Transaction Costs, Land Rental Markets, and Their Impact on Youth Access to Agriculture in Tanzania

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ABSTRACT *We use three waves of nationally representative panel data from Tanzania to estimate the extent to which land rental markets provide a pathway for youth to enter into agriculture. We also investigate how transaction costs may impede youth access to renting-in land. Results suggest that rental markets are important mechanisms through which young farmers access land, but younger farmers face higher transaction costs when renting land than do older farmers. We also find evidence that younger farmers pay higher prices for rented land and are somewhat less likely to belong to village savings groups than are their older counterparts.* (JEL O12, Q15)

1. Introduction

Recent empirical evidence suggests that markets for farmland are growing within the traditional tenure systems in many countries of Sub-Saharan Africa (SSA). However, this growth is uneven across countries and even within the same country. Land rental markets generally have lower barriers to entry than land sales markets and are thus more prevalent in smallholder agriculture. The extent to which these rental markets function seems to depend on the strength of local institutions, population density, and market access among, other factors (Holden, Otsuka, and Place 2009; Chamberlin and Ricker-Gilbert 2016). This gives rental markets the potential to provide more equal access to land and promote efficiency within the smallholder farming system (Holden, Otsuka, and Place 2009). As such, the performance of land rental markets is critical for agricultural and economic development in SSA during the twenty-first century.

At the same time, the rural population in SSA is projected to increase to 938 million people by 2050—an increase of 62% from the 579 million rural people in 2014 (United Nations 2015). Furthermore, it is highly unlikely that urban areas of SSA will be able to absorb all of the growing population, leaving many people to remain in densely populated rural areas, where most of them will depend on agriculture for their livelihoods (Fine et al. 2012; Losch 2012; Jayne, Chamberlin, and Headey 2014). Therefore, land rental markets can play an important role in transferring land to a younger generation of farmers, and enable land and labor factor ratios to equalize.

With these considerations in mind, the present article addresses two important questions related to land access in SSA, which remain largely unanswered to date. First, to what extent do land rental markets allow households to increase or decrease their operational farm size so that it aligns with their desired land size (and, conversely, to what extent do transaction costs impede such adjustments)?[1] Second, do land rental markets provide a pathway for youth to acquire land and thereby enter into agriculture? The two questions are interrelated, because in the absence of market frictions we would expect youth to be more

[1] As discussed by Holden, Otsuka, and Place (2009) and Chamberlin and Ricker-Gilbert (2016), examples of transaction costs in land rental markets include the fixed costs of finding, negotiating, and enforcing rental agreements, along with the costs of monitoring land management by tenants. Additionally, variable costs may be imposed by pressure not to rent-out too much land, lest a household be perceived as excessively wealthy (and thus possibly subject to losing land under reallocation by traditional authorities).

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likely to rent-in land, given that they need an entry point into agriculture and have a longer time horizon than older farmers. However, if transaction costs exist in the form of information access and/or trustworthiness in the absence of contractual enforcement, then youth may be systematically disadvantaged. Thus, we would expect that transaction costs are, ceteris paribus, higher for youth who want to rent-in land.

We conduct our analysis using nationally representative panel data on smallholder farm households from Tanzania collected in 2009, 2011, and 2013 by the World Bank. Tanzania is an interesting case study because, as in most of SSA, the vast majority of smallholders in Tanzania cultivate land under a traditional tenure system without formal title. Regardless, the country has relatively active land rental markets within the traditional tenure system, as our data suggest on average 7.5% of smallholders rent-in land across the survey waves.[2] Furthermore, nearly 75% of the country's population is rural and two-thirds are under the age of 25, making youth issues in agriculture of utmost importance. Our analysis benefits from the fact that Tanzania exhibits significant variation in land scarcity, market access, and population density within the country. All of these appear likely to condition the demand for land access via rental markets.

Existing evidence from SSA suggests that initial land endowments and transaction costs have a significant influence over access to land and the benefits that individuals accrue from them. For example, Uganda's land markets developed through the forces of supply and demand driven by rural-rural migration. As a result, land markets in that country serve as a pathway for landless or near landless households to acquire land for farming (Baland et al. 2007). Conversely, André and Platteau (1998) find that in Rwanda, a country with extremely high population density and severe land pressures, land markets in the 1980s and early 1990s functioned to increase inequality. In that context, households parted with land out of desperation to meet immediate consumption needs. As such, it is important to recognize that while land markets have the potential to provide mutually beneficial gains to tenants and landlords, the extent to which this happens (if it happens at all) is purely an empirical question.

While the literature on land rental market participation and farm-level impacts is growing, there is still relatively little evidence on the two salient issues of transaction costs and youth access to land surrounding rental market development. To our knowledge, Skoufias's (1995) is the first article to estimate the size of transaction costs in land rental markets. Using data from India, he builds a model in which operated land size is a function of owned land, observable household characteristics, and transaction costs. The magnitude of the coefficient estimate on the owned land variable estimated via Tobit measures the size of the friction in the land rental market and how transaction costs inhibit households from adjusting their operational land size to meet their desired land size. To our knowledge, the only published studies to empirically estimate the Skoufias model in Africa are those by Deininger, Ali, and Alemu (2008, 2009) in Ethiopia, Yamano et al. (2009) and Jin and Jayne (2013) in Kenya, and a recent article by Wineman and Liverpool-Tasie (2017a) in northwestern Tanzania. These studies are all consistent with Skoufias's findings that there are significant frictions in land rental markets in SSA. One of the main implications from these studies is that these frictions reduce agricultural productivity by preventing more able producers from acquiring land through rental markets (Deininger, Ali, and Alemu 2009).

A recent article based on data from Ethiopia by Bezu and Holden (2014) is perhaps the only study to empirically investigate youth access to farmland in SSA. The authors examine livelihood choices among youth in southern Ethiopia and find that only 9% of rural youth plan to engage in agriculture in the future. The authors attribute this low percentage to land scarcity and land market restrictions. Their analysis focuses on youth members of households living with their parents, and they complement a descriptive discussion of liveli-

[2] Tanzania's rate of renting-in land compares to a rate of 3% during 2012/13 in neighboring Zambia a much less densely populated country, and a rate of 15.6% during 2008/09 in neighboring Malawi, a much more densely populated country (Chamberlin and Ricker-Gilbert 2016).

hood choices with a multinomial logit analysis of individual-preferred livelihood choices among off-farm wage employment, off-farm self-employment/business, or urban salaried employment. Not surprisingly, the authors find that a youth whose family has more land per capita is less likely to be interested in off-farm opportunities, while a youth with a higher level of education is more likely to be interested in urban salaried employment.

The present article builds upon the previous research on these topics by linking the pertinent questions of youth access to farmland (and lack thereof), and how that may be inhibited by transaction costs when youth attempt to participate in land rental markets. Our analysis focuses on the age of the household head and the extent to which transaction costs from renting-in land change as the household head ages. We build on the model by Skoufias (1995) by interacting the variable for area of land owned with age of the household head in a model where the dependent variable is land rented-in. The coefficient estimate on this interaction term tests the hypothesis of whether transaction costs in land renting decrease with age. Subsequently we investigate potential sources of transaction costs, such as distance from home to the plot, access to credit, membership in a savings and credit cooperative (a village savings group) and land rental prices. Results from our analysis provide important information as to whether younger farmers face the prospect of higher frictions in the land rental market, and the sources of these frictions.

Our identification strategy relies on the use of household-level panel data that provide us with the ability to use the Mundlak-Chamberlain (MC) device. This estimator removes correlation between the observed covariates and the time-constant unobservable factors that affect the outcomes of interest in our study.[3] We also have a rich set of demographic, agronomic, and market-level controls that should be able to account for much of the correlation between observed covariates and unobserved time-varying shocks that could potentially bias our estimates. That being said, as with any article using observational data, our results cannot be treated as being fully causal. Regardless, we present important relationships in issues of pressing importance to policy makers and development practitioners in SSA.

Results of our study suggest that younger farmers are more reliant on land rental markets to acquire land for cultivation, and we find that rented-in land makes up a larger share of younger farmers' operated land than it does for older farmers. However, younger farmers face significantly higher transaction costs when it comes to renting-in land than do their older counterparts. Furthermore, we find that these transaction costs for younger farmers likely occur through paying higher prices for rented land and being somewhat less likely to belong to a savings and credit cooperative. These results suggest the need for policies that improve access to land and credit facilities for younger farmers in Tanzania, conditional on credit worthiness, so as to avoid the consequences of having a large bulge in unemployed youth with limited on-farm and off-farm opportunities.

2. Background: Land Rental Markets and Smallholder Agriculture in Tanzania

Roughly two-thirds of Tanzania's nearly 57 million people live in rural areas where agriculture serves as the main livelihood activity for most of them.[4] Agriculture accounts for 24% of GDP, 30% of total exports, and 65% of raw materials produced in the country (USAID 2016). Though Tanzania has a relatively low population density at 63 people per square kilometer, it has grown rapidly since 1967 when it stood at just 13 people per square kilometer (Maro and Mlay 1982). Related to this, fertility rates are high at 4.8 children per woman, and the population is growing at over 3% per year. As a result, Tanzania's population is one of the youngest in the world with a median age of 17.6 years, giving it a rank-

[3] Unlike a fixed effects estimator, the MC device allows us to keep time-constant observable variables in the model.

[4] See Worldometers, http://www.worldometers.info/world-population/tanzania-population/.

ing of 219 out of 229 countries in terms of age distribution (Central Intelligence Agency 2017).[5]

Though Tanzania is a large country by area with significant amounts of arable land and natural resources, demand for land is clearly growing. This is driven by (1) a large and growing rural population engaged in smallholder agriculture, as discussed above; (2) rapid urbanization, leading to demand for urban land and the development of peri-urban areas on the outskirts of cities; and (3) interest in land for commercial agricultural purposes from both domestic and foreign investors (USAID 2016) and land leases that are rented by tenants.

The Land Act of 1999 and the Village Land Act of 1999 categorized land in Tanzania into one of three regimes: general, reserved, and village land. General land tends to be located in urban or peri-urban areas, has been surveyed, and normally comes with title. Reserved land is public land that includes natural parks, game reserves, and forests, where agriculture and other private enterprises are not supposed to take place. Village land is customary land that is managed by local village councils made up of community elders and other leaders.

The vast majority of smallholders in Tanzania cultivate land that is designated as village land. Individual smallholder households have cultivation rights that may be passed down from parents to children, but most of these plots do not have formal titles associated with them. However, the land acts of 1999 allow for sales and rental of village land. According to the law, if a smallholder wishes to lease out his or her land to another villager for a year or less, then he or she is free to do so without the approval of the village council (Wily 2003). While it would seem that this provision should encourage land rental participation among smallholders, the village council still maintains power over the land market in a number of ways. First, the village council must approve all land leases that are longer than a year, and are rented by tenants from outside the village. Second, the council maintains the power to reclaim land that it views as being underutilized by its current occupants and reallocate it to others (Sundet 1997). Third, under the 1967 Land Acquisition Law, village councils have the right to convert village land to general land and sell it to investors. Once transferred out of village tenure, land cannot be converted back, because the villages have surrendered their customary rights with this transfer (USAID 2016). It is possible that the authority of village councils to oversee land rental markets and reallocate land could increase transaction costs in land rental activities, and these market frictions may make it difficult for smallholders to adjust their operational farm size to match their desired farm size.

Despite the importance of land in Tanzania, to date there is still limited empirical work on land rental markets in terms of participation rates, determinants of participation, and the potential impact of rental markets on welfare. Using cross-sectional data from northwestern Tanzania, Wineman and Liverpool-Tasie (2017a) find that land rental markets allow the distribution of land to become more equal, especially for those with little or no land inheritance. In a separate paper, Wineman and Liverpool-Tasie (2017b) estimate the extent to which land rental markets affect women's access to land in northwestern Tanzania. The authors find that woman-headed households are less likely to participate in land rental markets than those headed by men. However, when they do participate, land rental markets can help women add to small landholdings that are left from their original marriages. A recent study by Deininger, Savastano, and Xia (2017) uses nationally representative cross-sectional data from six countries in SSA, including Tanzania, to understand the determinants of land rental market participation. The authors find that in Tanzania slightly more than 6% of respondents rent-in land, but for those who do, rented-in land makes up roughly 73% of their cultivated area. Furthermore, their regression results suggest that those who have less land ex ante are more likely to engage in land renting in Tanzania. This is consistent with Wineman

[5] For reference, Monaco's population is the oldest in the world with a median age of 52.4 years, while Japan's population is the second oldest with a median age of 46.9 years. In contrast, Niger's population is the youngest in the world (ranked #229) with a median age of 15.3 years (Central Intelligence Agency 2017).

and Liverpool-Tasie (2017a), suggesting that rental markets are a pathway for those with little land to engage in farming. However, Deininger, Savastano, and Xia find that age of the household head has no statistically significant effect on the decision to rent-in land.

The previous studies from Tanzania, cited above, show that there are potential gains from participating in land rental markets. The present article adds to the land rental market literature in Tanzania and in SSA more generally by identifying the extent to which transaction costs inhibit the gains from land rental market activities, and whether youth face greater barriers to participating in these markets than do older farmers.

3. Data

Our analysis uses household panel survey data, and geospatial data from secondary sources, to address the research questions presented above. Our household survey data are from the Tanzanian National Panel survey, part of the Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) Initiative supported by the World Bank.[6] For Tanzania, we observe 2,223 households in each of three waves (2009/10, 2011/12, 2013/14), with a larger number showing up in the unbalanced panel (total $n = 8{,}778$). Attrition is very modest: 6.1% of households attrite between waves 1 and 2, and 3.8% attrite between waves 2 and 3. The survey follows new household formations (i.e., follows members of enumerated households that leave the original household to form another in subsequent waves). These "breakaway" households are included in our sample, accounting for 17% and 25% of the 2011/12 and 2013/14 samples, respectively. Although breakaway households may be linked with the original (e.g., parent) households, we do not use this linkage in panel formation, since the original household is usually also present in the subsequent survey wave.

Also of interest is the fact that the survey tracks households that change location. In 2013, 51% of the sample had changed location from the original household, although this includes breakaway households, which account for 70% of the movers. Of this movement, 65% is within local areas (e.g., within the same district). This allows us to descriptively examine how rental market participation is associated with new household formation and movement.

It is also important to note that our study focuses on the tenant side of the land rental market. This is because there are relatively few landlords, that is, households which rent-out land, observed in our data: only 1.3% of the pooled sample, as compared with 7.5% renting-in (Appendix Table A1). Therefore, the number of young landlords is too small to evaluate econometrically. This asymmetry in landlord/tenant observation in rural household survey data is widespread (Deininger, Savastano, and Xia 2017). However, at least one empirical study (Chamberlin and Ricker-Gilbert 2016, using data from Zambia and Malawi) shows that econometric results for determinants of participation and impacts are not sensitive to whether tenants and landlords are modeled jointly.

4. Conceptual Framework

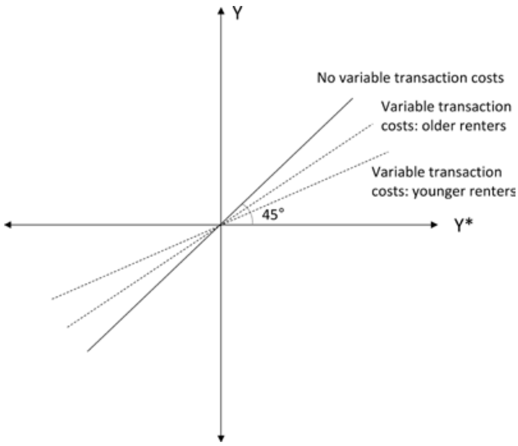
Our conceptual framework builds on that of Skoufias (1995) to model the relationship between the optimal amount of land that a smallholder household would like to cultivate (Y^*), and the amount of land that the household is able to operate given the constraints that it faces (Y). The relationship is specified as follows:

$$Y = f(Y^*), \quad [1]$$

where Y^* is affected by various household-level factors including land, transaction costs, market imperfections, and other nonland inputs. The shape of the land adjustment function is denoted by f, and with zero transaction costs in the land rental market a house-

[6] The data come from the National Panel Surveys covering the agricultural seasons of 2008/09, 2010/11, and 2012/13 in Tanzania, collected by the National Bureau of Statistics and supported by the World Bank as part of the LSMS-ISA program. Data are publicly available for download at http://surveys.worldbank.org/lsms/integrated-surveys-agriculture-ISA/tanzania.

Figure 1
Shape of Land Market Adjustment Function by Age of Renters



hold will be able to adjust its operational farm size to meet its desired farm size, such that $Y = Y^*$. This can be seen graphically in Figure 1, which follows Skoufias (1995) by showing the shape of $f(Y^*)$ in the presence of variable transaction costs for older and younger renters, respectively. In the absence of transaction costs, the slope of the adjustment function is equal to one as denoted by the solid 45-degree line in the figure. However, in the presence of transaction costs the household will not be able to fully adjust its land allocation, and the slope will be less than one. The modest conceptual contribution of this article is to explicitly model how the adjustment function may differ based on the age of the potential tenant. If younger farmers face higher transaction costs for renting-in land, then the slope for their adjustment function will be lower than the slope for older renters, who have an adjustment function slope closer to one, as seen in the figure.

Thus, when age of the renter is considered in the model of Y^*, it can be presented algebraically as follows:

$$Y^* = g\left(h,H\right) - \overline{A}, \quad [2]$$

where h is age of the household head, and H includes a vector of other household, community, and agronomic factors that affect Y^*, while a household's prerental landholding is denoted by $\overline{A}$. Prerental landholding is defined as the amount of land that a household has ownership of or cultivation rights to. This includes fallow land and all area cultivated by the household (excluding rented-in land) plus rented-out land (Chamberlin and Ricker-Gilbert 2016).

5. Empirical Model

This section operationalizes the conceptual model for estimating transaction costs in land rental markets, differentiated by age of the household head. Consider the decision by household i in time t for the amount of land the household chooses to rent-in during the upcoming growing season as a function of the following:

$$R_{it} = \beta\overline{A}_{it} + \gamma h_{it} + \alpha\overline{A}_{it}h_{it} + H_{it}\zeta + \epsilon_{it}, \quad [3]$$

where area rented-in in hectares is denoted by R. The variables $\overline{A}$, h, and H are the same as in equation [2], with β, γ, α, and ζ as parameters to estimate. Equation [3] is estimated via Tobit, and a key argument of Skoufias (1995) is that within a Tobit modeling framework, the coefficient estimate $\hat{\beta}$ on the prerental land endowment $\overline{A}$ can be interpreted as a measure of transaction costs in the land rental market. In the absence of transaction costs, the coefficient on land for tenants (renters-in) should be –1; in the presence of transaction costs, this coefficient moves away from –1 toward 0, as shown graphically in Figure 1.

We test the main hypotheses on the extent to which transaction costs in land rental markets differ by age of the tenant through the interaction between $\overline{A}$ and h in equation [3]. As such, the coefficient estimate $\hat{\alpha}$ allows us to test this hypothesis. If younger farmers do in fact face higher transaction costs than older farmers, we would expect the coefficient estimate on $\hat{\alpha}$ to be negative, as the slope of the adjustment function (f in equation [1]) will move closer to unity as the household head gets older.[7] The error term in equation [3] is

[7] We test the robustness of our estimates by interacting landholding with categories of age of the household head (for example a dummy = 1 if the head is less than 30, less

denoted by ϵ_{it}. Our strategy for dealing with potential correlation between ϵ_{it} and the observed covariates is discussed in the identification strategy subsection below.

Measuring Possible Sources of Transaction Costs

After estimating whether the magnitude of transaction costs differs by age of the potential tenant, we seek to identify some possible sources of these transaction costs and estimate the magnitude of their effects for younger farmers who may wish to engage in land rental markets. We estimate a series of reduced-form models in an attempt to elucidate these issues.

First, we estimate a model to test if younger farmers must travel farther from home to rented plots. Distance from the home of household i to plot j, denoted as D, is estimated as follows:

$$D_{ijt} = \rho h_{it} + \pi R_{ijt} + \delta h_{it} R_{ijt} + H_{it}\eta + \varepsilon_{it}, \qquad [4]$$

where h and H are the same as in equations [2] and [3], and R denotes a binary variable equal to 1 if the plot is rented-in. The parameters to estimate in equation [4] are ρ, π, δ, and η. The coefficient estimate $\hat{\delta}$ on the interaction between h and R tests if older farmers travel shorter distances to their rented plots than do younger farmers. If this is the case, it may indicate that transport costs and travel times create frictions in the land rental markets for younger farmers. The error term in equation [4] is denoted by ε.

Second, we estimate a model for credit membership of the household, where access to credit either through a savings and credit cooperative or other credit source is a function of age and other household factors. If we find that younger household heads are less likely to access credit than are older household heads, it would seem that credit and financial institutions are less likely to serve younger farmers. One could imagine that this friction could inhibit land rental market adjustments for younger farmers.

than 40, and less than 50). In this specification a positive coefficient estimate would suggest that younger households face greater transaction costs, as the slope of the adjustment function moves farther from –1 for younger renters.

Finally, we estimate a model in which land rental price, in Tanzanian shillings per hectare, of plot j is regressed on age of the household head and other household factors, including size of the plot. This allows us to test the extent to which younger farmers must pay a higher per unit price to rent land than their older counterparts.

Identification Strategy

As mentioned earlier, one of the challenges of using observational data is that the error terms may be correlated with the observed covariates in the models. If this correlation exists, then the observed covariates are endogenous, biasing their coefficient estimates. As Chamberlin and Ricker-Gilbert (2016) discuss, in a model of land renting the most likely source of endogeneity comes from omitted variable bias. For example, several studies have documented that rented land is of poorer quality than owner-cultivated land (Yamano et al. 2009; Ricker-Gilbert et al. 2017). If younger farmers are more likely to rent-in land that is of poorer quality than older farmers, and we do not control for soil quality in the model, then coefficient estimates on h in equation [3] would be biased. Other sources of omitted variable bias could come from risk aversion, motivation, and management skills. All of these are difficult to observe and could be correlated with age of the household head.

We are able to at least partially overcome this challenge by using three waves of panel data from Tanzania. The panel nature of our data allows us to decompose the error term (e.g., ϵ_{it} in equation [3]) into two components as follows:

$$\epsilon_{it} = a_i + u_{it}, \qquad [5]$$

where a_i represents the household-level unobserved heterogeneity that is time constant. Most of the omitted variables we are concerned about, such as soil quality, risk aversion, motivation, and management skills of the household head, are likely time constant and contained in a_i.

Fortunately, our panel data give us an estimation procedure to deal with correlation between a_i and the observed covariates in the

Table 1
Rental Market Participation Indicators in Tanzania, by Age of Household Head

Age Category	Mean Amount of Land before Renting-in	% of Households Renting-in	For Those Who Rent-in Land: Mean Amount of Land Rented-in (ha)	% of Operated Land That Is Rented-in	% of Renters Who Rent-in >90% of Their Land
<30	1.29	13	0.71	79	61
30–40	1.78	9	0.91	67	38
40–50	2.66	8	0.97	69	35
>50	3.41	4	0.72	59	30

Source: Data from 2013 wave of the LSMS-ISA survey.

model. We estimate the model of land renting-in equation [3] via Tobit, so we use the MC device, following Mundlak (1978) and Chamberlain (1984), to model the unobserved heterogeneity. The MC device controls for unobserved time-constant heterogeneity by including the household-level averages of all time-varying covariates in the model (see Wooldridge 2010 for more discussion). After using the MC device, any left-over time-varying shocks are denoted by u_{it}. We include community-level rainfall controls that proxy for some of the important unobservable shocks that households may face from year to year.[8] However, as with any study using observational data, we cannot claim that our results are fully causal.

6. Results

Descriptive Results

Our results indicate that smallholder participation in rural land rental markets is still limited, but nonetheless important in Tanzania. The percentage of households renting-in land ranges from 7.5% to 9.1% over the 2009/10–2013/14 period, as seen in Appendix Table A1. Furthermore, Table A1 indicates that, on average, tenants are younger than nontenants.

Table 1 provides information on land rental market participation by age categories (age of the household head). It indicates that younger farmers have less land ex ante than older households. Table 1 also shows the intensity of renting-in land, by the same age categories. While the average amounts rented-in do not differ radically across age groups, the percentage of total operated land area acquired via rental markets shows a pronounced trend across age groups: younger household heads rent-in a larger share of their total farms than do older household heads. This finding suggests that younger households are more dependent upon land rental markets to acquire land for farming than are older households.[9]

Given the seeming importance of rental markets as an initial avenue into farming for younger households, we next examine rental market participation indicators alongside the available information about household formation and migration in Table 2. Breakaway (or split-off) households are defined in the LSMS-ISA as new households formed by one or more members of a household observed in a previous wave. Local tracking indicates that the household moved from the previous wave but stayed within the same vicinity; distance tracking indicates that the household moved from the previous wave to a different locality (e.g., a different district).

Several observations stand out from Table 2. First, younger household heads are more likely to (1) rent-in land; (2) rent-in a larger share of their total farmland; and (3) farm exclusively on rented land, as compared with older household heads. Furthermore,

[8] While it is theoretically possible to take an instrumental variables (IVs) approach to dealing with such residual time-varying heterogeneity, the identification of a plausible IV is challenging. As noted by Wooldridge (2010), an IV that is itself endogenous may create more biased coefficient estimates than not using an IV.

[9] The same findings hold when we adjust the far-right column in Table 1 to "% of renters who rent >80% of their land" and "% of renters who rent >95% of their land."

Table 2
Rental Characteristics by Breakaway (Split-Off) and Movement Status (2013)

	In Same Location		Local Tracking		Distance Tracking	
Head's Age	Original HH	Split-Off HH	Original HH	Split-Off HH	Original HH	Split-Off HH
Estimated Population (thousands)						
<35	927	1	194	312	54	143
35–55	2,695	1	278	210	72	147
>55	2,121	3	115	122	17	86
Tenant % of Sample						
<35	10	0	14	12	12	23
35–55	8	0	10	18	6	12
>55	4	0	3	8	15	4
Mean % of Land Rented-in (Tenants Only)						
<35	64	0	71	87	82	87
35–55	55	0	84	82	90	87
>55	48	0	100	59	100	84
% of Tenants Renting ≥90% of Their Land[a]						
<35	38	0	51	77	27	82
35–55	24	0	44	67	40	69
>55	14	0	100	17	100	78

Note: A split-off household is defined in the LSMS-ISA as a new household formed by one or more members of a household observed in a previous wave. Local tracking indicates that the household moved from the previous wave but stayed within the vicinity; distance tracking indicates that the household moved from the previous wave to a different locality (e.g., a different district). HH, household.
[a] In this table, tenants are categorized as being without nonrented land if 90% or more of their reported farm area is rented.

households that move between survey waves (whether or not they are breakaway households) are more likely to rent-in land and are also more likely to rent-in a higher share of their total farmland. Breakaway households, compared with nonbreakaway households in each category of movement, also have mostly higher rates and extents of rental market dependence, particularly for those who move out of the locality. Table 2 shows that 23% of breakaway households that have been tracked to new localities are renting-in land, the vast majority of which are farming mostly or exclusively on that rented-in land. While these figures do not control for other conditioning factors (which we control for in the next subsection), they do provide some compelling initial evidence for the importance of rental markets in new household formation, as well as hint at the relationship between rural migration and land rental market participation.

Econometric Results

We estimate a binary response model via probit on the probability of a household renting-in land and present the results in Table 3 (descriptive statistics from our sample are provided in Appendix Table A2). The model controls for characteristics of the household head, as well as farm- and household-level characteristics and geographic context (i.e., local geospatial variables on population density, access to market, terrain, and seasonal rainfall). Of particular interest is the coefficient estimate for the age of the household head, which is negative and strongly significant. We compute probabilities of renting-in land at different ages, while holding other variables at their means, presenting the results in Appendix Table A3. The table shows that a 20-year-old household head has a 0.05 probability of renting-in land, while a 30-year-old has a 0.038 probability (1.2 percentage-points less than a 20-year-old), and a 40-year-old has a 0.028 probability of renting-in land (2.2 percentage-points less than a 20-year-old). Other coefficient estimates in Table 3 are consistent with those reported in similar models for other African countries (e.g., Chamberlin and Ricker-Gilbert 2016).

Our main empirical specifications that test the extent to which younger farmers face higher transaction costs when renting-in land

Table 3

Determinants of Renting-in Land (Average Partial Effects from Probit Model)

Dependent Variable: =1 if Household Rents-in Land	(1)
Age of head	–0.0134*** (0.000)
Prerental land (ha)	–0.456*** (0.000)
Household size	0.0051 (0.854)
Max. educ. attainment	0.057 (0.721)
Female head = 1	0.0 19 (0.929)
Number of plots	0.775*** (0.000)
Inverse hyperbolic sine (assets)	0.0 95*** (0.005)
Has ox plough = 1	0.1121 (0.342)
Has tractor = 1	0.0574 (0.734)
Rural = 1	0.0619 (0.753)
Km to road	–0.0017 (0.820)
Km to market	0.0004 (0.943)
Elevation	0.0007 (0.175)
Slope	–0.0315 (0.237)
Log(population density)	0.0000 (0.974)
Bimodal rainfall = 1	–0.4316 (0.451)
Mean annual rainfall	0.0015 (0.262)
N	8,741

Note: Mundlak-Chamberlain controls (time averages of time-varying regressors) included. Year dummies included, but coefficients not reported. p-Values are cluster robust.

*** $p < 0.01$.

are found in the Tobit results, shown in Table 4, where the dependent variable is the amount of land rented-in, in hectares. Five specifications are shown, which vary in the ways that prerental land and age of household head enter the model: (1) our base specification includes the amount of prerental land owned, (2) interacts the prerental land endowment with dummies indicating whether the household head is younger or older than 35, (3) includes a larger number of age categories as interaction terms, (4) interacts age of head and prerental landholding as continuous variables, and (5) shows the same interaction term along with the prerental landholding included again separately. Age of household head is included as an additional control in all of these specifications. The interaction terms allow the slope of the prerental land endowment to vary by age of household head.

The basic story about age of household heads and transaction costs in land rental markets is the same across all specifications: younger households have statistically significant coefficient estimates that are closer to zero than older households. This indicates that although younger households depend more on rental markets to obtain land for farming, they face higher transaction costs in rental markets than do households with older heads.

A limitation of the Skoufias (1995) framework is that it does not tell us much about the nature of the transaction costs being incurred. A priori, we may speculate that relevant transaction costs in a rural land rental setting may include factors such as costs of identifying and screening rental opportunities, costs of negotiating rental agreements, and costs of enforcing rental arrangements through formal and/or customary institutions. From a landlord's perspective, he or she may be less willing to rent to a potential tenant for whom the risks of soil nutrient mining are high or uncertain (e.g., production under low input levels), or for whom the risk of the renter exceeding the temporal terms of the rental agreement is high (i.e., squatting on the land in subsequent seasons). Unfortunately, we are not able to observe such costs directly in our data. From the tenant's perspective, it is also possible that some transaction costs may be associated not with the rental arrangement per se, but with accessing ancillary credit markets that reduce up-front cash constraints (in areas where rental arrangements are based on up-front cash payments).

Our dataset contains information on credit availability, so we are able to examine this latter issue indirectly by estimating models on the determinants of credit access via probit. (These results are provided in Appendix Table A4). We find that the probability of membership in a savings and credit cooperative is generally increasing with age, although in a nonlinear fashion, peaking at about age 60. When we consider other forms of credit, however, we find that younger farmers are generally *more* likely to have accessed credit within the last year, as compared with older farmers. For reference, about 5.4% of the pooled sample reports savings and credit cooperative membership, and 9.4% reports receiving credit from other sources within the previous 12 months. While receiving credit could be more a sign of need than availability, as younger farmers may have fewer assets to purchase input directly than older households, these results suggest that credit access per se

Table 4

Determinants of Amount of Land Rented-in by Tenants (Coefficient Estimates from Tobit Model)

Dependent Variable: Hectares of Land Rented-in	(1)	(2)	(3)	(4)	(5)
Prerental land (ha)	–0.5601 (0.000)***				–0.4861 (0.035)**
Prerental land × (Age < 35)		–0.4825 (0.000)***			
Prerental land × (Age ≥ 35)		–0.6028 (0.000)***			
Prerental land × (Age 17–35)			–0.4559 (0.000)***		
Prerental land × (Age 35–55)			–0.6126 (0.000)***		
Prerental land × (Age > 55)			–0.6179 (0.000)***		
Prerental land × Age of head				–0.0111 (0.000)***	–0.0017 (0.719)
Age of head	–0.0220 (0.000)***	–0.0190 (0.000)***	–0.0181 (0.000)***	–0.0095 (0.002)***	–0.0200 (0.000)***
Household size	0.0099 (0.816)	0.0099 (0.813)	0.0116 (0.781)	0.0068 (0.871)	0.0093 (0.826)
Maximum educational attainment	0.0040 (0.862)	0.0030 (0.896)	0.0027 (0.905)	0.0025 (0.912)	0.0036 (0.873)
Female head = 1	–0.0179 (0.960)	–0.0407 (0.910)	–0.0528 (0.883)	0.0313 (0.927)	–0.0134 (0.970)
Number of plots	0.9992 (0.000)***	0.9948 (0.000)***	0.9905 (0.000)***	0.9609 (0.000)***	0.9997 (0.000)***
Inverse hyperbolic sine (assets)	0.0776 (0.005)***	0.0788 (0.004)***	0.0800 (0.003)***	0.0767 (0.005)***	0.0779 (0.004)***
Rural = 1	0.1762 (0.567)	0.1832 (0.550)	0.1855 (0.544)	0.1782 (0.563)	0.1788 (0.561)
Kilometers to road	–0.0036 (0.764)	–0.0038 (0.753)	–0.0038 (0.751)	–0.0030 (0.805)	–0.0036 (0.765)
Kilometers to market	–0.0017 (0.851)	–0.0015 (0.869)	–0.0015 (0.873)	–0.0019 (0.839)	–0.0017 (0.852)
Elevation	0.0015 (0.057)*	0.0015 (0.061)*	0.0015 (0.060)*	0.0014 (0.069)*	0.0015 (0.058)*
Slope	–0.0472 (0.231)	–0.0475 (0.234)	–0.0479 (0.230)	–0.0493 (0.221)	–0.0475 (0.230)
Log(Population density)	–0.0000 (0.999)	–0.0000 (0.991)	–0.0000 (0.993)	–0.0000 (0.975)	–0.0000 (0.998)
Bimodal rainfall = 1	–0.9394 (0.306)	–0.9889 (0.283)	–0.9949 (0.278)	–1.0850 (0.245)	–0.9553 (0.300)
Mean annual rainfall	0.0024 (0.220)	0.0024 (0.223)	0.0024 (0.223)	0.0022 (0.270)	0.0024 (0.226)
N	8,741	8,741	8,741	8,741	8,741

Note: Mundlak-Chamberlain controls: time-averages of time-varying regressors. Year dummies included, but coefficients not reported. *p*-Values are cluster robust.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

is not the primary barrier to full utilization of rental markets.

As an alternative oblique view into possible barriers to land rental market participation by younger farmers, we next examine stated rental prices as reported by tenants (569 of the 618 pooled tenant households report seasonal rental prices paid). Table 5 shows the results of a linear regression model of the determinants of rental rate paid by tenants. The dependent variable is the log transformed stated season rental rate (=rent/hectare). We run several specifications of this model: (1) a baseline specification with plot-level, household-level,

Table 5
Determinants of Agricultural Land Rental Prices (Plot-Level Models)

Dependent Variable: Log(Rental rate)	(1)	(2)	(3)	(4)
Plot Characteristics				
Log(Plot size)	–0.4537	–0.4807	–0.4034	–0.2963
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
1 = Plot has good soil	0.1866	0.1910	0.1400	0.1229
	(0.011)**	(0.009)***	(0.057)*	(0.038)**
1 = Plot is sloped	–0.1056	–0.1123	–0.0684	–0.0711
	(0.159)	(0.144)	(0.390)	(0.283)
Plot km to market	–0.0108	–0.0119	–0.0026	–0.0006
	(0.020)**	(0.013)**	(0.576)	(0.883)
Plot km^2 to market	0.0001	0.0001	0.0000	0.0001
	(0.015)**	(0.009)***	(0.518)	(0.138)
Household Characteristics				
Age of head	–0.0083	–0.0077	–0.0070	–0.0048
	(0.008)***	(0.010)***	(0.016)**	(0.077)*
Number of members	0.0019	–0.1159	–0.1438	–0.0820
	(0.898)	(0.010)**	(0.002)***	(0.037)**
(Max) education	0.0071	–0.0020	0.0032	–0.0000
	(0.436)	(0.930)	(0.870)	(0.999)
1 = Female head	–0.0316	–0.4130	0.3926	0.2540
	(0.745)	(0.385)	(0.375)	(0.482)
Inverse hyperbolic sine (assets)	0.0166	0.0288	0.0217	0.0148
	(0.311)	(0.221)	(0.372)	(0.444)
Geographical Context				
District rental rate				0.7009
				(0.000)***
Elevation (mm)	0.0001	–0.0002	–0.0005	–0.0003
	(0.410)	(0.801)	(0.548)	(0.614)
Slope (degrees)	–0.0288	–0.0245	–0.0270	–0.0071
	(0.005)***	(0.366)	(0.302)	(0.736)
Log(Population density)	0.0337	0.0399	0.0409	0.0140
	(0.238)	(0.237)	(0.175)	(0.561)
Rural = 1	0.0224	–0.2454	–0.2849	–0.2811
	(0.849)	(0.307)	(0.237)	(0.143)
Bimodal = 1	0.3449	–0.1724	1.0914	0.0958
	(0.000)***	(0.680)	(0.057)*	(0.810)
Mean annual rainfall	0.0000	0.0005	–0.0002	–0.0010
	(0.812)	(0.770)	(0.930)	(0.443)
Other Controls				
Year dummies	Yes	Yes	No	No
Year and zone interactions	No	No	Yes	Yes
Mundlak-Chamberlain device?	No	Yes	Yes	Yes
N	652	652	652	652

Note: Unit of analysis is at the plot-level. Sample is all rented-in plots. Mundlak-Chamberlain device was defined at the household level: time-averages of time-varying household-level regressors. *p*-Values are cluster robust.
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

and geographical controls; (2) the additional incorporation of time averages of the household-level time-varying components (i.e., the MC device); (3) the additional inclusion of year-region interaction dummies to account for other unobservable time-varying factors; and (4) the additional inclusion of the average district rental rate, as calculated from our sample. Across all specifications, the coefficient estimate for age of household head is negative and statistically significant. After controlling for other factors, the semielasticity estimates on age of household head indicate that each additional year of age of a household head is associated with a 0.48% to 0.83% decrease in the average rental rate paid, depending upon the specification. These results provide some evidence that, holding observable characteristics constant, younger farmers are paying higher rental prices. This is consistent with the hypothesis that some kinds of age-differentiated transaction costs are being incorporated into effective land rental rates.

We further explore a range of other potential indicators of land quality or desirability but do not find any evidence that younger renters are systematically renting-in lower-quality land. For example, we estimate regression models of factors governing distance of the plot from the farmer's homestead, and factors affecting whether the plot was identified as being of poor quality by the respondent farmer. (These estimation results are reported in Appendix Table A5 and Table A6, respectively) Results from these models may be summarized as follows: While younger farmers generally farm plots that are farther from the homestead than those of older farmers, and rented plots are also more likely to be farther away, there is no evidence of an interaction between renting land and renter age. Similarly, while younger farmers are more likely to report farming poor-quality plots, and there is (weak) support for the notion that rented-in plots are of poorer quality than owner-cultivated plots, there is no evidence of a statistically significant interaction between renting and renter age in our models.[10]

7. Conclusions

Our article provides evidence that, while rental markets are important avenues for the acquisition of farmland by young farmers in Tanzania, the transaction costs faced by younger farmers attempting to access land rental markets appear to be higher than those faced by older farmers, holding other observable factors constant. One reason for this may be that weak contract enforcement could make rental arrangements contingent upon reputation, which may take many years to develop. While we are not able to fully parse out what these transaction costs consist of, we do find evidence that younger farmers pay higher rental rates, after controlling for other plot-level observable characteristics (including amount of land rented-in). We also find evidence that when younger people migrate or split off from their parents' household, rental markets are an important avenue for them to acquire land for farming. Furthermore, we find that younger farmers cultivate plots farther away from their homes and cultivate plots that they believe are of poorer quality than do older households. However, we do not find evidence that these plot-level characteristics (distance and self-assessed soil quality) are systematically different for young renters as compared with older renters.

Future work may help to clarify the specifics of what rental market transaction costs are in more detail, particularly with respect to younger farmers, given their greater relative dependence upon rental markets as a means for accessing farmland. This dependence is likely to increase across SSA, as rural populations are expected to grow and land pressures are projected to intensify across the region (Jayne, Chamberlin, and Headey 2014). In order to address the looming rural "youth bulge" and overcome the challenges associated with increased land pressure, it is important for policy makers to recognize the importance that land rental markets can play in facilitating land transfer and land access by new generations of farmers. This is particularly the case in countries like Tanzania, where the nonfarm and urban sectors are still too underdeveloped to absorb surplus labor that might wish to leave rural areas.

In order to better understand and redress transaction costs and transaction cost asymmetries that may disproportionately affect younger farmers who are in greatest need of access to farmland, this study makes the following policy recommendations. First, consider setting up a willing tenant/willing landlord program that matches younger potential tenants with older potential landlords. These

[10] We examined a number of other, more specific quality indicators such as slope and whether the farmer reported erosion problems, but find no evidence that young farmers are systematically renting-in land of worse quality.

arrangements could evolve into eventual sales of land from older to younger farmers. In this respect, clarifying and simplifying the regulations and procedures for title conversions and land purchases in customary tenure areas may also be an important complementary policy objective. Second, governments should consider means of collecting and disseminating representative land rental rates for different areas, in order to provide a reference for rental negotiations. This would be similar to how governments collect commodity prices in many rural retail markets in SSA countries. This may help increase transparency and could help lower prices for younger farmers and migrants to new areas who lack social connections and may be systematically disadvantaged and forced to pay higher prices for rented land.

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