Farm Households in Malawi." *Journal of Development Studies*, ***52***(2), 242-253.
Boone, C. 2019. "Legal Empowerment of the Poor through Property Rights Reform: Tensions and Trade-Offs of Land Registration and Titling in Sub-Saharan Africa." *Journal of Development Studies*, ***55***(3), 384-400.
Brasselle, A. S., F. Gaspart and J. P. Platteau. 2002. "Land Tenure Security and Investment Incentives: Puzzling Evidence from Burkina Faso." *Journal of Development Economics*, ***67***(2), 373-418.
Bros, C., A. Desdoigts and H. Kouadio. 2019. "Land Tenure Insecurity as an Investment Incentive: The Case of Migrant Cocoa Farmers and Settlers in Ivory Coast." *Journal of African Economies*, ***28***(2), 147-175.
Bruce, J. W. and S. E. Migot-Adholla. 1994. *Searching for Land Tenure Security in Africa.* Kendall/Hunt Publishers, Dubuque, IA.
Bubb, R. 2013. "The Evolution of Property Rights: State Law or Informal Norms?" *Journal of Law and Economics*, ***56***(3), 555-594.
Carletto, C. and S. Gourlay. 2019. "A Thing of the Past? Household Surveys in a Rapidly Evolving (Agricultural) Data Landscape: Insights from the Lsms-Isa." *Agricultural Economics*, ***50***, 51-62.
Casey, K., R. Glennerster, E. Miguel and M. Voors. 2019. "Skill Versus Voice in Local Development." Stanford University, Graduate School of Business, Research Papers.
Chen, C. 2017. "Untitled Land, Occupational Choice, and Agricultural Productivity." *American Economic Journal: Macroeconomics*, ***9***(4), 91-121.
Cherchye, L., B. De Rock, S. T. Walther and F. Vermeulen. 2016. "Where Did It Go Wrong? Marriage and Divorce in Malawi." University of Oxford, Department of Economics, Economics Series Working Papers: 786.
Chimhowu, A. 2019. "The 'New' African Customary Land Tenure. Characteristic, Features and Policy Implications of a New Paradigm." *Land Use Policy*, ***81***, 897-903.
Christiaensen, L. 2017. "Agriculture in Africa--Telling Myths from Facts: A Synthesis." *Food Policy*, ***67***, 1-11.
de Janvry, A., K. Emerick, M. Gonzalez-Navarro and E. Sadoulet. 2015. "Delinking Land Rights from Land Use: Certification and Migration in Mexico." *American Economic Review*, ***105***(10), 3125-3149.
de Kadt, D. and H. A. Larreguy. 2018. "Agents of the Regime? Traditional Leaders and Electoral Politics in South Africa." *The Journal of Politics*, ***80***(2), 382-399.

Deininger, K. and R. Castagnini. 2006. "Incidence and Impact of Land Conflict in Uganda." *Journal of Economic Behavior & Organization*, ***60***(3), 321-345.
Deininger, K. and S. Jin. 2006. "Tenure Security and Land-Related Investment: Evidence from Ethiopia." *European Economic Review*, ***50***(5), 1245-1277.
Deininger, K., D. A. Ali, S. Holden and J. Zevenbergen. 2008. "Rural Land Certification in Ethiopia: Process, Initial Impact, and Implications for Other African Countries." *World Development*, ***36***(10), 1786-1812.
Deininger, K. and A. Goyal. 2012. "Going Digital: Credict Effects of Land Registry Computerization in India." *Journal of Development Economics*, ***99***(2), 236-243.
Deininger, K., A. Goyal and H. K. Nagarajan. 2013. "Women's Inheritance Rights and Intergenerational Transmission of Resources in India." *Journal of Human Resources*, ***48***(1), 114-141.
Deininger, K. and F. Xia. 2017. "Assessing Impacts of Large Scale Land Transfers: Challenges and Opportunities in Malawi's Estate Sector." *Policy Research Working Paper*, World Bank, Washington DC.
Deininger, K., F. Xia and S. Holden. 2019. "Gendered Incidence and Impacts of Tenure Insecurity on Agricultural Performance in Malawi's Customary Tenure System." *The Journal of Development Studies*, ***55***(4), 597-619.
Delpierre, M., C. Guirkinger and J.-P. Platteau. 2019. "Risk as Impediment to Privatization? The Role of Collective Fields in Extended Agricultural Households." *Economic Development and Cultural Change*, ***67***(4), 863-905.
Dillon, B. and A. Voena. 2018. "Widows' Land Rights and Agricultural Investment." *Journal of Development Economics*, ***135***, 449-460.
Djurfeldt, A.A., F.M. Dzanku and A.C. Isinika, 2018. *Agriculture, Diversification, and Gender in Rural Africa, Longitudinal Perspectives from Six Countries*. Oxford: Oxford University Press.
Duflo, E., 2003. "Grandmothers and Granddaughters : Old-Age Pensions and Intrahousehold Allocation in South Africa." *The World Bank Economic Review*, ***17***(1), 1-25.
Eck, K. 2014. "The Law of the Land: Communal Conflict and Legal Authority." *Journal of Peace Research*, ***51***(4), 441-454.
Fenske, J. 2011. "Land Tenure and Investment Incentives: Evidence from West Africa." *Journal of Development Economics*, ***95***(1), 137-156.
Field, E. 2007. "Entitled to Work: Urban Property Rights and Labor Supply in Peru." *Quarterly Journal of Economics*, ***122***(4), 1561-1602.
Gavian, S. and M. Fafchamps. 1996. "Land Tenure and Allocative Efficiency in Niger." *American Journal of Agricultural Economics*, ***78***(2), 460-471.
Gochberg, W. 2021. "The Social Costs of Titling Land: Evidence from Uganda." *World Development*, ***142***, 105376.
Goldstein, M. and C. Udry. 2008. "The Profits of Power: Land Rights and Agricultural Investment in Ghana." *Journal of Political Economy*, ***116***(6), 980-1022.
Goldstein, M., et al. 2018. "Formalization without Certification? Experimental Evidence on Property Rights and Investment." *Journal of Development Economics*, ***132***, 57-74.
Greiner, C. 2017. "Pastoralism and Land-Tenure Change in Kenya: The Failure of Customary Institutions." *Development and Change*, ***48***(1), 78-97.
Harari, M. and M. Wong. 2019. "Slum Upgrading and Long-Run Urban Development: Evidence from Indonesia ", University of Pennsylvania.
Henn, S. J. 2020. "The State, Chiefs, and Development: Evidence from Africa." *Working Paper*, Boston University, Boston, MA.
Holden, S. and R. Lunduka. 2012. "Do Fertilizer Subsidies Crowd out Organic Manures? The Case of Malawi." *Agricultural Economics*, ***43***(3), 303-314.
Holden, S. T., K. Deininger and H. Ghebru. 2011. "Tenure Insecurity, Gender, Low-Cost Land Certification and Land Rental Market Participation in Ethiopia." *Journal of Development Studies*, ***47***(1), 31-47.
Honig, L. 2017. "Selecting the State or Choosing the Chief? The Political Determinants of Smallholder Land Titling." *World Development*, ***100***, 94-107.
Hunt, D. 2004. "Unintended Consequences of Land Rights Reform: The Case of the 1998 Uganda Land Act." *Development Policy Review*, ***22***(2), 173-191.
Jacoby, H. G., G. Li and S. Rozelle. 2002. "Hazards of Expropriation: Tenure Insecurity and Investment in Rural China." *American Economic Review*, ***92***(5), 1420-1447.
Jacoby, H. G. and G. Mansuri. 2008. "Land Tenancy and Non-Contractible Investment in Rural Pakistan." *Review of Economic Studies*, ***75***(3), 763-788.
Jayachandran, S. 2015. "The Roots of Gender Inequality in Developing Countries." in K. J. Arrow and T. F. Bresnahan (eds.), *Annual Review of Economics. Volume 7.*, Palo Alto, CA: Annual Reviews.
Kang, M., B. Schwab and J. Yu. 2020. "Gender Differences in the Relationship between Land Ownership and Managerial Rights: Implications for Intrahousehold Farm Labor Allocation." *World Development*, ***125***, 104669.
Khataza, R. R. B., A. Hailu, M. E. Kragt and G. J. Doole. 2017. "Estimating Shadow Price for Symbiotic Nitrogen and Technical Efficiency for Legume-Based Conservation Agriculture in Malawi." *Australian Journal of Agricultural and Resource Economics*, ***61***(3), 462-480.
Kilic, T., A. Palacios-Lopez and M. Goldstein, 2015. "Caught in a Productivity Trap: A Distributional Perspective on Gender Differences in Malawian Agriculture." *World Development*, ***70***, 416–463.
Kilic, T., H. Moylan and G.Koolwal, 2020. "Getting the (Gender-Disaggregated) Lay of the Land: Impact of Survey Respondent Selection on Measuring Land Ownership and Rights." World Bank Policy Research Working Paper No. 9151.

Krah, K., H. Michelson, E. Perge and R. Jindal. 2019. "Constraints to Adopting Soil Fertility Management Practices in Malawi: A Choice Experiment Approach." *World Development*, ***124***, 104651.
Kumar, N. and A. Quisumbing. 2012. "Inheritance Practices and Gender Differences in Poverty and Well-Being in Rural Ethiopia." *Development Policy Review*, ***30***(5), 573-595.
Kumar, N. and A. R. Quisumbing. 2015. "Policy Reform toward Gender Equality in Ethiopia: Little by Little the Egg Begins to Walk." *World Development*, ***67***, 406-423.
Lawry, S., et al. 2016. "The Impact of Land Property Rights Interventions on Investment and Agricultural Productivity in Developing Countries: A Systematic Review." *Journal of Development Effectiveness*, 1-21.
Leeson, P. T. and C. Harris. 2018. "Wealth-Destroying Private Property Rights." *World Development*, ***107***, 1-9.
Lentz, C. 2010. "Land Inalienable? Historical and Current Debates on Land Transfers in Northern Ghana." *Africa*, ***80***(1), 56-80.
Linkow, B., 2019, "Inheritance Practices, Investment Incentives and Women's Control Over Land in Rural Kenya." *Journal of African Economies*, ***28***(3), 304-322.
Liu, E., et al. 2013. "Long-Term Effect of Manure and Fertilizer on Soil Organic Carbon Pools in Dryland Farming in Northwest China." *PLOS ONE*, ***8***(2), e56536.
Lovo, S. 2016. "Tenure Insecurity and Investment in Soil Conservation. Evidence from Malawi." *World Development*, ***78***, 219-229.
Lowes, S. 2020. "Matrilineal Kinship and Spousal Cooperation: Evidence from the Matrilineal Belt." University of California, San Diego.
Luke, N. and K. Munshi. 2011. "Women as Agents of Change: Female Income and Mobility in India." *Journal of Development Economics*, ***94***(1), 1-17.
Lunduka, R. 2009. "Land Rental Markets, Investment and Productivity under Customary Land Tenure Systems in Malawi." *PhD Thesis*, Norwegian University of Life Sciences, Aas.
Marenya, P. P. and C. B. Barrett. 2009. "Soil Quality and Fertilizer Use Rates among Smallholder Farmers in Western Kenya." *Agricultural Economics*, ***40***(5), 561-572.
Meinzen-Dick, R., A. Quisumbing, C. Doss and S. Theis. 2019. "Women's Land Rights as a Pathway to Poverty Reduction: Framework and Review of Available Evidence." *Agricultural Systems*, ***172***, 72-82.
Melesse, M. B., A. Dabissa and E. Bulte. 2018. "Joint Land Certification Programmes and Women's Empowerment: Evidence from Ethiopia." *Journal of Development Studies*, ***54***(10), 1756-1774.
Menon, N., Y. van der Meulen Rodgers and H. Nguyen. 2014. "Women's Land Rights and Children's Human Capital in Vietnam." *World Development*, ***54***, 18-31.
Muchomba, F. M. 2017. "Women's Land Tenure Security and Household Human Capital: Evidence from Ethiopia's Land Certification." *World Development*, ***98***, 310-324.
Newman, C., F. Tarp and K. van den Broeck. 2015. "Property Rights and Productivity: The Case of Joint Land Titling in Vietnam." ***91***(1), 91-105.
Ng'ang'a, S. K., D. A. Jalang'o and E. H. Girvetz. 2019. "Soil Carbon Enhancing Practices: A Systematic Review of Barriers and Enablers of Adoption." *SN Applied Sciences*, ***1***(12), 1726.
Njoroge, S., A. G. T. Schut, K. E. Giller and S. Zingore. 2019. "Learning from the Soil's Memory: Tailoring of Fertilizer Application Based on Past Manure Applications Increases Fertilizer Use Efficiency and Crop Productivity on Kenyan Smallholder Farms." *European Journal of Agronomy*, ***105***, 52-61.
Paustian, K., et al. 2019. "Soil C Sequestration as a Biological Negative Emission Strategy." *Frontiers in Climate*, ***1***(8).
Peterman, A. 2012. "Widowhood and Asset Inheritance in Sub-Saharan Africa: Empirical Evidence from 15 Countries." *Development Policy Review*, ***30***(5), 543-571.
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.
Place, F. and K. Otsuka. 2001. "Tenure, Agricultural Investment, and Productivity in the Customary Tenure Sector of Malawi." *Economic Development and Cultural Change*, ***50***(1), 77-99.
Qian, N., 2008, "Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance." *The Quarterly Journal of Economics*, ***123***(3), 1251-1285.
Restuccia, D. and R. Santaeulalia-Llopis. 2015. "Land Misallocation and Productivity." University of Toronto, Department of Economics, Working Papers.
Ricker-Gilbert, J., C. Jumbe and J. Chamberlin. 2014. "How Does Population Density Influence Agricultural Intensification and Productivity? Evidence from Malawi." *Food Policy*, ***48***, 114-128.
Roodman, D., J. G. MacKinnon, M. O. Nielsen and M. D. Webb. 2018. "Fast and Wild: Bootstrap Inference in Stata Using Boottest." Queen's University, Department of Economics, Working Papers: 1406.
Sesmero, J., J. Ricker-Gilbert and A. Cook. 2018. "How Do African Farm Households Respond to Changes in Current and Past Weather Patterns? A Structural Panel Data Analysis from Malawi." *American Journal of Agricultural Economics*, ***100***(1), 115-144.
Telalagic, S. 2014. "Kinship and Consumption: The Effect of Spouses' Outside Options on Household Productivity." University of Oxford, Department of Economics, Economics Series Working Papers: 720.
Twyman, J., P. Useche and C. D. Deere. 2015. "Gendered Perceptions of Land Ownership and Agricultural Decision-Making in Ecuador: Who Are the Farm Managers?" *Land Economics*, ***91***(3), 479-500.

van Donge, J. K. 1999. "Law and Order as a Development Issue: Land Conflicts and the Creation of Social Order in Southern Malawi." *Journal of Development Studies*, ***36***(2), 48-70.
Vélez, M. A., et al. 2020. "Is Collective Titling Enough to Protect Forests? Evidence from Afro-Descendant Communities in the Colombian Pacific Region." *World Development*, ***128***, 104837.
Wang, S.-Y. 2014. "Property Rights and Intra-Household Bargaining." *Journal of Development Economics*, ***107***, 192-201.
Widman, M. 2014. "Land Tenure Insecurity and Formalizing Land Rights in Madagascar: A Gender Perspective on the Certification Program." *Feminist Economics*, ***20***(1), 130-154.
Yaro, J. A. 2013. "Neoliberal Globalisation and Evolving Local Traditional Institutions: Implications for Access to Resources in Rural Northern Ghana." *Review of African Political Economy*, ***40***(137), 410-427.
Zepeda, G. 2000. "Transformación Agraria. Los Derechos De Propriedad En El Campo Mexicano Bajo El Nuevo Marco Institucional." *CIOAC, Mexico*.