Land Markets and Equity of Land Distribution in Northwestern Tanzania

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ABSTRACT

Land markets can have potentially divergent effects on the distribution of land. While they may lead to a concentration of land in the hands of a wealthy minority, they can also enhance equity by serving as an alternative avenue of land access for those with a limited inheritance. This paper explores the equity implications of land sales and rental markets in northwestern Tanzania. Using household-level data collected in 2014 and a control function approach to address potential endogeneity, we find that the land market enables households to adjust their farm size to compensate for a small inheritance. The rental market is particularly used by those with no inheritance to secure a landholding, while households with a larger initial endowment are more likely to dispose of land. Our results indicate that the local land market, characterized by widespread participation, ultimately increases the equity of land distribution.

Key words: equity, land distribution, land markets, Tanzania
JEL classifications: D63, J16, Q12, Q15

1. Introduction

The impact of sales and rental markets on land distribution in developing countries remains a contentious topic.[1] Equitable land access is widely recognized as important for both the pace of agricultural growth and the extent to which such growth will reduce poverty (Deininger and Squire 1998; Jayne et al. 2003; Ravallion and Datt 2002). Land markets, particularly those operating in customary settings, are an important avenue through which rural households access land. However, these markets are poorly understood and sometimes even overlooked in policy discourse (Chimhowu and Woodhouse 2006), with scant empirical evidence on which to base decisions regarding their promotion or restriction (Deininger and Mpuga 2009).

This paper explores whether better-endowed households in northwestern Tanzania expand their landholdings through the market, or conversely, whether lesser-endowed households use the market to compensate for their limited inheritance. The paper makes several contributions to the existing literature. First, we contribute to a very thin body of knowledge in sub-Saharan Africa regarding how land markets mediate the distribution of land established through inheritance (Ainembabazi and Angelsen 2016; Baland et al. 2007; Yamano et al. 2009), and the only such paper from Tanzania. Relatedly, we provide evidence on market performance in a country where land allocation has long been the responsibility of democratically elected village

[1] The authors are grateful to Leah Lakdawala, Mywish Maredia, and Songqin Jin of Michigan State University for helpful feedback on an earlier draft of this paper. They also thank Valerie Mueller of the International Food Policy Research Center for providing access to the household data set used here. The survey was funded by an anonymous donor and implemented by Economic Development Initiatives, Ltd.

authorities (Daley 2005a and 2005b), rather than tribal leaders. This will complement studies in other contexts to highlight the form that land markets may take under this alternative governance structure. Second, our analysis addresses the strong relationship between inheritance, migration, and land market participation – a theme not captured in the work of Ainembabazi and Angelsen (2016), even as both migration and market participation may be a response to inheritance outcomes. Third, unlike studies that measure initial land endowment through the inherited land that has been retained (e.g., Yamano et al. 2009), we also measure inheritance through retrospective self-reports, including land inherited from the families of both men and women. This unique approach produces more accurate measures of historical inheritance.

The paper is organized as follows: Section 2 includes a literature review on the relationships between land distribution and land markets, in addition to background on Tanzanian land policy. Section 3 provides a conceptual framework of household-level land market behavior, and section 4 introduces the data set. Descriptive statistics are presented in section 5, while section 6 includes results of our econometric analysis. Section 7 concludes.

2. Background

2.1 Land markets and land access

Equitable land access is recognized as necessary for agricultural growth and poverty reduction in developing countries. In a cross-country comparison spanning several continents, relatively egalitarian patterns of land distribution are seen to generate higher rates of economic growth (Deininger and Squire 1998). This is partly due to a negative relationship between land concentration and agricultural efficiency, as occurs when large landholdings are not cultivated and rather held as speculative investments. In general, wherever an inverse relationship between farm size and land productivity can be found, land concentration leads to lower efficiency (Vendryes 2014). Such a relationship is found with remarkable consistency in sub-Saharan Africa (Larson et al. 2014; Holden and Otsuka 2014).[2]

In addition to contributing to economic growth, equitable land access can improve the poverty-reducing effects of such growth by ensuring that gains are more widely shared. In contrast, in settings of concentrated land access, growth can lead to increased inequality as the gains are usurped by those at the top of the income distribution (Deininger and Squire 1998). In rural populations, land and labor are the main factors of production held by households, with land the primary asset used to build wealth (Vendryes 2014). For this reason, there exists across rural Africa a strong relationship between land access and household income (Jayne et al. 2003; Muyanga and Jayne 2014), making the distribution of land a prime focus of poverty reduction efforts.

[2] We recognize that the emphasis on smallholder agriculture in African rural development is actively debated (see Collier and Dercon 2014). Some authors maintain that promoting smallholder farming is both more equitable and efficient (Hazell et al. 2010), while others question whether the attention given to smallholders is warranted. In focusing exclusively on the equity effects of land markets, this paper does not seek to settle this debate.

Although not often acknowledged in policy discourse, the land market constitutes an important avenue of land access for rural households in many countries. These 'vernacular' or 'informal' markets operate in customary settings, often outside of a formal legal framework. Although they lack statutory protection, they possess social legitimacy and are of growing importance in Africa. Their prevalence has been noted in a number of countries, including Ethiopia, Kenya, Malawi, Niger, Nigeria, Tanzania[3], and Uganda (Deininger et al. 2015; Holden et al. 2009). Nevertheless, policy discourse on poverty in Africa often relies on a perceived dualism between customary and statutory land systems, wherein customary tenure is associated with inalienability and guaranteed access. In Zambia, for example, the official definition of customary land even relies on its assumed non-market character (Sitko 2010). Policies aimed at formal land registration are often based on the premise that state-recognized property rights are a prerequisite for the functioning of a land market (Pinckney and Kimuyu 1994). However, as noted by Chimhowu and Woodhouse (2006, pp. 364), "failure to understand the nature and extent of land markets under customary tenure regimes risks obscuring the processes through which the poor have access to land and disabling efforts to maintain or improve that access."

The question of how land markets influence the equity of land access remains a source of debate, and the effect may run in two opposing directions: On one hand, the land market may enhance equity if it provides land-scarce farmers with a means to obtain or enlarge their farms (Baland et al. 2007). In the absence of severe imperfections that impede market functioning, the impersonal nature of markets can also benefit those with limited social capital. On the other hand, when land is commoditized, it can disadvantage those with less access to capital (Chimhowu and Woodhouse 2006). Where credit and insurance markets are absent, the opportunity to sell land may create the possibility for distress sales, as asset-poor farmers are compelled to liquidate their land base in response to negative shocks. This can push households into a 'poverty trap', now without the asset base necessary to emerge from poverty (Carter and Barrett 2006). At the same time, asset-rich farmers who are less vulnerable to such shocks can use the market to amass ever-larger landholdings (Holden et al. 2009). The land sales market can also facilitate speculative accumulation if financial markets do not function well, and in turn, land is used as a hedge against inflation. This pattern may lead to a concentration of land in the hands of (primarily) urban people with little intention of farming the land. Once land prices absorb the value of non-agricultural uses (e.g., inflation-protection or collateral), they extend beyond the reach of poorer community members (Binswager and Rosenzweig 1986). The risk of extreme asset concentration is what prompts Fafchamps (2005) to pointedly argue for the state to limit or prohibit certain asset markets, including land.

The existing literature on the link between land markets and land distribution offers sometimes contradictory findings. In India, the land sales market has been found to equalize factor ratios across households, serving to enhance both equity and efficiency (Deininger et al. 2009). Similarly, in Vietnam, the land market (both sales and rental) is seen to transfer land from wealthier and less productive owners to more efficient smallholders, with poorer households

[3] Deininger et al. (2015) focus exclusively on the rental market in Tanzania.

particularly benefiting from the rental market (Deininger and Jin 2008). The rental market is also used by land-constrained households in Kenya (Jin and Jayne 2013), and in Uganda, both Baland et al. (2007) and Ainembabazi and Angelsen (2016) find that the land market is primarily used by those with little or no land inheritance to gain access to farmland. Conversely, in Nicaragua in the 1990s, land markets were found to contribute to land concentration in a setting of already intense inequality (Deininger et al. 2003). Also in Rwanda, a pattern of distress sales by the poor exacerbated the inequality of land distribution in the early 1990s (André and Platteau 1997). In Zambia, where customary land is administered by traditional authorities and sales are generally prohibited, there exists a so-called clandestine land market. Of note, it has been found that many medium-scale farmers have amassed their land in these markets through a process characterized by elite capture, and much of this activity seems to be in the form of speculative accumulation (Sitko and Jayne 2014). Under certain conditions, land markets disproportionately benefit the elites.

One might expect sales and rental markets to exhibit different impacts on equity. In fact, rental markets are often heralded as better able to transfer land to poor households, as the factors that can potentially produce land concentration in the sales market are less relevant to the rental market. It does not require large sums of capital to enter, thus obviating the need for credit. With a range of contract-types, including sharecropping, rental arrangements do not require the immobilization of a household's savings (Yamano et al. 2009). A number of studies have found that rental markets contribute to greater equity in landholdings (Pender and Fafchamps 2001; Deininger and Mpuga 2009). In sub-Saharan Africa, land sales markets are assumed to be less active than rental markets (Holden et al. 2009), with far fewer empirical studies of their effects.

As noted, the equity impact of land markets is determined by a range of factors, including the functioning of markets for factors of production (e.g., land and labor), credit, and insurance, as well as transaction costs and the nature of returns to scale for agricultural production (Deininger and Jin 2008; Deininger et al. 2009). It is thus difficult to derive assumptions about the impact of land markets (particularly sales markets) from conceptual frameworks. Rather, the multiplication of studies across different contexts is necessary to understand this question. Fortunately, the opposing views outlined above produce empirically testable hypotheses based on the effect of initial household wealth on land market participation.

2.2 Land policy in Tanzania

While not always recognized by law, land has long been regarded as alienable in Tanzania. Descriptions of land market activity exist from the late nineteenth century (Malcolm 1953), the 1960s (Madula 1998) and the 1990s (Pinckney and Kimuyu 1994). Daley (2005a and 2005b) traces the gradual commoditization of land over the twentieth century in a single village in the Iringa region. Initially, land access was defined by the 'principle of first right', wherein first settlers to an area had the prior claim to land and the discretionary right to allocate it to newcomers. Even under colonial rule, actions of the British authorities served to promote the commoditization of land. For example, monetary compensation was paid when land was seized

from local farmers, reinforcing the concepts of monetary value and individual ownership. During this time, monetary exchange was allowed to accompany a transfer of land between peasants, though this was officially 'payment for unexhausted improvements' by the previous owner (Daley 2005a).

With independence, the new government sharply curtailed this market activity. Tanzania's first president, Julius Nyerere, expressed great skepticism of the land market, writing "it is quite possible that… if the poor African were allowed to sell his land, all the land in Tanganyika would belong to wealthy immigrants, and the local people would be tenants" (*Mali ya Taifi* 1958, cited in Sundet 2005). Freehold tenure status was thus abolished, as were customary claims, with the nationalization of all land in the country. The purchase, sale, and even rental of land were forbidden (Pinckney and Kimuyu 1994), though it is unclear how actively this ban was enforced.

State socialism was adopted in 1967, and villagization, through which rural residents moved to villages in order to facilitate the provision of services, was made compulsory by 1973. This was accompanied by several institutional innovations, including the establishment of democratically-elected Village Councils with the power to allocate land among private cultivators and enforce property rights (Daley 2005a; USAID 2011; Sundet 1997). Although some elders found positions in the new Village Councils, villagization officially removed traditional authority from the legal and political sphere (Daley 2005a). In 1982, Tanzania abandoned its system of state socialism, and the informal land market again picked up steam. This trend accelerated with the commoditization of agriculture through cash crops (boosting demand for land), as well as the growth of the cash-based economy, which placed pressure on landowners to access cash income through land sales (enhancing supply) (ibid).

Villagization left in its wake a landscape of contested and overlapping land claims, and in the 1990s, several new policies were introduced to clarify matters. The 1995 National Land Policy formally adopted the system of legal pluralism, whereby both customary and statutory laws exist side by side (Odgaard 2006). Then in 1999, the Land Act and Village Land Act translated the Land Policy into law. These Acts introduced a state-sponsored (formal) land market and a new tenure status in the form of a certificate of 'customary right of occupancy', thus recognizing customary rights as transferable (Wily 2003). However, this tenure option has not been widely adopted, and the impact of the Village Land Act on rural land administration is questionable. To this day, most land market activity occurs outside of the formal legal framework (USAID 2011).

One key component of land administration in Tanzania is the link between land tenure and use. Through the implementation of 'development conditions', rights to land have long depended on whether it is used productively (Sundet 1997). When left idle, land can potentially be expropriated by local governments and distributed to other households. These development conditions have even been credited with the reduction of fallow periods (Daley 2005a), and could potentially limit the appeal of land accumulation if owning unused land entails the risk of

expropriation. However, reports of speculative accumulation on the part of urban businessmen and politicians do exist in Tanzania (Odgaard 2003).

3. Conceptual framework and hypothesis

To portray the role of land markets in determining the extent to which land distribution is equitable, we adopt a simple conceptual framework (Figure 1, borrowed from Yamano et al. (2009)). The initial distribution of landholdings is determined through the system of inheritance. Land is then exchanged on the sales and rental markets, resulting in a final distribution of operational land holdings. This new distribution may be more or less equitable than the original. A more detailed conceptual framework for the land sales and rental markets is also provided in the appendix.[4]

To test the influence of land markets in a particular context, the following general equation is used:

$$Y_i = \alpha + \beta_1[Initial\_acres_i] + \boldsymbol{X_i}\boldsymbol{\beta_2} + \varepsilon_i \quad (1)$$

where Y_i is a measure of land market activity for household i, $Initial\_acres_i$ is a measure of a household's initial land endowment, $\boldsymbol{X_i}$ is a vector of household characteristics, and ε_i is a stochastic error term. Y_i can take the form of a binary indicator for having purchased or rented in land, or a continuous measure of the net amount of land purchased or rented. As well, $Initial\_acres_i$ can measure a household's inheritance or the amount of land held at the start of a study period. If the key coefficient, β_1, is positive, it indicates that households with relatively larger initial land holdings participate most actively as purchasers or renters. In other words, the land market results in a more concentrated distribution of land holdings. Conversely, if β_1 is negative, it indicates that the land market results in a more equitable land distribution, with households accessing land through the market in order to compensate for a small initial endowment.[5]

Consequently, we investigate the following hypothesis in this paper: Households with a smaller inheritance (initial endowment) are more likely to purchase and/or rent land, while households with a larger inheritance are more likely to dispose of land. Along these lines, the size of inheritance is negatively associated with land area purchased and/or rented.

4. Data

The data used for this analysis come from an impact evaluation of community-based legal aid undertaken by the International Food Policy Research Institute. This evaluation took place in

[4] As noted in the appendix, the model of inter-temporal asset accumulation does not lead to a clear hypothesis regarding the relationship we seek to explore between initial land stock and land accumulation behaviors. Rather, the extent to which the land market makes distribution more or less equitable is an empirical question, as modeled in Figure 1.

[5] Although Ainembabazi and Angelsen (2016) also explore this general question, they do so with an endogenous switching regression to account for whether a household had any land inheritance at the time of household formation, rather than focus on the precise relationship between the size of inheritance and market behaviors.

2013 and 2014 in two districts of the Kagera region of Tanzania, namely Karagwe and Biharamulo (Figure 2). All analyses in this paper draw from the 2014 survey round, as key variables were collected only in this year. Because the relevant information is retrospective or would not be influenced by this short-term intervention, it should not affect our analysis. Kagera is located in the northwestern corner of Tanzania and shares a border with Uganda, Rwanda, and Burundi. The local economy is dominated by agriculture (De Weerdt 2010), and as will be discussed, Kagera is characterized by a burgeoning land market in which a majority of households participate.

In the two study districts, 139 of the 142 rural villages were surveyed, and a community-level survey was administered to key informants in each village. A listing was conducted in one randomly selected hamlet[6] in each village to stratify the selection of 12 households equally by gender of household head, and the sample is not limited by any upper limit on landholding size. 1,434 households were interviewed in 2014, bringing the rate of attrition to 10.0%. Household population weights are used in all analyses, and are adjusted using inverse probability weights to reflect the likelihood of remaining in the sample in 2014. The survey also included household-level modules regarding asset holdings, land parcels held, and instances of land disposal for the period 2008-2014.[7] In 2014, individual-level modules were administered to the household head and primary spouse, collecting information on their experiences of inheritance. With this information, we estimate the size of land inheritance for households in which the head is either unmarried or monogamously married (668 male-headed and 629 female-headed households).[8] Our regression analysis is therefore limited to this subsample.[9] In some models, we consider only those monogamous households where both spouses were interviewed (461 households) in order to ensure an accurate measure of historical inheritance.

One key feature of this analysis is the measurement of both 'actual' and 'potential' inheritance. Actual land inheritance is calculated as follows: For monogamous households with both spouses interviewed, inheritance is the sum of land originally inherited by the two respondents. For unmarried households or monogamously married households with just one spouse interviewed, inheritance is estimated as the sum of the sole respondent's inheritance and the land area currently in the household's possession that was inherited by the respondent's spouse. Actual inheritance is likely to be endogenous if a parent's bequest decision was made with consideration of their children's participation in the land market, or if the allocation of bequests is correlated with other unobserved characteristics of their children (e.g., varying levels of social mobility). Consequently, we use potential inheritance as an instrument in a control

[6] Each village is comprised of several hamlets, or sub-village administrative units (mean = 6.7 hamlets, mean hamlet size = 106.8 households).

[7] Unfortunately, the survey did not capture information related to agricultural production, thus precluding an examination of the effect of land markets on efficiency.

[8] The few households with a married female head are considered to be male-headed in this analysis.

[9] To ensure accuracy of measurement, our econometric analysis excludes the 13.9% of households that are polygamous. However, as women tend to inherit smaller plots of land at lower frequency, the relationships found for monogamous households are likely to extend to polygamous households, and this sample restriction should not affect the quality of results.

function approach to address potential endogeneity. Respondents reported how much land they, along with each living sibling, have received, as well as what they expect to receive from their parents. A household's potential inheritance is defined as the sum of land each spouse *could have* received, had land been divided equally among their siblings.

Following Baland et al. (2007), we also classify households into three categories of migrant status. (1) In 'landed native' households, either the head originates from the village and has inherited land (even if not retained), or the head had immigrated to marry a spouse originally from the village. (2) 'Landless native' households are those for whom the head originates from the village, though the household did not inherit any land. (3) 'Migrants' are those for whom the head originates from another location, and the household possesses no inherited land inside the village.

5. Descriptive statistics

Table 1 reveals the dominant role of agriculture, and the centrality of land, in our study site. Just 13% of households include a working-age member whose primary occupation is non-agricultural (column 1). On average, almost all land accessed by households is owned. This region also displays a rapid pace of land transactions. While 11% of households report having sold a parcel in the previous 6 years, 29% possess land that was purchased in the same interval. (Note that this difference may be due to the omission of out-migrants and absentee landowners in our sample of rural households.) Many of these transactions are sealed with a sales contract, even as less than 0.1% of plots in our study site have either a land title or 'customary right of occupancy' certificate. This underscores the informal nature of the land market. Several notable differences are evident across the three categories of households (columns 2-4). Compared to landed native households, migrants have received an inheritance less than one-third as large, have retained a smaller proportion of their inheritance, and are more likely to have both purchased and sold land within the past 6 years. However, while the average landholdings owned by migrants is larger (at the 10% significance level), they do not appear to be wealthier than landed native households in other respects. While landless natives, by definition, have inherited no land, their average farm size is statistically indistinguishable from that of neighbors who inherited land.

Villages in the study site exhibit a wide range of land sales activity (Figure 3). We combine the categories of rental and borrowing because it seems plausible that borrowing entails a cost for the borrower (e.g., labor to clear the field or protect it from fires), even with no money exchanged. Odgaard (2006) similarly notes that few borrowing arrangements in Tanzania are genuinely 'free of charge'.[10] Few villages have less than 30% of households in possession of land that was purchased on the market, whereas most villages exhibit minimal renting activity. It therefore appears that the land sales market is more active than the rental market, a pattern

[10] Although not reported here, results of our econometric analysis remain consistent when borrowed land is excluded in a test of robustness. As borrowing land is difficult to categorize as a market-based (versus a more traditional) mode of land access, this narrower definition better ensures that rentals constitute a market transaction. However, the number of rental observations falls by half. All results are available from the authors upon request.

opposite to that found in some African countries (Holden et al. 2009), but consistent with that seen in Uganda (Baland et al. 2007).

A summary of land acquisition (Table 2) reflects the extent to which land is accessed through the market. A majority of plots (51%) are purchased, and while 36% are inherited or gifted from family, this accounts for just 29% of land area accessed. Another 8% of plots are accessed through rental or borrowing. Table 3 shows the proportion of households that access land using these various modes of acquisition. 62% of all households in the study site possess at least one parcel that was purchased, and this exceeds the 52% that possess inherited land. Almost all migrants (82%) but relatively few landed native households (48%) possess purchased land. Over one quarter (28%) of landless native households rent land, surpassing the rental rate of migrants (20%).

The top panel of Figure 4 displays the average land area accessed by each household type through different modes of acquisition. A typical migrant household has inherited 0.7 acres but currently retains just 0.16 acres of inherited land. This suggests that migrants tend to dispose of their inheritance through sale, gift, or bequest. In the bottom panel, households are categorized into four quartiles according to the amount of land originally inherited. On average, these quartiles inherited 0, 0.7, 1.8, and 4.5 acres of land, respectively. A typical household in the first quartile inherited no land but has purchased the largest amount (3.6 acres).

Figure 5 further illustrates that land bequests are often unequal among siblings, with a wide dispersion of the coefficient of variation among siblings' land inheritance. In 43% of cases, one sibling was entirely denied land while another received land. This pattern may reflect the potential endogeneity of inheritance, with parents differentially allocating land bequests in response to their children's characteristics (Wineman and Liverpool-Tasie 2015a). We seek to address this potential endogeneity in section 6.

To capture the degree of land concentration in our study site, a Gini coefficient[11] measures the extent to which the population deviates from a perfectly equal distribution. Values range from 0 to 1, with larger values representing greater inequality. The Gini coefficients (Table 4) show that currently-accessed land is more equitably distributed than inherited land. Thus, the coefficient for household-level inherited land is 0.61 (column 1), though this falls to 0.50 for currently-owned land, and 0.46 for currently-accessed land. The latter drop indicates a modest equalizing influence of the rental market. A consistent pattern is seen in column 2, which is limited to households with completed inheritance. Column 3 is limited to households for which we have observed potential inheritance by interviewing both spouses, and again, the degree of land concentration drops sharply between that of potential inheritance and currently-accessed land. This suggests that land markets may compensate for the initial inequity of inheritance.

[11] In our analysis, Gini coefficients are calculated and analyzed with the DASP package for Stata.

6. Econometric analysis

While the descriptive patterns of section 5 indicate that land markets are associated with reduced inequality, an econometric analysis is needed to better understand causality. In this section, we evaluate the determinants of land market participation, defined as land purchase, sale, rental, and net acquisition. We explore multiple specifications, treating the dependent variable as alternately binary or continuous, and focusing on the coefficients for initial land endowment. To begin, a seemingly-unrelated bivariate probit regression (SUR) is appropriate to identify the determinants of land market participation, as decisions to rent and purchase land are likely to be related (Baland et al. 2007), and this seemingly-unrelated system allows the error terms to be correlated across equations. In Table 5, the dependent variables in this system of equations are a household's status as renter and owner of purchased land. The equation is:

$$Y_{iv} = \alpha + \beta_1[Acres_{iv}] + \boldsymbol{X_{iv}\beta_2} + \boldsymbol{W_{iv}\beta_3} + \boldsymbol{V_v\beta_4} + \varepsilon_{iv} \quad (2)$$

where Y_{iv} is alternately a binary indicator for whether household *i* in village *v* possesses purchased land or rents, $Acres_{iv}$ is the land area inherited, $\boldsymbol{X_{iv}}$ is a vector of household demographic characteristics, $\boldsymbol{W_{iv}}$ is a vector of wealth indicators, and $\boldsymbol{V_v}$ is a vector of village characteristics. In all analyses in this section, standard errors are clustered at the village level to account for potential correlation of shocks to the land market within the same village.

In columns 1 and 2, village and household demographic characteristics are included as controls. In addition, we control for whether inheritance is not yet complete, as the anticipation of future inheritance may influence a decision to purchase land. The unexplained portions of the two equations are significantly and negatively correlated (rho = -0.4), suggesting that these decisions are made jointly. The coefficients on inherited land are negative and significant, indicating that with each additional acre inherited, a household is less likely to purchase or rent land. In general, this suggests that land is not being accumulated through the market by already well-endowed households; rather, the market is used to compensate for smaller initial endowments. Also note that the sales market seems to transfer land to households with a larger endowment of family labor.

In columns 3 and 4, we add several regressors that are likely correlated with land market behavior, but potentially endogenous. For example, a household may simultaneously make decisions of migration and land market participation if it lacks other avenues of land access in a new community (Wineman and Liverpool-Tasie 2015b). Migrant status may also be related to inheritance if a small inheritance prompts a household to search for a larger farm elsewhere. As well, indicators of wealth are susceptible to reverse causality, as when a household accumulates wealth after purchasing land. Results point to a strong, positive relationship between migration and the sales market, and wealth indicators (value of owned assets and having an iron roof) further reveal that poorer households are more likely to rent. In columns 5 and 6, the sample is limited to the 461 households for which we have directly observed past inheritance through retrospective interviews with both spouses.[12] Because a non-negligible number of households

[12] Because all households in this subsample are headed by men, the female-headed status is omitted.

have not received any land inheritance, we also add an indicator to identify those with no inheritance. Results are generally consistent with those of the larger sample, though we now see that the rental market is used mostly by households with zero initial land endowment.

As noted by Baland et al. (2007), a household's initial endowment (inheritance) may be endogenous with land area accessed through the market. Respondents could have been denied land if they were perceived as better able than their siblings to purchase land, or because they had already migrated from their natal village. We therefore employ a control function (CF) approach to address this potential endogeneity (Smith and Blundell 1986). The CF approach can be employed with a censored endogenous regressor, and requires at least one instrumental variable that is partially correlated with the endogenous regressor but uncorrelated with unobserved factors that affect the dependent variable. A household's 'potential' inheritance is understood as exogenous to the household's abilities and thus an appropriate instrument. In the first stage of the CF approach (column 7), a tobit model is used to regress realized inheritance on the control variables, in addition to potential inheritance. The F-statistic confirms potential inheritance as a suitably strong determinant of realized inheritance (F=61.37, P>F=0.000). Note that migrant status is omitted because it is likely to be correlated with potential inheritance, as when a household cannot possibly obtain a viable farm size through inheritance and therefore seeks a better life elsewhere.[13] Residuals from this tobit model are included in the second stage (column 8-9), which leaves the remaining variation in realized inheritance independent of the error term. However, the coefficients on these residuals are not significant, suggesting that realized inheritance is not endogenous with binary indicators of land market behavior.

Table 6 explores the relationship between initial land endowment and the accumulation of land through the market. A left-censored tobit model is appropriate because a sizable proportion of households possess no purchased (38%) or rented (84%) land. Equation (2) is again used, where Y_{iv} is now the number of acres the household possesses that were purchased (columns 1-4), or are currently rented (columns 5-8).[14] The dependent variable can also be thought of as a household's current stock of purchased or rented land. In column 1, we omit household wealth indicators and find that each additional acre inherited is associated with 0.2 fewer acres purchased, on average. This negative relationship remains in column 2, which includes migrant status and wealth indicators, and column 3, which is limited to the 461 households with directly-observed inheritance. Column 4 provides second stage results of a CF-tobit model that includes the same residuals generated in Table 5. Note that the coefficient on residuals is significant at the 10% level, while the coefficient on realized inheritance remains negative and significant. That the generalized residuals are significant in this specification

[13] Results are consistent in sign and significance when migrant status is included at this stage, and also when other potentially endogenous regressors (i.e., indicators of wealth) are omitted.

[14] We have re-run these models with several other functional forms, including those with logged values of land inherited and purchased/ rented (log-log models), with binary indicators of receiving no land inheritance, and with binary indicators of having inherited land (rather than a continuous measure of inheritance). The results are quite consistent with those reported here, and are available upon request.

indicates that inherited land is endogenous, while the inclusion of these residuals in the second stage estimation simultaneously corrects for this endogeneity.

Columns 5-8 repeat this exercise with land area rented. When wealth controls are omitted (column 5), there is again a negative relationship between land inherited and the area accessed through rental. However, when we control for the household's migrant and wealth status, our key coefficient becomes insignificant, and this remains the case for the CF model of column 8. This indicates that while households use the sales market to compensate for a small inheritance, the rental market is less relevant for this purpose. Recall, however, that the rental market is used specifically by those with zero inheritance (Table 5, column 6). suggesting that the relationship between inheritance and rented land area may not be linear.[15]

Following the test for allocative efficiency introduced by Skoufias (1995), if the key coefficients in these models (β_1) are not significantly different from -1, it would indicate that the sales and rental markets function without considerable transaction costs.[16] In other words, households would be seen to *perfectly* compensate for the size of their inheritance; for one less acre of inherited land, they pull in one additional acre through the market, holding constant other measures of wealth and household demographics that influence a household's desired farm size. This is referred to as a "complete resource adjustment". However, results across the bottom of Table 6 strongly reject the null hypothesis that β_1 is equal to -1. Rather, households respond to one less acre of land inheritance by purchasing, at most, approximately one quarter of an acre (column 4).[17] This points to the existence of transaction costs that, to some extent, constrain the fluid functioning of the land market.

Thus far, we have studied the land market only through a 'snapshot' of land accumulated, but we have not addressed the other side of these markets (sales and leases). Respondents were not specifically asked how they had disposed of inherited land that was not retained. However, we have reason to believe that land that is no longer held has likely been sold.[18] Consequently, we regard the amount of inherited land that is not currently retained as an *upper bound estimate* on the sale of inherited land. For the 350 households with a positive amount of directly-observed inheritance, we now estimate the net amount of land they have acquired through the sales market. Households are categorized as having a negative land acquisition (selling more than they purchased), zero net land acquisition, or positive land acquisition.

In Table 7, we estimate the propensity to fall into one of these categories with a multinomial logit model (using equation (2)), with zero net land acquisition as the base category. Village controls are omitted as they are not necessarily related to the location where inherited

[15] Although results are not reported here, when the regressions of Table 6 are augmented with an indicator for having received no land inheritance, this coefficient is positive and significant in columns 5-8.
[16] As noted by Skoufias (1995), imperfections in the land market may be asymmetric, affecting each side of the market differently, though Table 6 only refers to the demand side in our study site.
[17] When the results of Table 6 are reported as raw coefficients, β_1[Land inherited (acres)] equals -0.50 to -0.34 (columns 1-4) and -0.37 to -0.24 (columns 5-8). These coefficients are all significantly different from -1.
[18] The data set contains information on instances of land disposal since 2008, and 59.8% of all plots that were disposed-of during this interval had been sold.

land was sold.[19] In columns 1 and 2, with only demographic controls included, the area of land inherited is a positive determinant of a negative land acquisition, and *vice versa* for a positive land acquisition. This is consistent with the notion that the land market 'smooths out' the distribution of land across households. Household wealth indicators are included in columns 3 and 4, and wealthier households (with an iron roof and greater non-land assets) seem more likely to have acquired a positive amount of land. At the same time, poorer households are more likely to have sold or lost land, suggesting that these sales may, indeed, have been motivated by distress. However, our key coefficients on inherited land remain consistent. To address the potential endogeneity of realized inheritance, we again employ a CF approach (columns 5 and 6). When residuals from the first stage regression are included, results consistently point to the land market's role in smoothing out the land distribution.

Finally, we exploit the observations of land transactions in 2008-2014 to evaluate whether the same pattern holds over a shorter time interval, rather than a generational time scale. Households are categorized by whether they purchased and/or sold land during this time period, and whether they currently rent land. Unfortunately, the data set includes few observations of land leased out, perhaps due to absentee landlords or to inadvertent or intentional under-reporting.[20] A seemingly unrelated trivariate probit model is used, allowing the error terms to be correlated across equations, with the following equation:

$$Y_{iv} = \alpha + \beta_1[Initial\_Acres_{iv}] + \boldsymbol{X_{iv}\beta_2} + \boldsymbol{W_{iv}\beta_3} + \boldsymbol{V_v\beta_4} + \varepsilon_{iv} \quad (3)$$

where Y_{iv} alternately indicates whether the household has purchased or sold land since 2008, and whether it currently rents land. $Initial\_Acres_{iv}$ refers to the amount of land owned as of 2008 (for the sales market) or 2013 (for the rental market). Results of Table 8 show that households with a larger initial endowment are more likely to have sold land (column 2), while a smaller endowment is strongly associated with renting (column 3) and weakly associated with purchasing land (column 1). Again, the land market seems to produce a more equitable distribution of land.

7. Conclusions

This paper explores the equity implications of land sales and rental markets in northwestern Tanzania. We empirically test the relationship between initial land endowment and land market behavior to understand whether the market is used to concentrate landholdings or to 'smooth out' the inequity of initial endowments. Several intriguing outcomes emerge from the analysis: First, it is evident that commoditized access to land is common within the customary system of tenure, as a majority of households (62%) possess purchased land. The pervasiveness of the sales market indicates that capital market imperfections do not significantly inhibit the functioning of land markets in this region. Furthermore, there appears to be adequate security of tenure within the informal market to safeguard the returns to a land purchase. This is the case, even as efforts to

[19] Results do not change in direction or level of significance when these current-village controls are included.
[20] In 2014, there were just 17 observations of leased-out land. A similar discrepancy in reporting is seen in a nationwide agricultural survey in Tanzania (Deininger et al. 2015).

promote land titling have had negligible impacts in Tanzania (USAID 2011); the development of an active land sales market evidently does not require formalized property rights.

Second, our findings are consistent with studies from Uganda (Ainembabazi and Angelsen 2016; Baland et al. 2007), showing that land purchasers tend to be those with little or no initial land endowment in the form of inherited land. The concern over elite capture assumes that those with the greatest wealth or influence will gain the most from the commoditization of land (Holden and Otsuka 2014). At least with respect to initial land endowments, our results generally do not provide evidence of this phenomenon in the local land market. This conclusion differs from that of Sitko and Jayne (2014, pp. 201) in Zambia, where the authors find that "farm size growth [through statutory and vernacular land markets] among those primarily engaged in agriculture appears to be predominantly confined to a minority of rural residents who started out in a relatively privileged position with regard to initial landholding size." In contrast, in Tanzania we find widespread participation in the land market. Our findings suggest that policy efforts to facilitate the functioning of land markets can be pursued as pro-equity. However, it remains likely that when a market is driven underground (as in Zambia), it may pose a threat to smallholders whenever it can be manipulated by politicians, bureaucrats, and other elites. Still relevant is the cautionary advice of Deininger et al. (2003) that policy makers need to recognize the appeal of speculative accumulation, and put forth measures to reduce its attractiveness wherever this practice arises.

Third, a test of allocative efficiency reveals that households are not able to *completely* adjust their landholdings through the market in order to attain their (estimated) desired farm size, which is contingent on the household's labor endowment and wealth. Thus, although the land market is evidently quite important in the rural economy, transaction costs and/ or other market imperfections still seem to hinder its performance. Further research is needed to understand the remaining impediments to market functioning. Of note, we find limited evidence of land rental, suggesting that Kagera has not attained the requisite level of tenure security for land to be regularly exchanged on a temporary basis. Perhaps improved tenure security, clarification of laws around land rental, and lower-cost access to legal recourse, would enhance the supply of land to the rental market.

Several caveats are in order: We do not explore possible tensions between the priorities of equity and efficiency. Several papers analyze the efficiency implications of rental markets by estimating unobserved farmer ability (Deininger and Jin 2008; Jin and Jayne 2013), with rental markets found to transfer land to more capable producers, thereby improving agricultural efficiency. Note, as well, that this analysis has not considered absentee landowners which were not captured in the household survey, and we do not know whether these would influence the results.

Despite these limitations, this paper has upended several generalizations often made about rural Africa: The sales market in Kagera is characterized by widespread participation, which counters the "idealized models of customary tenure" that dominate the policy discourse (Chimhowu and Woodhouse 2006). As well, the local land market seems to facilitate a more

equitable distribution of land. As land becomes increasingly scarce in sub-Saharan Africa, owing to rising population density and greater demand for commercial agricultural land, market-based mechanisms of allocating land are expected to become more prevalent. While the market in Kagera evidently does not function ‘perfectly’, this paper sheds light on a vibrant land market that may represent, for other African contexts, the potential for markets to foster social mobility and a more flexible local economy.

Appendix A

For the land sales market, inter-temporal asset accumulation can be modeled as follows, where a household maximizes its utility over a lifetime horizon:

$$\underset{A_{t+k},S_{t+k}}{\text{Max}} \quad V = E_t \sum_{k=0}^{T-t}(1+\delta)^{-k}U(C_{t+k}) \tag{A1}$$

$$\text{subject to} \quad C_{t+k} + (\bar{A}_{t+k} - \bar{A}_{t+k-1})P_{t+k} + (S_{t+k} - S_{t+k-1}) \leq Y_{t+k}\,(\bar{A}_{t+k}, \varepsilon_{t+k}) \tag{A2}$$

$$\text{and} \quad \bar{A}_{t+k} \geq 0 \tag{A3}$$

$U(C_t)$ is the utility function in period t, C_t is the level of consumption, δ is the rate of time preference, $\bar{A}_t$ is the amount of land owned in time t, S_t is the amount of savings, P_t is the price of land, and $Y_t(\bar{A}_t, \varepsilon_t)$ is the income generated in time t as a function of land owned and a stochastic term (ε_t). Income is increasing in land stock, such that $\frac{\partial Y_t}{\partial \bar{A}_t} > 0$. In equation (A2), the amount of land purchased detracts from consumption in a given period, but increases income in the following period. The utility maximization is subject to a borrowing constraint (A3) that restricts the land stock to be non-negative. As noted by others (Deininger and Mpuga 2009; Deininger and Jin 2008), an analytical solution to this problem cannot be derived when income is stochastic (Zeldes 1989). The model does not yield a hypothesis regarding the relationship between land adjustments ($\bar{A}_t - \bar{A}_{t-1}$) and initial land stock ($\bar{A}_{t-1}$). Rather, the extent to which land markets reduce or exacerbate inequality in a particular setting is an empirical question.

Household behavior on the the land rental market can be modeled with a conceptual approach used by Deininger and Mpuga (2009):

$$\underset{l_i^a, A_i}{\text{Max}}\ Y = p\alpha_i f(l_i^a, A_i) + wl_i^o + I^{in}(A_i - \bar{A}_i)(r+T) + I^{out}(\bar{A}_i - A_i)(r-T) \tag{A4}$$

Household i has an endowment of labor ($\bar{L}_i$), land ($\bar{A}_i$), and agricultural ability (α_i). The household selects land area accessed (A_i) and can allocate its labor between own-farm (l_i^a) and off-farm employment (l_i^o, which equals $\bar{L}_i - l_i^a$) at a wage (w). Renting land incurs a rental cost (r) and transaction cost (T) proportional to the land area transferred. I^{in} and I^{out} are indicators of renting in or out, and p is the price of the agricultural good. The household chooses its labor allocation (l_i^o, l_i^a) and land area accessed (A_i) by maximizing equation (A4), and the optimal choices of l_i^{a*}, l_i^{o*}, and A_i^* solve the following first-order conditions:

For all households: $p\alpha_i f_{l_i^a}(l_i^a, A_i) = w$

For households that rent in: $p\alpha_i f_{A_i}(l_i^a, A_i) = r + T$

For households that rent out: $p\alpha_i f_{A_i}(l_i^a, A_i) = r - T$

For autarkic households: $r - T < p\alpha_i f_{A_i}(l_i^a, A_i) < r + T$

In words, these conditions set the marginal value product of on-farm labor equal to the exogenous wage rate, and set the marginal value product of cultivating an extra unit of land equal to either the rental plus transaction cost (for renters) or the rental minus transaction cost (for landlords). These transaction costs compel some households to remain autarkic when the productivity of their land falls between $(r-T)$ and $(r+T)$. Motivating our hypothesis in this paper, the amount of land rented-in is strictly decreasing in land endowment ($\bar{A}_i$).

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TABLES

Table 1. Household (HH) characteristics

	(1) All HHs		(2) Landed native		(3) Landless native		(4) Migrant		Tests		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	(2) = (3)	(2) = (4)	(3) = (4)
Number of working-age adults (ages 15-59)	2.27	(1.30)	2.26	(1.28)	1.80	(1.20)	2.41	(1.34)	***		***
Proportion of dependents	0.53	(0.24)	0.53	(0.23)	0.57	(0.26)	0.53	(0.25)			
1= Polygamous HH	0.14	(0.35)	0.14	(0.34)	0.11	(0.31)	0.15	(0.36)			
1= Female-headed HH	0.14	(0.35)	0.14	(0.34)	0.24	(0.43)	0.12	(0.32)	***		***
Head's age (years)	45.22	(15.97)	42.98	(15.71)	47.66	(17.98)	48.23	(15.30)	***	***	
1= HH member completed primary school	0.71	(0.45)	0.76	(0.43)	0.67	(0.47)	0.65	(0.48)	*	***	
1= Has non-agricultural income	0.13	(0.33)	0.14	(0.35)	0.08	(0.27)	0.11	(0.32)			
1= Iron roof	0.73	(0.44)	0.81	(0.39)	0.54	(0.50)	0.65	(0.48)	***	***	**
Value of assets (100,000s TSh)[a]	44.37	(163.83)	42.07	(183.49)	26.63	(72.72)	52.56	(145.49)			
Land area owned (acres)	4.66	(6.79)	4.40	(5.20)	4.09	(8.63)	5.23	(8.33)		*	
Number of agricultural parcels	2.28	(1.22)	2.41	(1.20)	1.87	(1.14)	2.16	(1.23)	***	***	**
Land area inherited (acres)[b]	2.06	(2.77)	3.15	(3.03)	0.00	--	0.82	(1.64)	N/A	***	***
1= Has inherited no land	0.31	(0.46)	0.00	--	1.00	--	0.63	(0.48)	N/A	N/A	***
Proportion inherited land retained [c]	0.63	(0.43)	0.74	(0.37)	--	--	0.13	(0.33)	N/A	***	N/A
1= Inheritance is complete	0.41	(0.49)	0.41	(0.49)	0.37	(0.49)	0.41	(0.49)			
1= HH has sold land in past 6 years	0.11	(0.31)	0.08	(0.27)	0.11	(0.31)	0.15	(0.36)		***	
1= HH has bought land in past 6 years	0.29	(0.45)	0.19	(0.39)	0.32	(0.47)	0.44	(0.50)	***	***	**
1= HH has sales contract	0.38	(0.49)	0.32	(0.47)	0.39	(0.49)	0.47	(0.50)		***	
1= HH head has sales rights to any plot [d]	0.65	(0.48)	0.62	(0.49)	0.48	(0.50)	0.74	(0.44)	**	***	***
Observations	1,434		809		157		468				

Note: Asterisks denote significance levels of a Tukey test for a difference in means. *** p<0.01, ** p<0.05, * p<0.1

[a] The exchange rate in 2014 was approximately 1,500 TSh = USD $1.

[b] Land/ non-land asset inheritance is not estimated for polygamous households.

[c] Proportion of inherited land area that has been retained is only calculated for households with a positive inheritance, and for which we directly observe their original inheritance. N=350 (column 1), 296 (2), and 54 (4).

[d] This information is only available for land-owning households in which the head was interviewed. N=1,251 (column 1), 724 (2), 132 (3), and 395 (4).

Table 2. Patterns of land acquisition and plot characteristics

Mode of acquisition	Obs.	Proportion of plots [b]	Area (acres)	Proportion of area	Plot size (acres)		Length of tenure (years)		1= HH head has sales rights [c]	
					Mean	SD	Mean	SD	Mean	SD
Purchased	1,318	0.51	268,343	0.54	2.45	(4.01)	12.40	(10.88)	0.72	(0.45)
Inherited/ Gift from family	1,092	0.36	144,150	0.29	1.87	(1.61)	18.30	(14.06)	0.55	(0.50)
Rented/ Borrowed	234	0.08	31,984	0.07	1.83	(2.47)	4.47	(6.96)	--	
Other [a]	204	0.06	48,811	0.10	4.12	(8.28)	27.04	(14.04)	0.55	(0.50)
Total	2,848		493,288							

[a] 'Other' includes land that was cleared by the household or allotted by government.
[b] Because plots are weighted, these proportions do not perfectly correspond to the number of observations.
[c] This information is only available for households in which the head was interviewed (85.8% of plots).

Table 3. Proportion of households (HHs) accessing land by mode of acquisition

Mode of acquisition	All HHs	Landed native	Landless native	Migrant
Purchase	0.62	0.48	0.72	0.82
Inherit/ Gift from family	0.52	0.87	0.00	0.08
Rent/ Borrow	0.16	0.11	0.28	0.20
Other	0.10	0.07	0.15	0.14
Rent/ borrow only	0.05	0.02	0.19	0.08
Inherit/ Gift only	0.23	0.41	0.00	0.01
Purchased only	0.31	0.08	0.57	0.61
Observations	1,434	809	157	468

Table 4. Concentration indices of inherited land and currently accessed land

	(1) All HHs		(2) HHs with completed inheritance		(3) Monogamous HHs with both spouses interviewed	
	Gini	SE	Gini	SE	Gini	SE
Household (HH)						
Land accessed (acres)	0.462	(0.016)	0.471	(0.027)	0.441	(0.024)
Land owned (acres)	0.505	(0.017)	0.494	(0.027)	0.479	(0.025)
Land originally inherited (acres)	0.606	(0.014)	0.612	(0.017)		
Difference (land inherited - accessed)	0.143***	(0.019)	0.141***	(0.030)		
Potential land inheritance (acres)					0.559	(0.022)
Difference (potential inheritance - land accessed)					0.117***	(0.031)
Individual (per capita)						
Land accessed (acres)	0.447	(0.022)	0.451	(0.044)	0.434	(0.031)
Land owned (acres)	0.486	(0.023)	0.478	(0.044)	0.470	(0.032)
Land originally inherited (acres)	0.605	(0.017)	0.602	(0.023)		
Difference (land inherited and accessed)	0.157***	(0.027)	0.151***	(0.048)		
Potential land inheritance (acres)					0.571	(0.025)
Difference (potential inheritance - land accessed)					0.136***	(0.039)
Observations	1,297		817		461	

Table 5. Determinants of purchase and rental status (seemingly unrelated bivariate probit)

	All households (HHs)				HHs with observed inheritance				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	SUR		SUR		SUR		Tobit	CF-SUR	
	Purchased	Rents	Purchased	Rents	Purchased	Rents	Land inherited (acres)	Purchased	Rents
Land inherited (acres)	-0.044***	-0.028***	-0.037***	-0.020**	-0.033***	-0.005		-0.044***	-0.013
	(0.008)	(0.008)	(0.008)	(0.008)	(0.012)	(0.012)		(0.014)	(0.009)
1= HH has received no land inheritance					0.098	0.117**			
					(0.065)	(0.052)			
1= Inheritance is not complete	-0.044	0.026	-0.061	0.032	0.006	-0.003	-0.421**	0.014	0.008
	(0.041)	(0.037)	(0.038)	(0.035)	(0.044)	(0.041)	(0.168)	(0.045)	(0.043)
1= Female-headed HH	-0.168***	-0.017	-0.133***	-0.008					
	(0.041)	(0.032)	(0.039)	(0.034)					
Age of head	0.030***	-0.002	0.017***	-0.000	0.018**	0.011	-0.040	0.021***	0.012
	(0.007)	(0.006)	(0.006)	(0.005)	(0.009)	(0.008)	(0.035)	(0.008)	(0.009)
Age^2 of head	-0.000***	-0.000	-0.000***	-0.000	-0.000*	-0.000*	0.000	-0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1= HH member has completed primary school	0.019	-0.043	-0.029	-0.012	-0.081	-0.036	0.050	-0.083	-0.026
	(0.045)	(0.044)	(0.046)	(0.045)	(0.062)	(0.052)	(0.195)	(0.067)	(0.058)
No. working-age adults	0.074***	-0.013	0.057***	-0.012	0.046**	-0.018	0.057	0.047**	-0.018
	(0.016)	(0.015)	(0.015)	(0.015)	(0.021)	(0.022)	(0.081)	(0.020)	(0.021)
1= Migrant			0.193***	0.061	0.184***	-0.017			
			(0.045)	(0.040)	(0.059)	(0.050)			
1= Has non-agricultural income			0.006	-0.002	-0.063	0.091	0.214	-0.066	0.084
			(0.050)	(0.054)	(0.056)	(0.068)	(0.330)	(0.066)	(0.078)
1= Iron roof			0.115**	-0.103*	0.103	-0.080	0.305	0.067	-0.101**
			(0.047)	(0.054)	(0.064)	(0.049)	(0.218)	(0.053)	(0.051)
Value non-land assets (ln)			0.060***	-0.018	0.092***	-0.056***	-0.021	0.110***	-0.052**
			(0.017)	(0.014)	(0.021)	(0.019)	(0.065)	(0.023)	(0.021)
1= Karagwe district	0.070	-0.052	0.080*	-0.028	0.188***	-0.087**	0.641**	0.131*	-0.125**
	(0.049)	(0.036)	(0.043)	(0.037)	(0.051)	(0.043)	(0.316)	(0.067)	(0.054)
Village population density (100's people/ km^2)	0.002	0.003	-0.001	0.003	0.001	-0.007	0.080*	0.001	-0.010
	(0.008)	(0.006)	(0.008)	(0.006)	(0.007)	(0.008)	(0.044)	(0.009)	(0.008)
Time to road (hours)	0.030	-0.088**	0.060*	-0.103***	0.082	-0.137***	0.202	0.095	-0.146**
	(0.041)	(0.037)	(0.031)	(0.037)	(0.063)	(0.052)	(0.258)	(0.081)	(0.064)

Table 5 (Cont'd)

Time to phone (hours)	-0.049	-0.053	-0.085	-0.061	-0.170	-0.042	1.228*	-0.208	-0.073
	(0.084)	(0.076)	(0.085)	(0.085)	(0.122)	(0.102)	(0.636)	(0.142)	(4.34)
1= Land available in village to be allocated	-0.070*	0.023	-0.082**	0.025	-0.055	-0.004	-0.195	-0.048	0.001
	(0.040)	(0.032)	(0.036)	(0.032)	(0.041)	(0.039)	(0.231)	(0.057)	(0.043)
Village median land value (log)	-0.052	-0.004	-0.078**	0.019	-0.107**	0.028	0.142	-0.135***	0.018
	(0.038)	(0.023)	(0.034)	(0.026)	(0.042)	(0.029)	(0.195)	(0.045)	(0.029)
Potential inheritance (acres)							0.828***		
							(0.091)		
Residuals (first stage)								0.019	0.016
								(0.018)	(0.016)
rho	-0.406***		-0.410***		-0.118			-0.097	
	(0.100)		(0.101)		(0.124)			(0.128)	
sigma							2.232***		
							(0.158)		
F (Potential inheritance)							61.37		
P > F							0.000		
Observations	1,297	1,297	1,297	1,297	461	461	461	461	461
Uncensored observations							350		

Average partial effects; Standard errors in parentheses, clustered by village; *** p<0.01, ** p<0.05, * p<0.1
Standard errors bootstrapped in columns 8 and 9 (50 replications).

Table 6. Determinants of land area purchased or rented (tobit)

	Land purchased (acres)				Land rented/ borrowed (acres)			
		Tobit		CF-tobit		Tobit		CF-tobit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land inherited (acres)	-0.233***	-0.180***	-0.252***	-0.288***	-0.059**	-0.038	-0.039	-0.022
	(0.054)	(0.053)	(0.074)	(0.080)	(0.027)	(0.027)	(0.046)	(0.038)
1= Inheritance not complete	-0.090	-0.234	0.260	0.265	0.126	0.134	0.062	0.068
	(0.244)	(0.228)	(0.329)	(0.356)	(0.103)	(0.098)	(0.123)	(0.129)
Residuals from first stage				0.182*				0.048
				(0.106)				(0.056)
HH demographic controls	Y	Y	Y	Y	Y	Y	Y	Y
HH migrant status		Y	Y			Y	Y	
HH wealth controls		Y	Y	Y		Y	Y	Y
Village controls	Y	Y	Y	Y	Y	Y	Y	Y
P > F (land inherited = -1)	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000
Observations	1,297	1,297	461	461	1,297	1,297	461	461
Uncensored observations	702	702	272	272	190	190	72	72

Average partial effects; Standard errors in parentheses, clustered by village; *** p<0.01, ** p<0.05, * p<0.1
Standard errors bootstrapped in columns 4 and 8 (50 replications).

Table 7. Determinants of net land acquisition through the sales market (multinomial logit)

	Households (HHs) with > 0 inheritance					
	(1)	(2)	(3)	(4)	(5)	(6)
	Negative	Positive	Negative	Positive	Negative	Positive
Land inherited (acres)	0.044***	-0.052***	0.045***	-0.051***	0.058***	-0.050**
	(0.011)	(0.017)	(0.012)	(0.018)	(0.014)	(0.024)
1= Inheritance not complete	-0.094*	0.047	-0.073	0.018	-0.071	0.024
	(0.048)	(0.062)	(0.047)	(0.056)	(0.046)	(0.055)
Age of head	-0.011	0.030***	-0.000	0.010	-0.003	0.014
	(0.011)	(0.011)	(0.011)	(0.012)	(0.013)	(0.011)
Age-squared of head	0.000	-0.000**	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1= HH member has completed primary school	-0.114	0.174**	-0.037	0.052	-0.026	0.024
	(0.076)	(0.081)	(0.075)	(0.092)	(0.081)	(0.086)
No. working-age adults	0.001	0.030	-0.001	0.040	-0.002	0.035
	(0.023)	(0.027)	(0.023)	(0.025)	(0.027)	(0.027)
1= Migrant			-0.048	0.194**		
			(0.065)	(0.092)		
1= Has non-agricultural income			0.004	-0.068	0.015	-0.064
			(0.076)	(0.056)	(0.087)	(0.055)
1= HH dwelling has iron roof			-0.054	0.174**	-0.087	0.139
			(0.065)	(0.077)	(0.064)	(0.090)
Value non-land assets (log)			-0.063***	0.096***	-0.061***	0.105***
			(0.022)	(0.026)	(0.022)	(0.028)
Residuals (first stage)					0.025	0.013
					(0.016)	(0.021)
Observations	350	350	350	350	350	350

Average partial effects; Standard errors in parentheses, clustered by village; *** p<0.01, ** p<0.05, * p<0.1
Standard errors bootstrapped in columns 5 and 6 (50 replications). The coefficient on residuals in column 5 is close to significant (P=0.135).

Table 8. Determinants of land market behavior in the short term (2008-14) (seemingly unrelated trivariate probit)

	(1) Has purchased land in past 6 years	(2) Has sold land in past 6 years	(3) Currently rents/ borrows land
Land owned by household 6 years ago (acres)	-0.042*	0.026*	
	(0.025)	(0.013)	
Land owned by household 1 year ago (acres)			-0.241***
			(0.043)
HH demographic/ wealth controls/ migrant status	Y	Y	Y
Village controls	Y	Y	Y
Observations	1,297	1,297	1,297

Standard errors in parentheses, clustered by village; *** p<0.01, ** p<0.05, * p<0.1
Athrho (1 & 2): 0.133 (0.084); Athrho (1 & 3): -0.205 (0.106); Athrho (2 & 3): -0.110 (0.112)
Likelihood ratio test that all rhos = 0: χ^2: 198,005 P > χ^2 = 0.0000

FIGURES

Figure 1. Role of land markets in land distribution

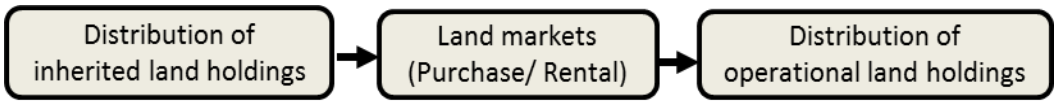
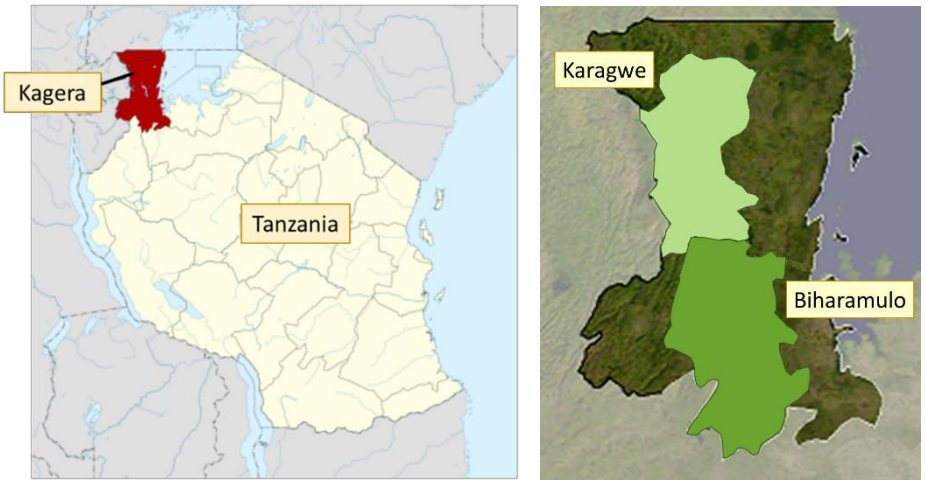


Figure 2. Study site



Source: Wikimedia Commons and authors' summary.

Figure 3. Rates of land market activity

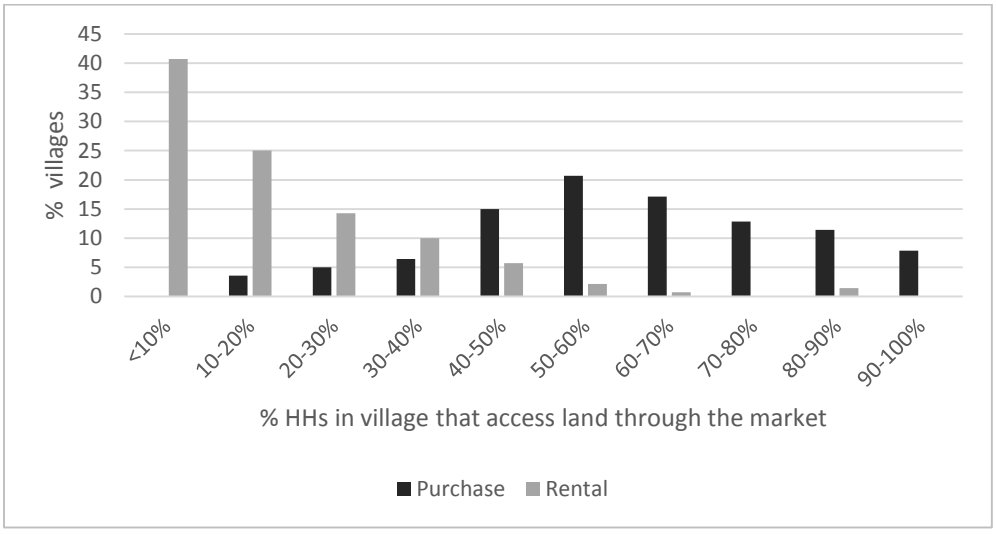


Figure 4. Average landholdings of various household categories, by mode of acquisition

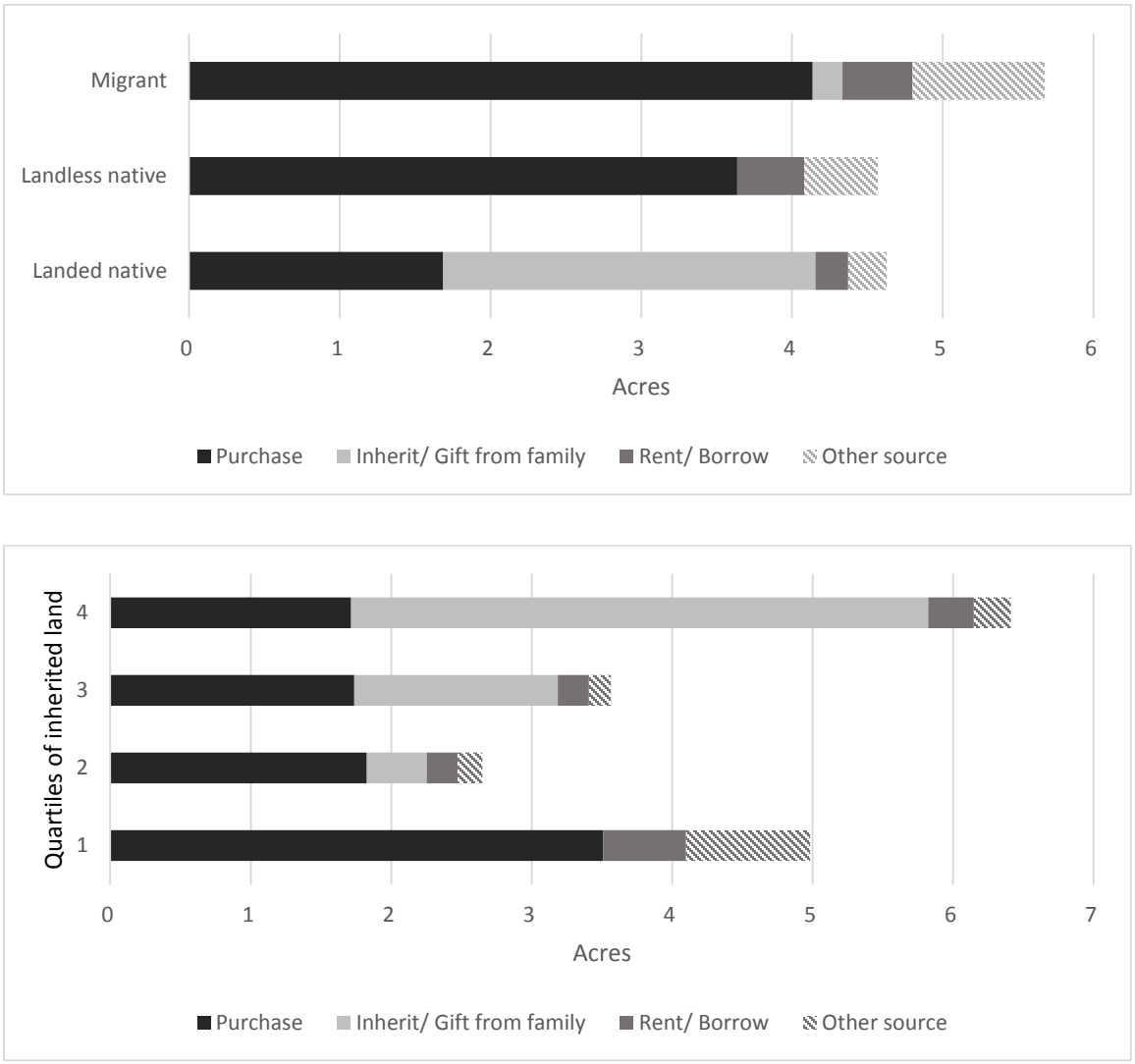
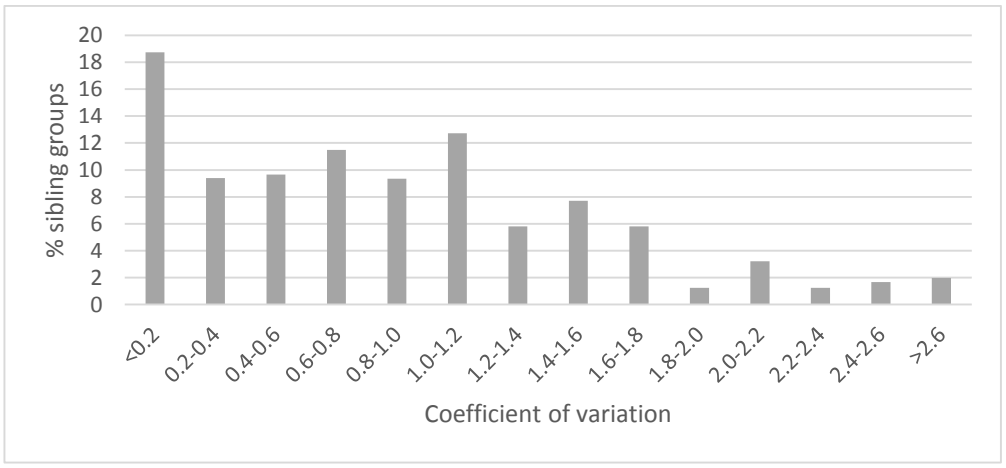


Figure 5. Inequality in sibling inheritance



Note: Limited to sibling groups with completed inheritance.