

PARTICIPATION IN RURAL LAND RENTAL MARKETS IN SUB-SAHARAN AFRICA: WHO BENEFITS AND BY HOW MUCH? EVIDENCE FROM MALAWI AND ZAMBIA

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We use nationally representative household-level panel survey data in two neighboring countries in Southern Africa—Zambia and Malawi—to characterize the current status of rural land rental market participation by smallholder farmers, and their subsequent welfare impacts. Rural rental market participation is much higher in densely-populated Malawi than in lower-density Zambia, reflecting the role of land scarcity in driving rental market development. Consistent with previous literature, we find evidence that rental markets contribute to efficiency gains within the smallholder sector by facilitating the transfer of land from less-able to more-able producers, on average, in both countries. Furthermore, we find that rental markets serve to re-allocate land from relatively land-rich to land-poor households. We examine the impacts of participation on a number of welfare outcomes and find evidence for generally positive returns to renting in land in both countries, on average. However, our analysis also indicates that the returns to renting in land vary strongly with scale of production: tenants who produce more have larger returns to renting in, and many of the smaller producers who rent in do so at an economic loss. The impacts of renting out (i.e., participating in markets as landlords) are decidedly more mixed, with overall negative returns to landlords in Malawi and negligible returns to landlords in Zambia. The findings in this article highlight the need for researchers and policymakers in sub-Saharan Africa to stay attuned to how land rental market participation and its impacts evolve in the near future.

Key words: Africa, land rental, land scarcity, Malawi, smallholder farming, Zambia.

JEL codes: D63, O12, Q15.

Access to farmland in sub-Saharan Africa (SSA) is a key factor that determines whether or not rural households are poor, food

insecure, and vulnerable to shocks. Although land rental and sales markets have typically not been regarded as features of traditional tenure systems, recent evidence suggests that land markets are far more widespread than commonly perceived (Holden, Otsuka, and Place 2009a). This misperception makes understanding the factors affecting land market development and their impacts of considerable interest to both researchers and policy makers. Thus far, empirical focus has been placed on rental markets in SSA as they generally face lower developmental barriers than sales markets, and are consequently more prevalent within the region's smallholder production systems (Jin and Jayne 2013;

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Yamano et al. 2009; Otsuka 2007; Binswanger and Rosenzweig 1986).¹

With these considerations in mind, this article uses nationally representative household-level panel data from two neighboring countries in Southern Africa—Malawi and Zambia—to make two main contributions to the literature on land rental markets in SSA. First, we directly measure rental market impacts on a broader range of income and welfare indicators than previous studies by including crop income, total household income, and poverty. Food security is an ongoing concern in both Malawi (Ellis and Manda 2012) and Zambia (Chapoto et al. 2011); relating household food security outcomes to emerging land rental markets is of great relevance for both land and social welfare policy. Second, we use quantile regression to query the distribution of land rental market impacts, going beyond the conditional mean estimates used in other studies. This enables us to estimate how renting land may benefit smallholders at different points of the crop income distribution.

Theory suggests three primary channels in which land rental markets may impact smallholders: equity, efficiency, and welfare (Holden, Otsuka, and Place 2009a). The literature discusses equity gains in terms of equality, as the reallocation of land across households with different assets occurs in a way that land and non-land factor ratios tend to equilibrate. Efficiency gains are associated with net land transfers from less productive to more productive users. The literature often implies that welfare gains occur through rental markets by facilitating greater access to land for smallholders as the primary productive asset within their production system. Welfare is also derived through higher household incomes and food security associated with enhanced equity and efficiency outcomes from land rental markets.

Malawi and Zambia together represent a wide spectrum of relative land scarcity and market access conditions. While there is a growing body of empirical literature on land markets in SSA, little work has been done on these issues in Malawi, and to our knowledge

no work has been done in Zambia. For Malawi, Lunduka, Holden, and Øygard (2009) examine the relationship between tenure security and rental market participation in a cross-sectional context. Lunduka (2009) examines the impact of tenure security on a range of farm investment outcomes, as well as on technical efficiency. However, the household-level effects of land rental participation have not yet been empirically explored in this setting. Our study aims to address this gap. Furthermore, the existing empirical studies that we are aware of have focused on rental markets in areas with high population density (e.g., Uganda, Malawi, Ethiopian highlands, and high density parts of Kenya). Little attention has been paid to the function and role of markets in (ostensibly) lower population density countries such as in Zambia, where land access may also be constrained (e.g., by competing land claims). More generally, no empirical studies have systematically investigated how both participation and impacts differ across a wide range of population density and market access conditions.

In addition to panel data, the present study uses geospatial data to control for contextual factors such as population density, which may affect household rental market participation, as well as characterize the impacts of rental markets on a range of welfare measures. This cross-country analytical approach offers rich insights and greater external validity for our results. We use panel estimation methods including the Mundlak-Chamberlain (MC) Device, and household fixed-effects (FE) to deal with potential endogeneity of land rental market participation in the welfare models of interest in this article. Data from each country is analyzed separately, but we evaluate results comparatively and draw conclusions on this basis.

The rest of this article is organized as follows. In the following section we describe the current state of land rental markets in Malawi and Zambia, along with the key features of their respective institutional and legal contexts. We then review the conceptual arguments for rental market impacts in smallholder systems, as well as the existent empirical support. In the next section we discuss a conceptual model, followed by our methodological approach. The following section discusses data, while the next section describes our estimation results. The last section contains conclusions and implications for policy.

¹ These barriers include the lack of formal institutional mechanisms for sales within customary tenure systems, as well as the greater flexibility of rental arrangements as compared with sales arrangements, particularly in environments characterized by missing or imperfect credit markets, and the greater risk of longer-term investments implied by sales.

Rental Markets and Their Contexts in Malawi and Zambia

Malawi and Zambia share similar environments in many important respects. Both countries are predominantly agricultural, and rural populations consist primarily of farm households.² The overwhelming majority of these households are smallholders, conventionally defined as farming 10 hectares or less. Even within the smallholder sector, median farm sizes are very small: 1.2 ha for Zambia, and 0.8 ha for Malawi.³ The smallholder sector is characterized by low productivity, low levels of market engagement, and high poverty rates.

Both countries recognize two major land tenure regimes: customary (or traditional) tenure, and private (or leasehold). Customary lands are under the localized management of chiefs according to customary law. Specific terms of customary law vary across localities, but generally adhere to a model wherein usufruct rights to land resources within a chiefdom are allocated by the chief (or sometimes via their subordinate networks of headmen and *indunas*) to clan members. Familiar usufruct rights are generally heritable, but ultimately subject to possible reallocation by the chief.

Under leasehold tenure, land allocation is regulated by the market: titled lands may be bought and sold without restriction. In order to formally access customary lands through this mechanism, they must first be transferred from customary to leasehold status, as provided by the respective land acts in either country.⁴

Although an increasing amount of customary land has been converted to leasehold tenure over the last decade, few people operate leasehold farms, and the vast majority of smallholders operate farms under customary tenure (Sitko, Chamberlin, and Hichaambwa

2014; Chirwa 2008).⁵ Within customary lands, the buying and selling of land has no legal basis, though it is frequently carried out clandestinely under the guise of traditional mechanisms for transferring permanent usufruct rights (Sitko 2010). Meanwhile, renting of customary landholdings, while also legally ambiguous, is something that the chief may tacitly or explicitly endorse. Thus, land rentals are found both within formal and customary tenure systems, while sales are mostly confined to titled land. Evidence suggests that fixed cash rent contracts are the dominant contractual form when smallholders rent in and rent out land (Holden, Kaarhus, and Lunduka 2006, for Malawi).⁶ These contractual arrangements are usually undocumented.

It is important to note that both Malawi and Zambia have public land, which corresponds to land rights claimed by state entities. These lands include forest reserves, game parks, and other protected areas. Officially, public lands are not supposed to be used for agriculture, but in reality smallholders encroach upon these areas to increase their cultivated area.⁷

While Malawi and Zambia have many economic, cultural, and institutional similarities, one of the major structural differences between the two countries is the substantial contrast in population density. Official population density estimates in Malawi stand at 139 people/km², while Zambia's official population density estimate is just 19.3 people/km². Table 1 indicates that land rental markets are much more developed in Malawi than in Zambia, in terms of smallholder participation rates. Differences in population density between the two countries is likely associated with increased demand for land, and subsequently underlie the greater development of land rental markets in Malawi compared to Zambia. Nonetheless, the table shows that rental market participation is growing in both countries over time. In Zambia the growth in land rental markets may be fueled by perceptions of land unavailability, which are widespread, but particularly strong in Zambia's higher population density

² The population of Zambia is about 13 million; 61% reside in rural areas and earn their incomes primarily from agriculture. The population of Malawi is about 16 million; about 85% live in rural farm households.

³ Farm size distributions are also highly skewed *within* the smallholder sector. For example, in Zambia, 50% of smallholder households cultivate less than two hectares and about one-quarter have farms of one hectare or less. In Malawi, 55% of smallholder households cultivate less than one hectare.

⁴ The Zambia Land Act of 1995 established mechanisms for the conversion of customary land to leasehold statuses. Malawi has no such formal mechanism, as the Land Act has yet to be passed.

⁵ About 10% of the land area under smallholdings in Zambia has now been converted to leasehold tenure. In Malawi, as of 2005, only 1.55% of all plots were in leasehold or were purchased with or without a title.

⁶ The nationally representative IHS3 dataset in Malawi indicates that in the 2008/09 and 2009/10 cropping seasons, 96% of all rental contracts were upfront cash rent.

⁷ We thank an anonymous reviewer for making this point.

Table 1. Rental Status of the Sample by Survey Wave

	Malawi			Zambia		
	2002/03	2006/07	2008/09	2001/02	2008/09	2012/13*
Percentage of sample renting in land	7.9%	13.6%	15.8%	0.9%	1.0%	3.0%
Percentage of sample renting out land	4.4%	5.2%	8.4%	0.2%	0.7%	0.5%
Percentage of sample renting in and renting out land	0.4%	0.2%	0.2%	0.0%	0.0%	0.0%
Percentage of sample that does not rent in or out	88%	82%	76%	99%	98%	97%
Average area rented in unconditional (hectares)	0.06	0.08	0.08	0.01	0.02	0.03
Average area rented out unconditional (hectare)	0.02	0.03	0.05	>0.01	0.01	0.01
Average area rented in conditional on renting (hectares)	0.78	0.59	0.49	1.35	1.81	1.06
Average area rented out conditional on renting (hectare)	0.54	0.65	0.60	1.53	1.02	1.59
Median land rental price (2009 USD/hectare)	23.6	27.0	42.7	33.8	21.9	20.03

Note: 2012/13 data for Zambia are from the nationally representative Rural Agricultural Livelihood Survey (RALS), from the Indaba Agricultural Research Institute and Michigan State University. Other data sources are as described in the Data section.

areas (Sitko, Chamberlin, and Hichaambwa 2014). Almost nobody both rents in and rents out land, indicating that tenants and landlords are two distinct groups of households.

In summary, Malawi and Zambia constitute a two-country setting that is characterized by predominantly small farm sizes, high rates of poverty and food insecurity, and similar institutional environments in which customary tenure predominates. Rental markets are legally ambiguous in customary lands but are nonetheless on the rise, particularly within areas of high population density.

Literature Review

Understanding the drivers and welfare impacts of land rental markets in SSA is extremely important given the high population growth projections for the region, the perception of high and rising constraints to accessing land, as well as concerns about the unequal distributions of landholdings (Holden and Otsuka 2014). A key result from previous theoretical assessments of rental markets is that they have the potential to improve farm efficiency by facilitating the equilibration of land and non-land factor ratios across farm households, when non-land factor markets are imperfect (Deininger 2003; Feder 1985).⁸

⁸ When all factor markets are well functioning, and production has constant returns to scale, land endowments should not matter for either efficiency or equity, as household factor ratios would equilibrate via markets (even where land markets do not exist but non-land factor markets do). Given the highly imperfect factor markets in SSA,

Such gains may be further enhanced by the inverse farm-size-productivity relationship, under which net transfers of land from land-rich to land-poor households would contribute to overall efficiency gains, in addition to welfare improvements. However, there are several reasons why we might question the ability of land markets to deliver on these theoretical benefits.

First, in the presence of transactions costs, such efficiency gains may be limited (Skoufias 1995). The general idea is that the presence of such costs drive a wedge between optimal and actual efficiency gains.⁹ Empirical support for transactions costs in rental markets is particularly high in areas where land rights are tenuous or ambiguous, which is a frequently alleged characteristics of customary tenure systems in the region (Teklu and Lemi 2004; Tikabo, Holden, and Bergland 2008; Deininger, Ali, and Alemu 2009; Ghebru and Holden 2009; Yamano et al. 2009; Lunduku, Holden, and Øygard 2009; Holden and Bezabih 2009; Kassie and Holden 2009; Jin and Jayne 2013).

Furthermore, under certain conditions (e.g., limited access to credit), land market participation may be systematically easier for wealthier, land-rich households (Deininger

however, we would expect land endowments to have important implications for both efficiency and equity.

⁹ Examples 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, for example, 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).

and Jin 2008). If so, land markets may actually have a regressive impact on equity and efficiency outcomes. Empirical evidence on this question for Africa is mixed, with some studies finding that markets result in a net transfer of land from land-poor to land-rich households (Andre and Platteau 1998, for Rwanda; Zimmerman and Carter 1999, for Burkina Faso; Deininger, Ali, and Alemu 2009 and Ghebru and Holden 2009, for Ethiopia), while others find net transfers in the opposite direction (Lunduka, Holden, and Øygard 2009, for Malawi; Deininger and Mpuga 2009, for Uganda; Yamano et al. 2009 and Jin and Jayne 2013, for Kenya). These results seem closely aligned to conclusions about whether or not land rental markets serve as safety nets for poor rural tenants (Deininger, Ali, and Alemu 2009; Ghebru and Holden 2009).

Conceptual Model

Following Bliss and Stern (1982) and Skoufias (1995), we assume a household utility maximization model which asserts that land rental decisions (renting in, renting out, and autarky) are made in an effort to minimize the distance between a household's actual and desired farm size. Achieving desired farm size is an efficient outcome, but if there are transactions costs in the land rental market then the distance between actual and desired farm size will be different from zero. Desired farm size (and thus, rental market participation decisions) is conditioned by household endowments of non-tradable, non-land assets such as household farming ability, family labor, and other household characteristics. Therefore, the land rental decision for household i in village j is represented as follows:

$$(1) \quad R_{ij} = \zeta A_{ij}^* (\alpha_{ij}, \mathbf{C}_{ij}, \rho_i, \mathbf{H}_{ij}, \mathbf{V}_j) + \delta A_{ij} + \epsilon_{ij}$$

where R_{ij} is the amount of land rented in or out by the household. When $R_{ij} > 0$, the household rents in land, when $R_{ij} < 0$ the household rents out land, and when $R_{ij} = 0$ the household is autarkic. Actual pre-rental landholding is represented by A_{ij} , and A_{ij}^* represents optimal (desired) farm size. Pre-rental farm size is defined as the amount of land that a household has ownership or cultivation rights to. This includes fallow land and all cultivated area by

the household (excluding rented in land), plus rented out land. The coefficient estimate on δ tells us the extent to which pre-rental landholding affects area rented in or area rented out. A coefficient of -1 for land rented in and +1 for land rented out would indicate a fully efficient rental market, as households can adjust their operational land size to match their desired land size through rental markets (Skoufias 1995).

Desired farm size, A_{ij}^* , is a function of several key factors, including household farming ability, represented by α . Cash constraints that the household faces at the time the rental market decision is made are denoted by \mathbf{C} . Since most smallholder farm households in Malawi and Zambia do not produce enough maize to meet their own consumption needs, many must make a decision at planting time between purchasing inputs such as fertilizer and seed for the upcoming season, or purchasing food to meet immediate consumption needs as their own maize stocks dwindle and the next harvest is still several months away (Alwang and Segal 1999; Dorward 2006). Therefore, we might expect cash-constrained households to rent out some land to less cash constrained households to earn some cash at planting time, even if that means forgoing future income at the next harvest on the rented out land.

The household's level of risk aversion is denoted by ρ in equation (1). In a fixed-rent contract, which constitutes the majority of rental arrangements in our study area, all of the production risk is transferred from the landlord to the tenant. In this situation, we might expect that tenants are less risk averse *ceteris paribus* than landlords, but that their expectations of the level of risk will factor into the price of the rental arrangement. Other household endowment factors such as labor availability and education level of the household head are denoted by \mathbf{H} . Community-level conditioning variables that are exogenous to the household such as rainfall expectations and market access are denoted by \mathbf{V} . The error term is represented by ϵ_{ij} .

In this context, the household finds itself in one of three rental regimes: renting-in ($R_{ij} > 0$), renting-out ($R_{ij} < 0$), and autarky ($R_{ij} = 0$). This can be thought of as an ordinal response where the household picks one of the rental regimes (Jin and Jayne 2013). The rental decision can also be conceptualized as a continuous response, where the household

considers the decision to rent in or rent out an additional hectare of land based on the marginal returns to renting in (out) relative to the net costs of renting. The returns to renting are a function of the same household and community factors α , C , ρ , H , and V presented in equation (1), along with the direct rental income that accrues to landlords. The costs of renting include both rental costs that tenants incur, and the transactions costs associated with renting land.

Empirical Model and Identification Strategy

We operationalize the conceptual model in order to estimate land rental market impacts in three steps. First, we estimate a measure of a household's farming ability using a modified Cobb-Douglas functional form for household i , village j , and year t as follows :

$$(2) \quad \log(Q_{ijt}) = \alpha_i + \beta_1 \log(A_{ijt}^c) \\ + \beta_2 \log(L_{ijt}) + \beta_3 \log(X_{ijt}) \\ + \beta_4 V_{jt} + \beta_5 T_t + \epsilon_{ijt}$$

where Q_{ijt} is the real value of rainy season agricultural production, and A_{ijt}^c is the amount of cultivated land. Labor availability measured in adult equivalents in the household is denoted by L_{ijt} , while X_{ijt} is a vector of other inputs such as fertilizer use, V_{jt} are village-level shifters, and T_t are year-dummies.

The indicator of household farming ability is denoted by α_i . Since farming ability is not observed directly, we obtain it as the time-invariant component when equation (2) is estimated via household-level fixed-effects (FE). This procedure follows several previous studies, and the coefficient estimate is easily recovered following FE estimation (Deininger and Mpuga 2009; Jin and Deininger 2009; Jin and Jayne 2013). The other parameters to be estimated in equation (2) are represented by β_{1-5} . The error term in equation (2) is represented by ϵ_{ijt} .

The second estimation step takes the derived coefficient of ability $\hat{\alpha}_i$ from equation (2), and adds it as a covariate in the model of factors affecting land rental market participation as follows:

$$(3) \quad R_{ijt} = \delta_1 \hat{\alpha}_i + \delta_2 A_{ijt} + \delta_3 L_{ijt} + \delta_4 Z_{ijt} \\ + \delta_5 V_{jt} + \delta_6 T_t + \mu_{ijt}$$

where R represents the household's land rental market decision of hectares rented in

and hectares rented out, as in equation (1). The statistical significance of $\hat{\delta}_1$ tests the hypothesis of whether or not participation in land rental markets increases efficiency. If $\hat{\delta}_1 > 0$ in the renting in equation, and $\hat{\delta}_1 < 0$ in the renting out equation, it would indicate that land rental markets are transferring land from less efficient to more efficient farmers. Pre-rental landholding is again denoted by A , with δ_2 as the corresponding coefficient. The statistical significance and sign of $\hat{\delta}_2$ tests the hypothesis of whether or not land rental markets promote land equity (equality) by transferring land from relatively land-rich to relatively land-poor households. The parameter to be estimated on household labor L , measured in adult equivalents, is represented by δ_3 . The statistical significance of $\hat{\delta}_3$ tests the hypothesis of whether or not land rental markets transfer land from relatively labor-rich to relatively labor-poor households.

Other variables in equation (3) include a set of household-level factors that may affect rental market participation. These factors are represented by Z , and include education of the household head in years, immigrant status of the household head, gender of the household head, value of livestock and durable assets, and whether or not there was an adult death in the household within the previous two years. These last three variables may be taken as observable proxies for risk aversion and cash constraints, consistent with our conceptual model in equation 1. It is our maintained assumption that these proxies do a reasonable job of capturing such unobserved heterogeneity; nonetheless, any remaining unobserved variation related to risk aversion and cash constraints may be a source of bias, and we therefore interpret our results with this caveat in mind. The corresponding parameter vector is represented by δ_4 .

Community-level variables in equation (3) are again represented by V , with the corresponding parameter vector δ_5 . These factors include population density, distance to paved road, whether land inheritance goes to daughters in the village (denoted as matrilineal inheritance), and past rainfall. Past rainfall is defined in equation (3) as the average cumulative rainfall over the previous five growing seasons. This serves as a proxy for the naive expectation of rainfall in the coming year at the time the rental market decision is made. In addition, year dummies are

also included in T , with parameter δ_6 . The error term in equation (3) is represented by μ_{ijt} .

While we follow several other studies in interpreting $\hat{\alpha}_i$ as a measure of farmer ability, it is important to acknowledge that this term also captures other time-invariant unobserved farm-level heterogeneity, such as soil quality and risk aversion. Furthermore, because we cannot exclude rented in land from the regression that generates this term, there is some concern about endogeneity arising from its inclusion in equation (3). Therefore, circumspection is urged in interpreting coefficient estimates. However, there are several reasons in favor of its inclusion in this analysis. With respect to the first issue, as noted by Jin and Jayne (2013), since soil quality is likely to be lower on rented land than on owner-operated land, any associated bias on the coefficient of $\hat{\alpha}_i$ is likely to be downward. Thus, we are more likely to suffer from attenuation bias than overestimation of the impacts of ability on renting in or out land. Second, coefficient estimates for all the models in our study are robust to whether or not $\hat{\alpha}_i$ is included as a regressor. This suggests that even if inferences about farmer ability should be treated with caution, our other analytical results (and overall conclusions) are not affected by whether or not we include this term in the model.

Equation (3) is estimated via tobit, where the dependent variables are the number of hectares rented in and the number of hectares rented out. Using a tobit estimator allows us to account for the corner solution nature of the land rental variable where many households do not rent in or out land but, for those who participate, the amount of land rented is relatively continuous. In an alternative specification, the rental decision in equation (3) is treated as a set of discrete outcomes, that is, binary participation indicators that are observed on three rental regimes (rent-out, autarkic, and rent-in) and estimated via ordered probit. Since results from both models are very similar, we focus on the tobit results in this article, but provide the ordered probit results in tables A1a and A1b of the supplementary online appendix. The P-values on the coefficients from the models presented in equation (3) are obtained via bootstrapping at 300 repetitions. Bootstrapping accounts for the two-step estimation process that uses the estimates from equation (2) to generate $\hat{\alpha}_i$.

The third part of our empirical procedure estimates a set of models to determine how land rental participation affects a set of production, income, and welfare indicators that include i) value of crop production, ii) net crop income, iii) net off-farm income, iv) net total household income, and v) the probability that a household is below the \$1.25 per day poverty line. These indicators are represented by Y , and estimated as follows:

$$(4) \quad Y_{ijt} = \gamma_1 R_{ijt} + \gamma_2 A_{ijt} + \gamma_3 L_{ijt} + \gamma_4 Z_{ijt} + \gamma_5 V_{jt} + \gamma_6 T_t + e_{ijt}$$

where land rental market participation is again represented by R , with corresponding parameter γ_1 . The main specification of equation (4) is estimated when R is treated as a continuous decision of hectares rented in/out. Results from the alternative specification where R is treated as a binary decision to rent in or rent out land are presented in tables A2a and A2b of the supplementary on line appendix. Other variables included in equation (4) represent many of the same covariates as in equation (3), with γ_{1-6} representing the parameters to be estimated. There are several differences between the covariates in equations (3) and (4). First, rainfall in equation (4) is measured as realized current season cumulative rainfall rather than average rainfall over the previous five seasons as it was in equation (3). Second, since equation (4) is estimated via household-level FE, the time-constant variables in equation (3) such as age and education of the household head drop out of the model. Third, lagged maize prices are also included in equation (3), but not in equation (4). The error term in equation (4) is represented by e_{ijt} .

Conceptually, our measure of ability, $\hat{\alpha}_i$, could affect the outcomes measured in equation (4), and failure to include it could lead to endogeneity concerns due to omitted variable bias. Empirically this is not an issue because our estimation strategy employs household FE to control for potential endogeneity caused by time-constant unobservable heterogeneity in the models. Since $\hat{\alpha}_i$ is also time-constant, it is removed from the models in equation (4), along with the unobserved heterogeneity through the de-meaning process when FE is used. Our identification strategy is discussed in greater detail in the following sub-section.

Identification Strategy

This study uses observational data, and given that households do not randomly choose to rent in and rent out land we must deal with potential endogeneity in order to identify consistent coefficient estimates in our models. The most likely source of endogeneity bias in this context is omitted variables. For example, households with better land, better management skills, more social connections, or lower levels of risk aversion may be more likely to participate in rental markets, and for the same reasons may also be more likely to experience higher welfare outcomes. If this is the case, then failure to control for these factors would likely lead to coefficients that overestimate the relationship between land rental participation and the welfare indicators of interest in this study.

Fortunately, we have panel data in both Malawi and Zambia that can help us overcome this concern. Furthermore, the unobservable factors that concern us, such as land quality, management skills, social-connections, and risk aversion, do not vary much over time within the household. Therefore, we can use panel estimators to remove these time-constant unobservables from the model and obtain consistent coefficient estimates of land rental market impacts.

Since the land rental market participation model in equation (3) is non-linear estimated via tobit, we employ the Mundlak-Chamberlain (MC) device, following Mundlak (1978) and Chamberlain (1984). The MC device employs household-level averages of all time-varying components of the model in order to control for unobserved time-constant heterogeneity, under the assumption that such heterogeneity is correlated with the time-averages (see Wooldridge 2010 for elaboration). In addition, the welfare models estimated in equation (4) are treated as linear so we use household-level FE estimation. The FE estimator removes the time-constant unobservable factors that may bias the land rental coefficients from the model through the time-demeaning process.

Even after removing time-constant unobservable factors from our model, it is possible that land rental participation could be endogenous in the welfare model presented in equation (4) due to potential correlation with leftover unobservable time-varying shocks. We control for this possibility by including proxy variables for the major shocks that

might affect smallholder households as observed covariates in our welfare models. These variables are (i) whether or not there was an adult death in the household over the past two years, and (ii) rainfall during the current growing season. We suggest that in the present context it is reasonable to assume that leftover unobserved time-varying shocks are uncorrelated with land rental market decisions, at least for the renting-in side of the market. Fortunately, we are able to test the robustness of our results with specifications that examine both sides of the rental market separately versus simultaneously. Nonetheless, no study that relies on observational data can claim decisively to have fully controlled for all unobservable factors. Thus, our statements about causality are made cautiously.

Data

Data used in this study for the Malawi analysis come from three surveys of smallholder households. The first wave of data comes from the Second Integrated Household Survey (IHHS2), a nationally representative stratified random sample of households conducted during the 2002/03 and 2003/04 growing seasons that covers 26 districts in Malawi. The second wave of data comes from the 2007 Agricultural Inputs Support Survey (AISS1) conducted after the 2006/07 growing season. The budget for AISS1 was much smaller than the budget for IHHS2 and of the 11,280 households interviewed for IHHS2, only 3,485 of them lived in enumeration areas that were re-sampled in 2007. Of these 3,485 households, 2,968 were re-interviewed in 2007, which gives us an attrition rate of 14.8%.

The third wave of data comes from the 2009 Agricultural Inputs Support Survey II (AISS2) conducted after the 2008/09 growing season. The AISS2 survey had a smaller budget than the AISS1 survey in 2007, so of the 2,968 households first sampled in 2003 and again in 2007, 1,642 of them lived in enumeration areas that were revisited in 2009. Of the 1,642 households in revisited areas, 1,375 were found for re-interview in 2009, which gives us an attrition rate of 16.3% between 2007 and 2009.

We focus our analysis on the 1,375 households who were interviewed in all three

surveys, and the 1,593 households who were interviewed in just the first and second surveys. This gives us a total sample size of 7,311 observations in the unbalanced panel used in the Malawi analysis. Of this total, removing households without any crop production results in a final sample of 6,904 households.

Smallholder household data for Zambia come from the Supplemental Surveys carried out by the Zambian Central Statistical Office in association with the Zambian Ministry of Agriculture and Michigan State University's Food Security Research Project. These surveys are a stratified random sample that are linked with the 2000 Post-Harvest Survey for small- and medium-scale farm households. We construct a panel of 3,736 smallholder households for 2001 and 2008.¹⁰ The survey is nationally representative and the sampling frame includes villages in 70 of Zambia's 72 Districts.¹¹

Since the MC device and household FE are used in both the Malawi and Zambia estimates, households that were only interviewed in the first survey wave are not included because those households have values for the household time averages that are equivalent to their year t values.

Spatial data on market access, population density, and climate were used in both countries. Market access is defined as estimated travel time to the nearest town of 50,000 or more inhabitants, based on a model using geospatial data on roads, town location and year 2000 populations, land cover, and slope. Data on rural population densities were obtained from the GRUMP database (Balk and Yetman 2004). Rainfall data were obtained from the TAMSAT project (Maidment et al. 2014). The data were brought into a common geographic information system (GIS) framework, where they were associated with georeferenced survey households at the village level.¹²

¹⁰ This panel survey has three waves in total: 2001, 2004, and 2008. In this study, we use data from the first and last waves only due to limited information collected on rental participation in the 2004 wave.

¹¹ Other analysis was performed for Zambia using cross-sectional data on 8,716 households from the 2012 Rural Agricultural Livelihoods Survey. These results are largely consistent with the results presented here, but because cross-sectional data do not allow us to control for unobserved heterogeneity (as we can with panel data) we do not report these results here.

¹² Landholding and land rented in and out are measured using farmer estimates of area in both Malawi and Zambia. Though this may lead to some measurement error compared to land estimates using GPS, if the measurement error is random, and is not

Dealing with Potential Attrition Bias

Households leaving the survey for non-random reasons between waves can potentially cause attrition bias in our coefficient estimates, and must be addressed in this analysis. We deal with this issue in the following ways. First, we control for the time-constant unobservable factors that affect attrition using the MC device in the land rental market participation models, and household FE in the welfare models (Wooldridge 2010). Second, we test whether any remaining unobservable time-varying factor affecting attrition influences our results using inverse probability weights (IPW). The IPW technique involves three steps: (i) using probit to measure whether observable factors in one wave affect whether a household is re-interviewed in the next wave; (ii) obtaining the predicted probabilities (Pr_{it}) of being re-interviewed in the following wave; (iii) computing the $IPW = (1/Pr_{it})$ and applying it to all models estimated (for more information on IPW see Wooldridge 2010, and Baulch and Qisumbing 2011). Results from our basic specifications indicate that the coefficient estimates do not vary in any meaningful way when IPWs are included in the models and when they are not. This suggests that attrition bias should not be a major concern in this context, so our main results do not include IPWs but are estimated with sampling weights that are representative of the estimated populations of each country.

Results

Descriptive statistics for both countries are shown in table 2a for Malawi and table 2b for Zambia. Female-headed households are more likely to participate in rental markets as landlords than as tenants in both countries. This may indicate a lack of available labor for female headed households that occurs when their husbands die, or leave the home for other reasons. As would be expected, tenant households (i.e., those who rent in at least

misestimated by farmers for any systematic reason, then the farm size coefficient estimates will still be unbiased. The results from this study are generally consistent when the land rental variables are measured as binary indicators, compared to when they are measured as continuous variables. This lends robustness to the notion that measurement error is not biasing the results in our analysis.

Table 2a. Household Characteristics by Rental Status and Survey Wave in Malawi

Characteristics	2002/03 & 2003/04			2006/07			2008/09		
	HH renting in	HH renting out	autarkic	HH renting in	HH renting out	autarkic	HH renting in	HH renting out	autarkic
Percentage female headed households	17	29	25	17	22	28	23	28	32
Adult equivalents	4.5	4.0	3.7	4.7	4.4	4.1	4.9	4.4	4.3
Landholding (ha)	0.7	1.6	1.2	0.9	1.7	1.1	0.7	1.8	1.1
Value of assets (2009 USD)	535	110	220	532	284	318	436	398	405
Off-farm income (2009 USD)	426	97	168	133	53	61	375	201	192
Percentage of heads with primary education	46	22	29	41	28	29	45	29	29
Percentage of heads with secondary education	2	0	1	3	0	1	2	0	1
Percentage staple deficit in maize last year	–	–	–	58	67	65	73	80	77
Distance to paved road	14.9	17.4	17.2	15.7	19.8	17.0	16.8	22.1	17.2
Percentage in matrilineal villages	68	69	69	67	65	69	64	54	67
Population density (persons/km ²)	183	171	166	228	203	204	288	215	250
Years HH head lived in village	23	31	31	25	32	31	24	33	33
Percentage immigrants	31	2	11	23	5	12	18	8	10

Notes: HH=household; N = 2,758 for 2002/03 & 2003/04, 2,823 for 2006/07, and 1,323 for 2008/09.

Table 2b. Household Characteristics by Rental Status and Survey Wave in Zambia

Characteristics	2000/01			2007/08			2011/12		
	HH renting in	HH renting out	autarkic	HH renting in	HH renting out	autarkic	HH renting in	HH renting out	autarkic
Percentage female headed households	6	51	20	9	9	23	15	31	24
Adult equivalents	7.0	4.8	4.9	6.6	5.5	5.2	4.8	5.4	4.4
Landholding (ha)	0.8	4.4	3.2	1.7	4.4	2.9	1.9	2.6	1.6
Value of assets (2009 USD)	606	1105	838	1,520	294	538	2,677	790	1,274
Off-farm income (2009 USD)	622	172	260	967	684	320	1,785	535	911
Percentage heads w/ primary educ.	73	47	45	45	37	40	69	35	47
Percentage heads w/ secondary educ.	0	3	1	9	0	1	20	0	3
Percentage in matrilineal villages	56	23	42	37	38	42	36	55	36
Pop. density (persons/km ²)	17.3	34.2	18.0	24.1	30.3	20.1	32.9	26.2	19.0
Percentage immigrants	54	0	13	29	27	13	71	36	55

Notes: HH=household; N = 3,947 for 2000/01 and 2007/08 (Supplemental Surveys); N = 8,716 for 2011/12 (RALS).

some farmland) tend to have larger labor endowments (measured in adult equivalents) and smaller land endowments than landlord households in both countries. The tables also generally show that while landlords have larger pre-rental landholdings than other

households, tenants have higher values of livestock and durable assets, higher off-farm incomes, and are more educated than landlords and autarkic households. This provides some *prima facie* evidence that tenants may have the financial resources to make the

Table 3a. Cobb-Douglass Production Function for Malawi

	(1)	
	Log value of crop production	
	coef.	p-value
Log fertilizer applied (kg/ha)	0.1030	(0.000)***
Log adult equivalents	0.1302	(0.010)***
Log landholding (ha)	0.5182	(0.000)***
Female headed household (=1)	0.0520	(0.397)
Adult mortality (=1)	-0.0073	(0.877)
Log value of assets (USD)	0.1559	(0.000)***
Log growing season rainfall (mm)	0.0917	(0.437)
Log pop. density	0.0607	(0.928)
N	6904	

Note: Table shows coefficient estimates from fixed effects regression. Model includes year dummies (not shown). Standard errors are robust to clustering at the community level. Significance denoted by

*p < 0.10, **p < 0.05, and ***p < 0.01.

upfront cash payments to rent in land, and that tenants may also be better managers. Immigrants are much more likely to be tenants than non-immigrants, and they are less likely to be landlords than non-immigrants. This is what we would expect if rural migration is driven in part by the search for land. We also see evidence that land rental market activity is associated with higher rural population densities.

Table 3a presents the Cobb-Douglas production function estimates for factors affecting the value of crop production in Malawi. The model is estimated via household FE. Results indicate that households with greater labor endowments, larger landholding, a higher value of livestock and durable assets, and those which apply more fertilizer per hectare have a significantly higher value of crop production, on average, than do other households. As discussed earlier, we use the time-constant error component from these results as a measure of farmer ability, which is then incorporated as a regressor in the models of rental market participation.

Table 3b shows the Cobb-Douglas production function estimates for Zambia. Results are very similar to those for Malawi. Household adult equivalents, landholding,

Table 3b. Cobb-Douglass Production Function for Zambia

	(1)	
	Log value of production	
	coef.	p-value
Log fertilizer applied (kg/ha)	0.0932	(0.000)***
Log adult equivalents	0.1539	(0.000)***
Log landholding (ha)	0.2773	(0.000)***
Female headed households (=1)	-0.2787	(0.005)***
Adult mortality (=1)	-0.2048	(0.122)
Log value of assets (USD)	0.0571	(0.000)***
Log growing season rainfall (mm)	1.0384	(0.005)***
Log pop. density	-0.0196	(0.873)
N	7894	

Note: Table shows coefficient estimates from fixed effects regression. Model includes year dummy (not shown). Standard errors are robust to clustering at the community level. Significance denoted by

*p < 0.10, **p < 0.05, and ***p < 0.01.

value of assets, and fertilizer application per hectare have a statistically significant and positive relationship with the value of crop production. As in the Malawi production function, we obtain a household-specific estimate of farming ability as the FE estimate from these results, which we use in the rental market participation models for Zambia described below.

Table 4a presents the results for Malawi when we evaluate the determinants of rental market participation using a tobit estimator with the MC device. We show two specifications for the land-rented-in and land-rented-out models, respectively. The first specification (shown in columns 1 and 3) includes the generated regressor $\hat{\alpha}$ representing household farming "ability," with p-values based on 300 iterations of a bootstrap routine that includes both the production function as well as the market participation model. The second specification (shown in columns 2 and 4) omits the ability indicator in order to evaluate the robustness of other coefficient estimates to its inclusion.

The estimates derived in tables 4a and 4b follow previous literature to indirectly make inference about welfare implications of land rental markets through the household's participation decision. As such, the coefficient on $\hat{\alpha}$, which is the regressor derived from the production

Table 4a. Determinants of Land Renting in Malawi (Average Partial Effects from Tobit Estimators)

	(1) Land rented in (ha)	(2) Land rented in (ha)	(3) Land rented out (ha)	(4) Land rented out (ha)
$\hat{\alpha}$ ("ability")	0.0309 (0.000)***		0.0026 (0.396)	
Landholding (ha)	-0.0221 (0.015)**	-0.0213 (0.013)**	0.0150 (0.000)***	0.0149 (0.000)***
Adult equivalents	0.0112 (0.000)***	0.0111 (0.000)***	-0.0030 (0.094)*	-0.0030 (0.084)*
Female-headed household (=1)	-0.0092 (0.254)	-0.0137 (0.060)*	0.0001 (0.986)	-0.0003 (0.954)
Age of head ^a	0.0392 (0.000)***	0.0421 (0.000)***	-0.0071 (0.097)*	-0.0068 (0.113)
Head has primary educ. (=1) ^a	0.0164 (0.614)	0.0140 (0.648)	-0.0324 (0.000)***	-0.0324 (0.000)***
Head has secondary educ. (=1) ^a	-0.0008 (0.000)***	-0.0008 (0.000)***	-0.0001 (0.619)	-0.0001 (0.637)
Value of assets ('000*USD)	0.0004 (0.902)	0.0003 (0.734)	-0.0064 (0.087)*	-0.0062 (0.026)**
Immigrant household (=1) ^a	0.0602 (0.000)***	0.0591 (0.000)***	-0.0226 (0.000)***	-0.0227 (0.000)***
Adult mortality (=1)	0.0189 (0.171)	0.0200 (0.105)	0.0102 (0.229)	0.0103 (0.196)
Matrilineal village (=1) ^a	-0.0112 (0.235)	-0.0122 (0.337)	-0.0068 (0.207)	-0.0069 (0.255)
Previous hungry season median retail maize price (USD/kg)	-0.5744 (0.034)**	-0.5715 (0.030)**	0.0199 (0.946)	0.0180 (0.933)
Previous harvest season median retail maize price (USD/kg)	0.8962 (0.006)***	0.8949 (0.004)***	-0.1649 (0.589)	-0.1633 (0.472)
Log avg. growing season rainfall, past 5 yrs (mm)	-0.0987 (0.001)***	-0.1040 (0.023)**	-0.0500 (0.004)***	-0.0506 (0.033)**
Log rural pop. density	0.0436 (0.005)***	0.0425 (0.000)***	0.0087 (0.058)*	0.0086 (0.066)*
Distance to paved road (km)	0.0005 (0.009)***	0.0005 (0.039)**	0.0001 (0.480)	0.0001 (0.554)
N	6904	6904	6904	6904

Note: Average Partial Effects (APE) shown in the table. All models are estimated via tobit with the Mundlak-Chamberlain device that includes time averages of all time-varying covariates (not shown). Year and province dummies are included but not shown. Cluster robust p-values, shown in parentheses, are bootstrapped at 300 repetitions: *p < 0.10, **p < 0.05, and ***p < 0.01.

Superscript ^a indicates that corresponding variables are time constant and do not change across panel waves.

function estimated in table 3, indicates that farmers with greater farming ability are more likely to rent in more land (ordered probit results, which appear in the supplementary online appendix, show similar results). This likelihood supports the contention that rental markets enhance efficiency, as more talented farmers rent in land from less talented farmers. This finding is consistent with previous literature such as Deininger and Mpuga (2009), Jin and Deininger (2009), and Jin and Jayne (2013). When we analyze the results from the landlord side of the market, we find

that ability is not a significant determinant of how much land a household rents out, although the ordered probit results (shown in the supplementary on-line appendix) indicate that less able farmers are significantly more likely to participate in the market as landlords. On the whole, these results are consistent with the idea of a net transfer of land from less-efficient to more efficient producers. However, these findings differ from those in Jin and Jayne (2013) for Kenya, who find that more able farmers are more likely to participate in rental markets both as tenants

Table 4b. Determinants of Land Renting in Zambia (Average Partial Effects from Tobit Estimators)

	(1) Land rented in (ha)	(2) Land rented in (ha)	(3) Land rented out (ha)	(4) Land rented out (ha)
$\hat{\alpha}$ ("ability")	0.0138 (0.001)***		-0.0021 (0.093)*	
Landholding (ha)	-0.0059 (0.016)**	-0.0050 (0.066)*	0.0005 (0.336)	0.0006 (0.114)
Adult equivalents	0.0032 (0.016)**	0.0030 (0.032)**	0.0013 (0.194)	0.0013 (0.120)
Female headed household (=1)	-0.0055 (0.564)	-0.0044 (0.486)	0.0139 (0.983)	0.0149 (0.399)
Age of head ^a	-0.0006 (0.013)**	-0.0007 (0.003)***	-0.0000 (0.828)	-0.0000 (0.916)
Head has primary education (=1) ^a	0.0023 (0.571)	0.0031 (0.446)	0.0008 (0.699)	0.0007 (0.757)
Head has secondary education (=1) ^a	0.0112 (0.521)	0.0196 (0.440)	0.0006 (0.951)	-0.0003 (0.959)
Value of assets ('000*USD)	0.0016 (0.096)*	0.0018 (0.062)*	0.0002 (0.889)	0.0001 (0.924)
Immigrant household (=1) ^a	0.0310 (0.009)***	0.0262 (0.016)**	0.0046 (0.278)	0.0049 (0.208)
Adult mortality (=1)	-0.0025 (0.999)	-0.0040 (0.725)	-0.0023 (0.998)	-0.0024 (0.365)
Matrilineal village (=1) ^a	0.0032 (0.491)	0.0033 (0.497)	-0.0010 (0.652)	-0.0011 (0.529)
Previous harvest season median retail maize price (USD/kg)	-0.0000 (0.324)	-0.0000 (0.334)	-0.0000 (0.306)	-0.0000 (0.167)
Log avg. growing season rainfall, past 5 yrs (mm)	0.0507 (0.017)**	0.0379 (0.027)**	0.0147 (0.386)	0.0174 (0.163)
Log rural pop. density	0.0006 (0.891)	0.0003 (0.906)	0.0017 (0.295)	0.0018 (0.166)
Hours to market	-0.0004 (0.205)	-0.0004 (0.219)	0.0000 (0.928)	0.0000 (0.993)
N	7894	7894	7894	7894

Note: Average Partial Effects (APE) shown in the table. All models are estimated via tobit with the Mundlak-Chamberlain device that includes time averages of all time-varying covariates (not shown). Year and province dummies are included but not shown. Cluster robust p-values, shown in parentheses, are bootstrapped at 300 repetitions: * p < 0.10, **p < 0.05, and ***p < 0.01.

Superscript ^a indicates that corresponding variables are time constant and do not change across panel waves.

and as landlords. In our view, the Malawi results are more consistent with a net transfer of land to more able producers.

We also find evidence in table 4a that is consistent with the premise that land rental markets generate equity (equality): households with larger landholdings are more likely to rent out land but less likely to rent in land. This suggests that land rental markets transfer resources from relatively land-rich, to relatively land-poor households. In addition, households with more adult equivalents are significantly more likely to rent in land and significantly less likely to rent out land, indirectly indicating that rental markets transfer land from relatively labor-poor to

relatively labor-rich households. These results are robust to specification choices that omit the generated regressor representing ability, $\hat{\alpha}$.

We also find some evidence in table 4a that asset constraints play a role in land rental decisions, as households with a lower value of assets are significantly more likely to rent out land. To the extent that households with fewer assets are more likely to face periodic liquidity constraints, this is consistent with the notion embedded in our conceptual model that cash-constrained households rent out some land in order to buy inputs at planting time, and/or to purchase food to meet consumption needs. It also appears that

Table 5a. Factors Affecting Household Welfare in Malawi

	(1) Value of crop production (USD)	(2) Net crop income (USD)	(3) Net off-farm income (USD)	(4) Net total household income (USD)	(5) Probability of poverty ^a
Land area rented in (ha)	213.8093 (0.001)***	174.7723 (0.007)***	-29.3622 (0.605)	136.3201 (0.127)	-0.0807 (0.000)***
Land area rented out (ha)	-110.8427 (0.010)***	-156.3894 (0.004)***	-17.3046 (0.771)	-193.9210 (0.050)*	-0.0049 (0.858)
Landholding (ha)	112.7068 (0.001)***	87.8544 (0.007)***	-12.0028 (0.703)	75.7221 (0.093)*	-0.0253 (0.000)***
Adult equivalents	13.7101 (0.011)**	7.2282 (0.111)	18.3777 (0.034)**	33.9508 (0.002)***	0.0267 (0.000)***
Female headed household (=1)	-44.2856 (0.043)**	-25.1425 (0.191)	-91.0449 (0.016)**	-121.3918 (0.009)***	0.0413 (0.035)**
Value of assets (1000s USD)	20.1666 (0.169)	9.8532 (0.253)	24.0600 (0.239)	43.7621 (0.214)	-0.0113 (0.150)
Fertilizer applied (kg/ha)	0.0558 (0.180)	-0.0121 (0.551)	0.0043 (0.795)	-0.0021 (0.942)	-0.0000 (0.515)
Adult mortality (=1)	14.5212 (0.210)	13.2971 (0.319)	72.7252 (0.162)	83.9908 (0.127)	-0.0305 (0.053)*
Log growing season rainfall, current year (mm)	-30.3672 (0.322)	3.4963 (0.912)	49.8854 (0.209)	34.4683 (0.545)	-0.0355 (0.252)
N	6904	6904	6904	6904	6904

Note: All models are estimated using household fixed effects. Model includes year dummy (not shown). P-values, shown in parentheses, are robust to clustering at the community level: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Superscript ^a indicates that the model in column 5 is estimated as a Fixed Effects Linear Probability Model (FE LPM).

migrants are significantly more likely to rent in land and less likely to rent out land. This aligns with the descriptive statistics in table 2a, and is what we would expect if rural migration is driven in part by the need to acquire farmland. Again, these results are robust to whether or not the ability measure is included. We also find evidence to suggest that households in areas of higher population density are more likely to rent in and rent out land, which is what we would expect *ex ante*.

Table 4b presents results for factors affecting the extent of land rental market participation in Zambia, estimated via tobit with the MC device (ordered probit model results are also shown in the supplementary online appendix). As in Malawi, Zambian households with greater farming ability are significantly more likely to rent in land, and significantly less likely to rent out land. This finding provides further indirect evidence that rental markets facilitate a net transfer of land from less able to more able households. Furthermore, households that have smaller landholdings are significantly more likely to rent in than are other households. This suggests that rental markets

transfer land to relatively land-poor households. In addition, households with higher adult equivalents are significantly more likely to rent in land than other households. This indicates that land rental markets transfer land from labor-poor to labor-rich households in Zambia, just as in Malawi. Households with a higher value of assets are more likely to rent in land, probably because they have the resources to enter into up-front cash rental agreements with landlords. Finally, immigrant households in Zambia are more likely to rent in than local households.

Other coefficient estimates for the Zambian model are generally of the same sign and of similar magnitude as in Malawi, although fewer covariates are statistically significant. This may be the result of lower statistical power for the Zambia data, due to fewer market participants. Nonetheless, results for both countries are notably similar, suggesting that many of the same factors are at play.

Next, we directly estimate the relationship between land rental market participation and a number of welfare outcomes in Malawi, the results of which are presented in table 5a. For

Table 5b. Factors Affecting Household Welfare in Zambia

	(1) Value of crop production (USD)	(2) Net crop income (USD)	(3) Net off-farm income (USD)	(4) Net total household income (USD)	(5) Probability of poverty ^a
Land area rented in (ha)	143.67 (0.000)***	52.17 (0.000)***	-11.23 (0.887)	40.94 (0.621)	0.01 (0.431)
Land area rented out (ha)	-8.03 (0.839)	-13.65 (0.740)	146.77 (0.186)	155.68 (0.221)	-0.07 (0.204)
Landholding (ha)	16.74 (0.000)***	14.02 (0.000)***	1.39 (0.660)	15.41 (0.001)***	-0.00 (0.152)
Adult equivalents	12.91 (0.007)***	12.05 (0.008)***	26.57 (0.003)***	38.62 (0.000)***	0.01 (0.000)***
Female headed household (=1)	-42.63 (0.271)	-42.93 (0.222)	-53.00 (0.329)	-95.94 (0.092)*	0.02 (0.267)
Value of assets (1000s USD)	55.22 (0.000)***	50.81 (0.000)***	9.74 (0.426)	60.56 (0.000)***	-0.01 (0.000)***
Fertilizer applied (kg/ha)	0.44 (0.000)***	-0.07 (0.453)	0.25 (0.219)	0.18 (0.423)	-0.00 (0.075)*
Adult mortality (=1)	-69.18 (0.108)	-70.93 (0.082)*	-15.31 (0.782)	-86.23 (0.203)	-0.00 (0.875)
Log growing season rainfall, current year (mm)	351.78 (0.000)***	379.65 (0.000)***	-125.70 (0.486)	254.02 (0.221)	-0.02 (0.564)
N	7894	7894	7894	7894	7894

Note: All models are estimated using household fixed effects. Model includes year dummy (not shown). P-values, shown in parentheses, are robust to clustering at the community level: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Superscript ^a indicates that the model in column 5 is estimated as a Fixed Effects Linear Probability Model (FE LPM).

each outcome, we use continuous measures of the amount of land rented in or rented out, in hectares, as our right-hand side measures of rental market participation. For comparison, in the [supplementary online appendix](#) we also present results from alternative specifications of these models in which rental market participation is measured in terms of binary indicators (i.e., *tenant=1*, *landlord=1*); results are highly consistent across both specifications.

The first model (column 1 of [table 5a](#)) estimates the factors affecting the gross value of crop production.¹³ Results indicate that renting in land has a strong positive relationship with this measure, as renting in an additional hectare increases the value of crop production by \$214, on average. Conversely, an extra hectare rented out is associated with a \$111 decline in the value of crop production, on average. This is what we might expect, as renting out land means that the household has less land to cultivate.

Column 2 suggests that renting in land has a positive relationship with average crop

income, net of rental costs, fertilizer costs, seed costs, and hired labor costs. However, the average increase in profits due to renting in one additional hectare, at \$175, are about 82% of revenue. As expected, the returns to net crop income for landlords are negative.

Next, we examine the relationship between renting land and off-farm income to see if there is any evidence of crowding out (crowding in) of off-farm work from renting in (renting out) land, the results of which are presented in column 3. Coefficient estimates suggest that renting in and renting out land do not have statistically significant relationships with off-farm income in any of the specifications. It is perhaps concerning that while we find evidence indicating that landlords have a significantly lower value of crop production and net crop incomes than autarkic households (columns 1–2), column 3 provides no evidence to suggest that landlords are able to generate higher off-farm income with the money they earn from renting out land.

Column 4 of [table 5a](#) presents factors affecting net total household income, which includes all on-farm and off-farm income-generating activities during the year. Results suggest that renting in land has a positive and economically

¹³ All monetary values in this analysis are converted to real 2009 USD.

meaningful benefit on total household income. Although results are not strongly significant, the average return to total household income from an additional hectare rented in is \$136, with a p-value of 0.127. Conversely, the relationship between total household income and renting out land is negative and statistically significant. While not definitive, this finding supports the notion in our conceptual model that landlords choose to forego some income later in the year for income at planting time. It could also be that landlords chose to reduce labor time spent on the farm or maximize some other outcome that we do not observe in the data. This could be particularly true for older or unwell household heads.

The determinants of the probability of falling below the poverty line (defined as under \$1.25 per person per day in purchasing power parity terms) are shown in column 5.¹⁴ This is estimated as a linear probability model using the FE estimator. Results show that each additional hectare of land rented in is associated with an eight percentage point lower probability of being in poverty, on average. The association between renting out land and poverty is not statistically significant.

In summarizing the welfare results of [table 5a](#), several observations stand out. First, the positive association between renting in land and household welfare are remarkably consistent across multiple indicators. This suggests that there are positive benefits to renting in land. Second, we generally find negative or insignificant relationships between renting out land and welfare. Third, these results are very consistent with the results of alternative specifications which use binary measures of market participation as the covariates of interest (shown in the [supplementary on-line appendix](#)). This suggests that these findings are robust to alternative model specifications.

[Table 5b](#) presents the factors affecting the same welfare outcomes in Zambia as presented in [table 5a](#) for Malawi. Coefficient estimates for factors affecting the gross value of crop production are presented in column 1. Results indicate that renting in land has a strong positive association with the value of crop production. An additional hectare

rented in provides the household with an extra \$144, on average. Renting out land has a small negative but statistically insignificant relationship with the value of crop production. In terms of net crop income (column 2), the benefit of renting in an additional hectare of land is positive but much smaller than for gross income, reflecting the importance of input costs in overall profits.¹⁵ The estimate of renting out land on net crop income is negative but not statistically significant.

As in the Malawi case, here we also examine the relationship between renting in and renting out land and net off-farm income to see if there is any crowding out or crowding in of off-farm work as a result of rental market participation (column 3). Our results suggest that renting (either in or out) does not have any significant relationship with off-farm income. In terms of total household income and the probability of the household being below the \$1.25 per day poverty line, there is no statistically significant association for either renting in or renting out land.

Overall, the welfare benefits from land rental markets in Zambia are generally consistent with those of Malawi, lending support to our overall findings. The benefits are smaller in Zambia than in Malawi, which is possibly due to the less mature state of land rental market development in Zambia. As with the Malawi case, the results in Zambia are robust to alternative model specifications that use binary indicators for tenancy and landlord status rather than continuous measures (results are presented in the [supplementary on line appendix](#)).

Distributional Benefits of Land Rental Markets

While the econometric results suggest a generally positive relationship between renting in land and welfare, and a negative or insignificant relationship for those who rent out land, it is worth pushing the analysis further by estimating the magnitude of these benefits and losses across the distribution of smallholder households in our sample. We focus the subsequent analysis and discussion on

¹⁴ This is about 70 Malawian kwacha in real 2009 terms; 89% of the households in our sample are below this threshold, which accords with recent poverty headcount estimates for the rural smallholder population.

¹⁵ One note of caution in interpreting these results is in order: in the Zambia panel data, costs of production are only partially observed. Thus, net crop income accounts for fertilizer costs and the costs of renting, but not for labor, traction, seed, or other input expenditures.

Malawi, where the magnitude of the coefficient estimates is clearly larger than in Zambia.

Table 6 shows the distribution of rental rates as a share of the value of crop production per hectare in Malawi. At the median, rental rates are equal to 18% of the value of production for tenants, while the share is slightly higher at 23% for the entire sample, as we would expect. However at the 75th percentile, almost 40% of the value of production on rented in land is consumed by rental costs. This indicates that land renting is expensive relative to revenue. Furthermore, when other costs such as seed, fertilizer, and hired labor are considered, it may be difficult for many smallholders to generate significant income gains through renting in land.

To further examine the distributional welfare gains and/or losses from rental market participation, we estimate the net crop income model (originally presented in column 2 of table 5a) for Malawi using quantile regression with the MC device.¹⁶ Results presented in table 7 suggest that the returns to renting in land are concentrated at the top end of the crop income distribution. At the bottom decile, renting in land actually has a negative relationship with net crop income (with a loss of \$34 associated with each additional hectare rented in). The benefits of renting in land only become positive and statistically significant at the median, with the median household earning an extra \$40 from each additional hectare rented in. This compares to a mean return of \$175 as shown in column 6. The fact that the mean is so much higher than the median (approaching the 75th percentile of the distribution) suggests that the benefits from renting in land may be skewed to a relatively small group of people at the top of the distribution, or that more than half of the tenants are not earning much of a return from their rental investment. There are several possible ways to interpret this. First, positive net returns to renting in may depend on capital resources that are more available to larger producers (e.g., households who have larger budgets for fertilizer and other purchased inputs). Second, smallholder agriculture is notoriously risky and maize production in these systems has a

Table 6. Rental Rate as a Proportion of Value of Crop Production per Hectare (Malawi)

	percentile				
	10th	25th	50th	75th	90th
Tenants only	0.05	0.09	0.18	0.36	0.79
Full sample	0.08	0.13	0.23	0.43	0.86

substantial stochastic component. Better capitalized households may be able to reduce stochastic risk through technology adoption (e.g., irrigation, drought resistant seed varieties), better management practices, crop diversification, etc., and thus obtain higher average returns to renting in land in risky production environments. Third, the heterogeneous returns across the crop income distribution also demonstrate the risks associated with entering into a rental arrangement as a tenant. Since all risk is transferred from the landlord to the tenant in the upfront fixed rental arrangements that are prevalent in this context, tenants must have a sufficient level of risk tolerance, in addition to having the capital resources required for renting in land.

It appears that on the landlord side of the market, most of the crop income losses occur to people in the upper end of the net crop income distribution, as the mean loss is above the loss at the 90th percentile. This may mean that the crop production losses from renting out land are skewed towards a few households that lose a great deal. Investigating the determinants of why this occurs could be the subject of future research.

Taken together, these findings provide evidence suggesting that while land rental markets may produce welfare gains on average, when we consider the cost of participating in land rental markets and look at the benefits across the distribution of smallholders, the results are not uniformly positive. Given the quantile regression results in table 7, it seems that returns to renting in land are mainly going to top producers who likely have an easier time accessing land rental markets in the first place. This is especially the case when the costs of renting land are high and rising as evidenced by land rental prices in table 2, and when land rental costs constitute a substantial share of revenue, as shown in table 6. In addition, the predominance of up-front cash rental arrangements in Malawi likely makes

¹⁶ The quantile regression results for the Zambian model generate no statistically significant results on the land rental coefficients.

Table 7. Quantile Regression Estimates of Factors Affecting Net Crop Income in Malawi

	(1) 10 th	(2) 25 th	(3) 50 th	(4) 75 th	(5) 90 th	(6) Mean ^a
Ha rented in	-33.9954 (0.000)***	-2.0785 (0.630)	39.5847 (0.000)***	188.7371 (0.000)***	196.0505 (0.000)***	174.7723 (0.007)***
Ha rented out	4.3181 (0.601)	-7.1439 (0.266)	-16.4504 (0.099)*	-20.0922 (0.320)	-145.0029 (0.000)***	-156.3894 (0.004)***
Adult equivalent	1.0684 (0.416)	2.2844 (0.025)**	3.6934 (0.020)**	5.2646 (0.101)	9.7885 (0.093)*	7.2282 (0.111)
Land owned (ha)	2.1361 (0.245)	10.2343 (0.000)***	29.7032 (0.000)***	60.1792 (0.000)***	117.2363 (0.000)***	87.8544 (0.007)***
Assets (1,000s USD)	0.4298 (0.682)	1.2960 (0.112)	24.0909 (0.000)***	57.1166 (0.000)***	109.6011 (0.000)***	9.8532 (0.253)
Fertilizer (kg/ha)	-0.1429 (0.000)***	-0.0243 (0.000)***	-0.0032 (0.624)	0.0175 (0.180)	0.0254 (0.282)	-0.0121 (0.551)
Log growing season rainfall, current year (mm)	7.0328 (0.174)	10.5464 (0.009)***	15.4866 (0.013)**	32.9669 (0.009)***	21.7482 (0.343)	3.4963 (0.912)
N	6904	6904	6904	6904	6904	6904

Note: Models 1–5 are estimated via quantile regression with the Mundlak-Chamberlain device that includes time averages of all time-varying covariates (not shown). Provincial dummies and time-averages not shown. P-values, shown in parentheses, have statistical significance denoted as follows: *** $p < 0.01$,

** $p < 0.05$, and * $p < 0.1$.

Superscript ^a denotes that estimates in column 6 of this table are the same as in column 2 in Table 5a.

it difficult for limited-resource farmers to obtain the cash to even enter into these markets.

Conclusions

The objectives of this study are to determine the factors that influence smallholder African households' decisions to participate in rural land rental markets, as well as their subsequent relationship between rental market participation and household welfare. The analysis is conducted in the neighboring southern African countries of Malawi and Zambia. These countries have many institutional, economic, and cultural similarities but very different rural population densities, and together represent a broad spectrum of land scarcity conditions. Our study indicates that while there are very different levels of rental market participation in the two countries, rental markets in both countries are performing similarly in many respects.

The main results of the study are as follows. First, land rental market participation rates are still relatively low within the two countries, although there is considerable variation across geographic space within and between them. Rental market participation is higher in Malawi than in Zambia. This is as we would expect, given the much higher rural

population densities and implied levels of farmland scarcity in Malawi than in Zambia. This is further supported by the coefficient estimate for rural population density in the rental market participation model for Malawi. However, land rental market participation rates have been increasing in both countries over time.

Results also indicate that in both Malawi and Zambia more people participate in land rental markets as tenants than as landlords. This is consistent with other empirical studies within the region (e.g., the studies in Holden et al. 2009; and Jin and Jayne 2013). These results suggest that either land is entering the system from outside the smallholder sector, or that there is a systematic bias against disclosing renting out, or both. More research is needed to inform this issue. If the reason is the former, where is such land coming from? It could be that many landlords are urban-based, and thus are not sampled in our survey (Deininger and Jin 2008). To the extent that renting-out is systematically under-observed in our sample, results pertaining to the determinants and benefits of renting-out land should be taken with caution. However, we tested specifications of the welfare models that excluded the variable for landlord participation, and results were highly consistent. This indicates that including landlord participation is not a problematic factor for the

overall interpretation of rental market impacts on tenants.

The suggestion that landlords in our sample seem to experience a net loss in income from renting out land requires some careful interpretation. Recall that our conceptual model posits that short-term cash constraints and risk aversion may encourage participation as landlords even if observable net economic benefits for the season are negative. We find some support for this notion in the coefficient estimates on the value of household assets (for Malawi, they are negative and statistically significant in one of the renting-out models, while in Zambia they are positive and statistically significant for the renting-in models). Subsequent empirical work may seek to clarify this further, possibly through more direct measures of risk aversion and time-specific cash constraints. It could be that landlords in our sample prefer lower and safer incomes to higher and riskier incomes.¹⁷ As it stands, our results on limited (or negative) benefits from renting out land suggest that conclusions about equity gains from rental market transfers obtained indirectly through estimating market participation models as has been done in previous studies should be nuanced. For example, if rental markets transfer land away from households with relatively more land, but which are less wealthy by most other metrics—such as value of assets, level of education, labor availability, and off-farm income—then clearly “equity gains” merit further unpacking.

Overall, our main results are very similar in both Malawi and Zambia, suggesting that our findings are robust to alternative datasets and are valid across a wide range of conditions. Furthermore, our two-country setup offers some unique insights. While the overall benefit channels of renting in land appear similar (i.e., in terms of efficiency, equity, and welfare outcomes), the magnitudes of these benefits appear to vary across countries in a way that suggests that welfare benefits may be increasing in rental market maturity. More specifically, the larger average magnitude of income benefits of tenancy in Malawi, relative to the benefits in Zambia where markets

are less developed, may reflect differing levels of market distortions, which may attenuate welfare impacts. If this is the case, we would expect average welfare benefits for tenants to increase in both countries as rental markets continue to mature. For example, the finding of no meaningful relationship between renting in land and poverty in Zambia is consistent with recent findings from [Jin and Jayne \(2013\)](#) in Kenya. However, the fact that we find significant poverty reduction effects from renting in land in Malawi suggests that in areas of high population density renting-in land may be a pathway to reducing poverty for tenants.

The results from our study lead to several important policy recommendations. First, to the extent that rental markets bring positive net benefits, policy decisions that may encourage rental market development should be sought. These might include efforts to clarify rental rights as a subset of usufruct rights within customary tenure systems, and measures to strengthen tenure security (perhaps especially for vulnerable groups, including female-headed households). Policies that promote lower costs of information sharing and contract enforcement could also encourage rental market development.

Furthermore, because the net financial returns to tenancy are linked with net returns to production, improvements in total factor productivity (which may take the form of lower production costs for a given level of output, or higher output for a given level of input costs) will likely influence rental market participation into the future. Thus, productivity investments may provide an important stimulus for rental market development.

However, quantile regression results from this study indicate that there are differing returns to farmers with different levels of production. This suggests that targeting such investments will be important. For example, if wealthier farmers who are larger producers disproportionately benefit from policies that are meant to enhance productivity, such as input subsidies, then inequalities in the distribution of rental benefits could be exacerbated.

Relatively rapid growth in rental market participation rates in Malawi and Zambia in recent years underscores the timeliness of paying attention to rental market development within the region. While the findings from this study indicate important positive gains from rental markets on efficiency, equity, and household welfare outcomes, it is

¹⁷ Our finding of negative returns to landlords contrasts with [Holden and Ghebru \(2013\)](#), who find that landlords in Ethiopia benefit from renting out and increase their consumption levels. Their study context, however, is characterized by sharecropping as the predominant rental mode, under which production risk is shared between tenant and landlord.

important to acknowledge that the region's smallholder farm economies—and the contexts in which they operate—are evolving over time. Therefore, researchers and policy-makers must stay attuned to how land rental market participation and its impacts evolve in response to changing conditions. This may be particularly true in the context of rising rural population densities, as well as increasing land acquisition by large- and medium-scale investors, both of which may exacerbate land scarcity within sub-Saharan Africa's smallholder populations.

Supplementary material

Supplementary material is available online at http://oxfordjournals.org/our_journals/ajae/.

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