How do Informal Farmland Rental Markets Affect Smallholders' Well-being? Evidence from a Matched Tenant-Landlord Survey in Malawi.

Jacob Ricker-Gilbert, PhD

Professor, Dept. of Agricultural Economics

Purdue University

jrickerg@purdue.edu

Virtual Seminar for IFPRI Malawi; Wednesday, February 16, 2022

PURDUE UNIVERSITY

CIMMYT MR International Maize and Wheat Improvement Center

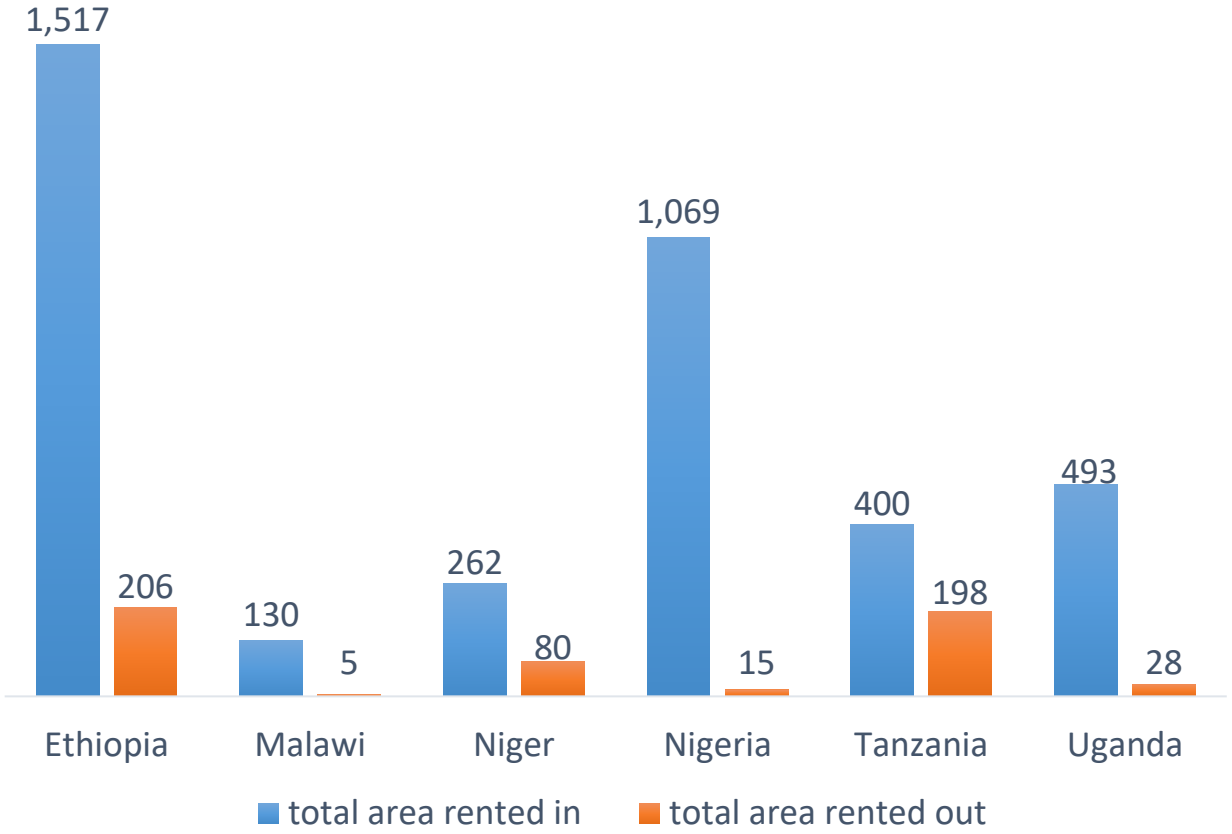
LUANAR

Government of Malawi

BILL & MELINDA GATES foundation

What's wrong with this picture?

Area rented-in and rented-out across countries (in '000 hectares)

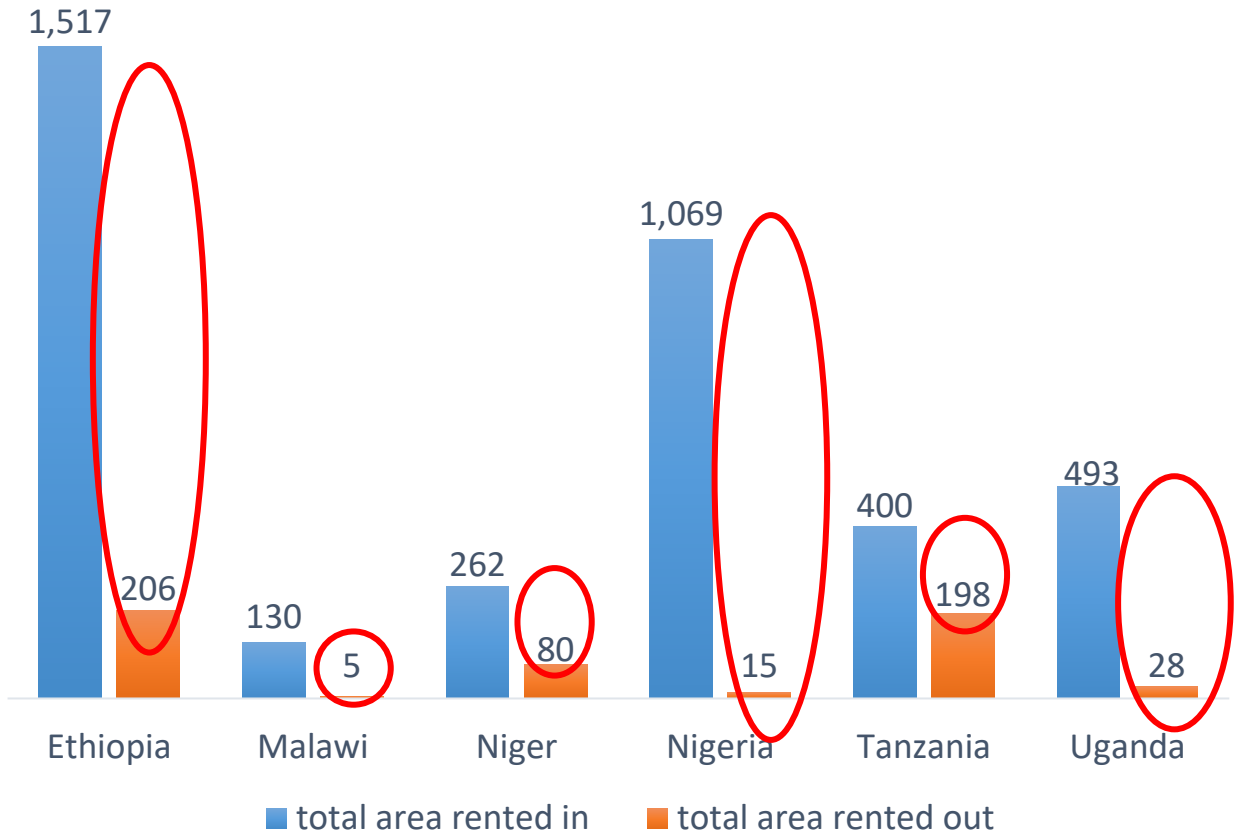


From Deininger et al. (2016) constructed from World Bank LSMS-ISA datasets

Landlord (LL) **under-reporting** is common in large datasets

Area rented-in and rented-out across countries (in '000 hectares)

CAN YOU REALLY DRAW CONCLUSIONS ABOUT LAND RENTING FROM THESE SAMPLES?



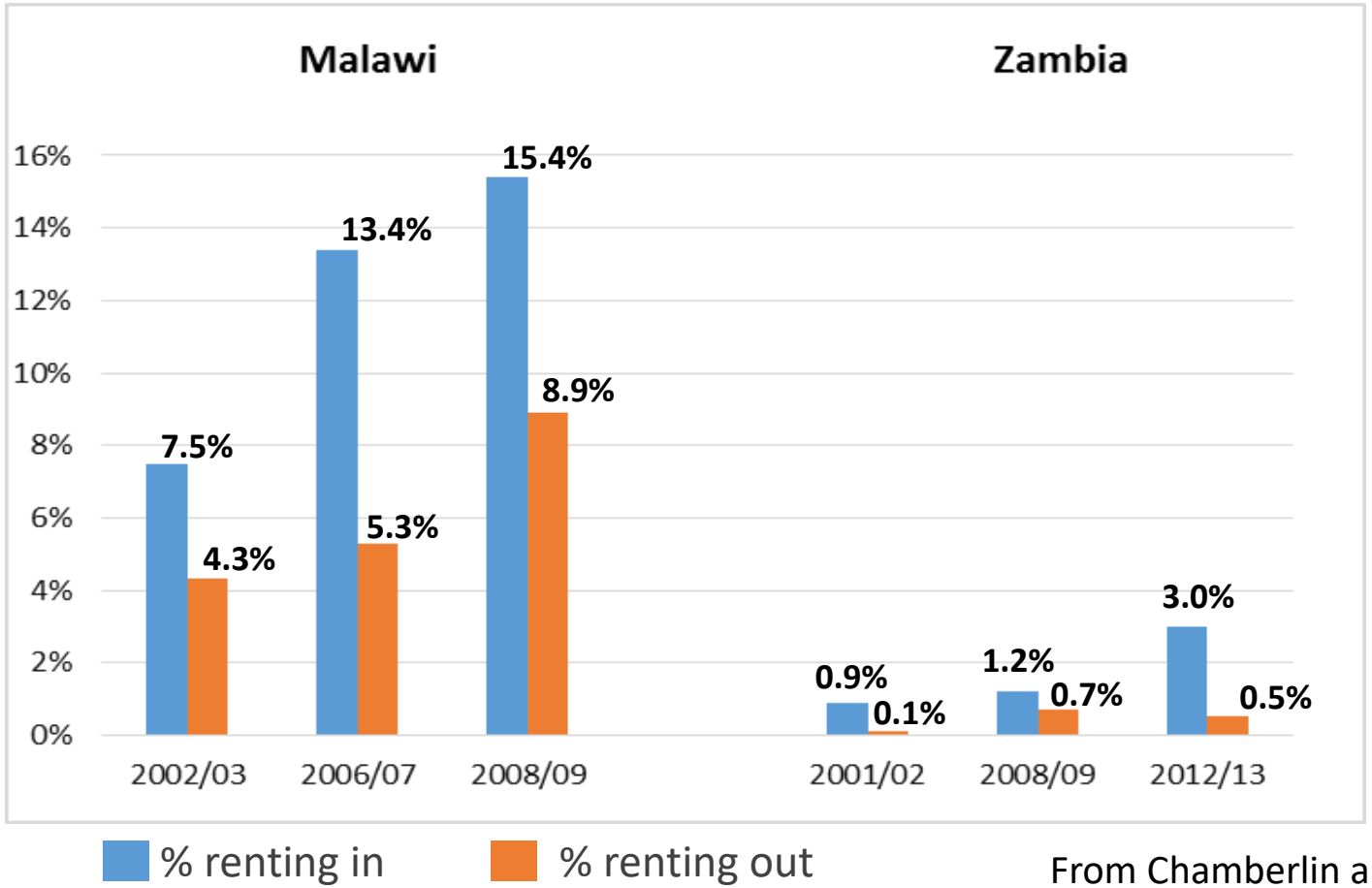
From Deininger et al. (2016) constructed from World Bank LSMS-ISA datasets

Landlord under-reporting:

i) at best leaves out important details

ii) at worst biases any results and conclusions drawn from that research.

Similar issues in other datasets



From Chamberlin and Ricker-Gilbert (2016)

Most arrangements are up front cash rentals.

Several anecdotal reasons for LL under-reporting

1) Landlords being reluctant/afraid to discuss rented out land
2) Problems with survey questions and enumerators not probing respondents about rented out land
3) Absentee landlords, few landlords renting to many tenants

Evidence of…….

1) Suggests tenure insecurity
2) Problems with survey design and implementation (Holden et al. 2016)
3) Local land grab/rise of medium-scale farmers (Sitko and Jayne 2014; Jayne et al. 2016; Anseeuw et al. 2016).

This talk draws on one dataset collected in 2016, to address the issue of "missing" landlords.

Received: 10 August 2018 | Revised: 1 April 2019 | Accepted: 21 May 2019

DOI: 10.1111/agec.12512

ORIGINAL ARTICLE

AGRICULTURAL ECONOMICS
The Journal of the International Association of Agricultural Economists

WILEY

How do informal farmland rental markets affect smallholders' well-being? Evidence from a matched tenant–landlord survey in Malawi

Jacob Ricker-Gilbert[1] | **Jordan Chamberlin**[2] | **Joseph Kanyamuka**[3] | **Charles B.L. Jumbe**[3] | **Rodney Lunduka**[4] | **Stevier Kaiyatsa**[5]

[1]Department of Agricultural Economics, Purdue University, West Lafayette, Indiana

[2]CIMMYT, Mexico City, Mexico

[3]Center for Agricultural Research and Development, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi

[4]World Bank, Lilongwe, Malawi

[5]Ministry of Finance, Economic Planning and Development, Government of Malawi, Lilongwe, Malawi

Correspondence
Jacob Ricker-Gilbert, Purdue University, 610 Purdue Mall, West Lafayette, IN 47907.
Email: jrickerg@purdue.edu

Abstract

We estimate the efficiency and equity returns to farmland rental markets in Malawi using a matched tenant–landlord survey of smallholder farm households in four districts. Our sample allows us to more fully observe the landlord side of the rental market, which is almost always missing in previous studies. Our results suggest that land rental markets promote efficiency by facilitating a net transfer of land to more productive farmers. We also find that land rental markets promote equity as conventionally defined in the land markets literature, that is, by transferring land from land-rich households to land-poor households, and from labor-poor to labor-rich households. However, our study identifies some important challenges for land rental markets in this context. First, we find that tenants in our sample are wealthier than their landlord counterpart on average in all dimensions other than landholding. In addition, most landlords report the motive for renting out their land as either the need for immediate cash, or the lack of labor and/or capital to cultivate the plot that was rented out. These findings align with concerns about potential "stress renting" by poor landlords and suggest the value of defining equity along a broader set of dimensions other than simply equalizing the distribution of farmland and labor.

KEYWORDS
land rental markets, landlords, Malawi, sub-Saharan Africa, tenants

JEL CLASSIFICATION
D63, O12, Q15

HH-level analysis focused on "efficiency" and "equity" of land renting using matched T-LL dataset (*Agricultural Economics* 2019)

Soil Investments on Rented versus Owned Plots: Evidence from a Matched Tenant-Landlord Sample in Malawi

Jacob Ricker-Gilbert *Associate Professor, Department of Agricultural Economics, Purdue University, West Lafayette, Indiana; jrickerg@purdue.edu*

Jordan Chamberlin *Spatial Economist, Maize and Wheat Improvement Center (CIMMYT), United Nations, Nairobi, Kenya; jordan.chamberlin@gmail.com*

Joseph Kanyamuka *Consultant, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi; jkanyamuka@gmail.com*

ABSTRACT *We use a unique data set on matched tenant-landlord pairs in Malawi to compare decisions on smallholder plots that were rented versus those that were owner-operated. Controlling for household and rental-pair fixed effects, we found that some input use (e.g., hybrid maize seed) and soil fertility investments (e.g., manure, compost, minimum tillage) were higher on tenants' owner-operated plots than on their rented-in plots. Tenants were also less likely to use compost than their landlords. Landlords were less likely to rent out plots with fruit trees. Our results suggest that the expansion of farmland rental markets may exacerbate soil fertility maintenance concerns.* (JEL D63, O12)

demand and improving input market conditions. During this process, land transfers through rentals and sales should facilitate the reallocation of land resources to these more efficient farmers.[1] For example, functioning land rental markets should allow tenants to expand the cultivated area and bring more capital into the sector while potentially providing landlords with compensation for their land assets while they engage in pursuits outside of agriculture.

Although most land cultivated by smallholders in SSA is managed in customary tenure systems where operators lack formal titles, recent evidence from the region suggests growth in land rental markets has been pronounced (Holden, Otsuka, and Place 2009;

plot-level analysis focused on investments in i) tenants owner-cultivated, ii) tenant's rented-in and ii) landlord's owner-cultivated plots (*Land Economics* forthcoming)

Role of land rental markets?

- Land markets (particularly rental markets) have role to play in African structural transformation
  - US and EU ≈ 50% of farmland is rented

- Holden, Otsuka and Place (2009) first to investigate these issues comprehensively in SSA.
  - Related studies have consistent findings (Deininger et al., 2008; Ghebru and Holden, 2009; Yamano et al., 2009; Jin and Jayne 2013; Chamberlin and Ricker-Gilbert 2016).

- Rental markets enable net transfers of land
  - From land-rich to land-poor → equity gains
  - From less-able to more-able farmers → efficiency gains

- Enable productive livelihoods
  - Especially for households with insufficient land… → welfare gains

- Gains from renting are consistently clear for **tenants**. Not so clear for **landlords**
  - Chamberlin and Ricker-Gilbert find some evidence of **"stress-renting"** in Malawi and Zambia"
  - But sample is unbalanced between T and LL

Outline

I. Motivation
II. Objectives/Contribution
III. Context/Background
IV. Methods and Identification Strategy
V. Data
VI. Descriptive results
VII. Econometric Results
VIII. Conclusions/Implications

Questions: Would positive benefits from land rental markets hold if LL are fully observed?

1. Article 1: Do rental markets still promote:
   a. Production efficiency
   b. Equity (equality) in land, labor…….. and other factors

2. Article 2: How do input use and investment decisions differ
   a. On owner-cultivated and rented plots
   b. Between Tenants and Landlords

- Collect a matched sample of Tenant-Landlord pairs and autarkic households in the same villages, in four districts of Malawi in 2016.
- Identification strategy uses pair-FE to control for underlying unobserved factors in the T/LL relationship.

Contributions

Article 1: First study to measure “efficiency” & “equity” in matched T-LL sample

Article 1: New measure of production efficiency.

- We created some observable proxies for:

1) Ability, measured as self-assessed level of grit (following Duckworth et al. 2007)
   - Grit ≈ “perseverance and passion for long term goals”

2) Risk Aversion and present bias/discount rate (following Holt and Laury (2002), along with Ashraf et al. (2006), and Gine and Karlan (2014).
   - Gives us a way to arguably differentiate how these factors affect land renting.

Article 2: estimated potential input use and investment decisions on plots among T/LL pairs

- Rental contracts are short-term by nature, and often informal
- Might expect tenants to increase use of annual inputs (like inorganic fertilizer) to boost yields in the current year
- Might not expect tenants to make longer-term investments in soil fertility (like using animal manure) as benefit take multiple years to materialize.

Empirical model: Rental participation for household j affected by numerous factors

- Rental amount decision (ha): tobit, includes autarkic households

1) $R_j^D = \delta_1 A_j + \delta_2 \bar{L}_j + \delta_3 G_j + \delta_4 r_j + \delta_5 P_j + \boldsymbol{H_j \delta_6} + v_j, \mathrm{D} \in [In, Out]$

- A = # of family members (proxy for labor available)
  - H_{o1}: $\hat{\delta}_1 = 0$, test of labor equity(equality); $\hat{\delta}_1 > 0$ in Rent in equation, $\hat{\delta}_1 < 0$ in Rent out equation
- $\bar{L}$ = pre-rental landholding (owner-cultivated, to be rented out, fallow, pasture, woodlot, etc. excludes rented-in land)
  - H_{o2}: $\hat{\delta}_2 = 0$, test of land equity(equality); $\hat{\delta}_2 < 0$ in Rent in equation, $\hat{\delta}_2 > 0$ in Rent out equation
- G = self-assessed "grit" scale (ability proxy) (Duckworth et al. 2007; Duckworth and Quinn 2009; Duckworth and Gross 2014).
  - H_{o3}: $\hat{\delta}_3 = 0$, test of production efficiency; $\hat{\delta}_3 > 0$ in Rent in equation, $\hat{\delta}_3 < 0$ in Rent out equation
- r = Risk aversion proxy
- P = Discount rate / Present bias (Holt and Laury 2002; Ashraf et al. 2006; Gine and Karlan 2014)
- H = Other household factors: education, gender of head, assets, savings, district dummy, etc
- v = specific individual error

Identification issues: correlation between v and covariates

- Primarily through omitted variable bias.
  - i) Have rich set of controls,
    - a) household demographics,
    - b) Ability, risk aversion, discount rate /present bias proxies (G, R, P)

  - i) Matched T/LL sample allows us to use pair FE,
    for household j in rental pair p excluding autarkic

$$2)\ R_{jp}^{D} = \delta_1 A_{jp} + \delta_2 \bar{\mathrm{L}}_{jp} + \delta_3 G_{jp} + \delta_4 r_{jp} + \delta_5 P_{jp} + \boldsymbol{H_{jp}\delta_6} + \alpha_p + \varepsilon_{jp}, \qquad \mathrm{D} \in [In, Out]$$

α_p = pair-specific FE, captures unobserved differences between T/LL pair

ε_{jp} = individual specific error, assumed iid normal; conditional on observed covariates and α

Cannot claim full causality

Data: Collection during April and May 2016

- Sampling frame
  - Identify 4 districts with high land rental activity according to 2010 IHS3
  - Worked with District Extension staff to identify Extension planning areas with high land rental activity
  - Random selection of village within each EPA
  - Within village use village list and info from village leaders about who rents in and rents out.
  - From list and sub-list,
    i) randomly select 5 tenants for interview – then find their 5 landlords
    ii) randomly select 5 landlords for interview – then find their 5 tenants
    iii) Randomly select 10 autarkic households from village.

  - The use of key informants to help identify respondents to answer questions about sensitive land-related issues has been used in previous studies {Macours et al. (2010); Macours (2014); Vranken et al. (2011), and Bardhan and Mookherjee (2010)}.

Target was 600 households: 200 T, 200 LL, 200 A

- 30 HH per village (10, 10, 10)
- 5 villages per district (150 HH)
- 4 districts
- After cleaning have 173 matched T/LL pairs and 187 autarkic HH, N=533
- 1,502 sub-plots, 404 rented in & 1,191 owner-cultivated

- Sub-plot level
  - Rented and largest owner-cultivated sub-plot measured by GPS
  - Soil samples taken on rented and largest owner-cultivated sub-plot
  - 948 plots sampled among T/LL pairs

Table 1: Averages for key variables by rental market status

Variable Category	Variable	Tenants	Landlords	Autarkic
Land	Pre-rental landholding in ha	0.844	1.854	1.278
	Cultivated area in ha	1.713	0.961	1.160
Input purchases	Kgs commercial fertilizer purchased	169	30	79
	Kgs of commercial maize seed purchased	10	4	4
Savings and assets	Household savings in USD	83	10	40
	household received credit (0, 1)	0.387	0.295	0.326
	total value all assets USD	748	119	234
Demographics	Number of family members	5.462	4.988	5.086
	female headed hh (0,1)	0.104	0.260	0.299
	head is a migrant (0,1)	0.497	0.301	0.278
	head age	40.439	47.231	49.428
	head years schooling	7.775	4.751	5.139
	Adult equivalents	4.531	4.128	4.225
	Dependency ratio	1.033	1.297	1.212
Revenue	Member works as casual laborer on other farm	0.277	0.584	0.428
	total cash from non-farm work USD	445	83	140
Scales	Grit score[i]	30.34	28.65	29.81
	discount rate[ii]	55,477	39,725	45,535
	risk preferences[iii]	169,383	229,392	70,741

N= 533, 173 tenants, 173 landlords, 187 autarkic;
[i] scale from 8-40, higher score = more grit and higher ability;
[ii] higher score = lower discount rate, less present bias;
[iii] lower score = less risk averse

Table 2: Rental market comparisons by market participation status

	Response by tenant	Response by landlord
Rental agreement is fixed rent or borrowed	0.99	0.95
Rental partner same ethnicity	0.84	0.80
Rental partner lives in same community	0.72	0.78
Rental partners main occupation is farming	0.86	0.70
Have a written rental agreement with partner	0.08	0.07
Number of additional seasons over the past 5 that this was rented ? (mean | median)	1.50 | 1.00	1.70 | 1.00

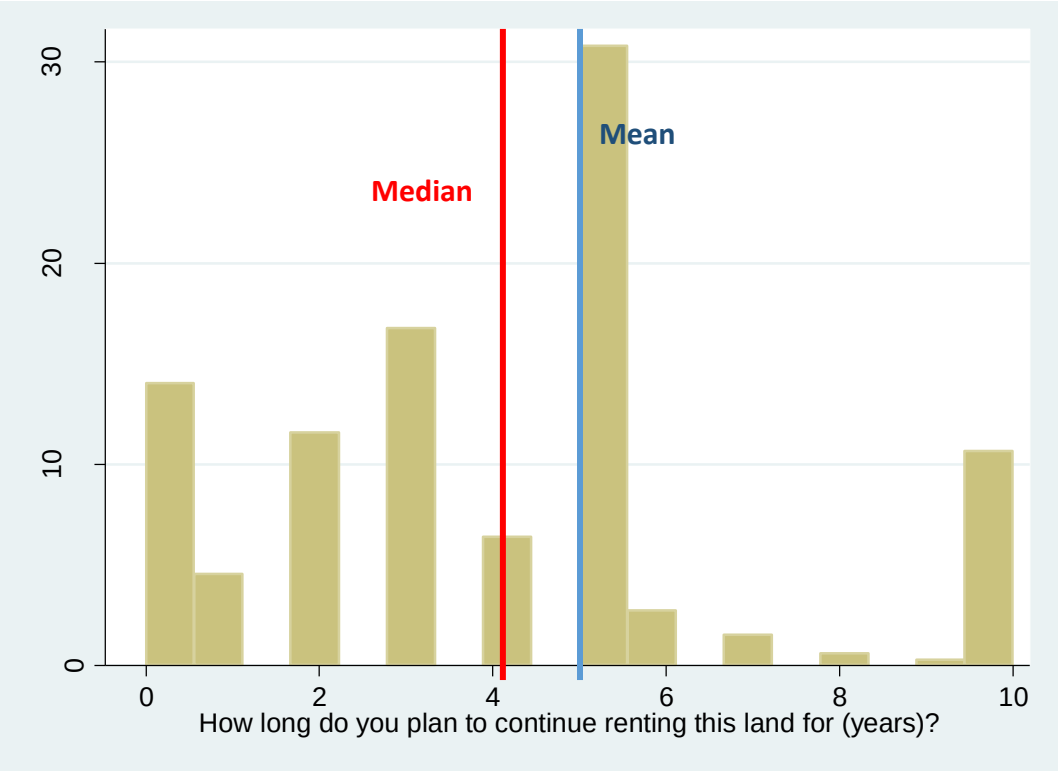
- Most rental partners are same ethnicity & live in same community
  - consistent with tenure insecurity as found elsewhere (Macours 2015 in Guatemala)
- Most (not all) landlords and tenants are farmers by occupation
- Agreements are short-term and informal

Number of years in the future you plan to continue this arrangement?

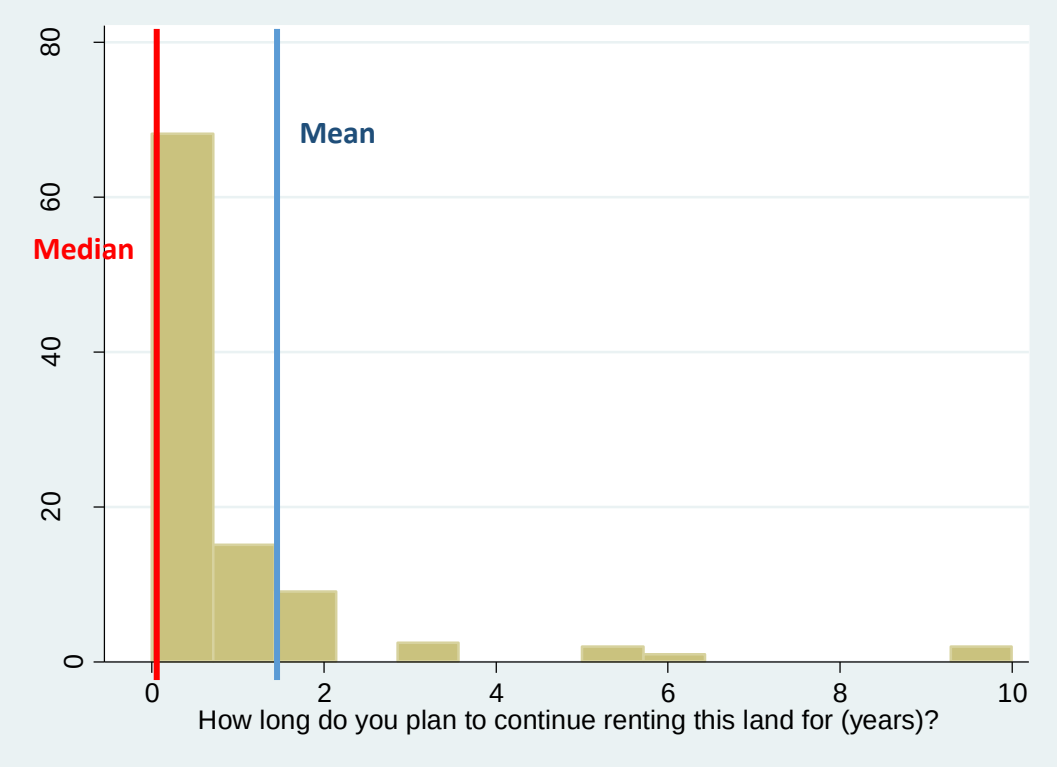
Agreement between partners ?

Number of years in the future you plan to continue this arrangement?

Tenants



Landlords



	Response by tenant	Response by landlord
Number of years that you plan to continue in this arrangement (mean)	4.70	1.14
Number of years that you plan to continue in this arrangement (median)	4	0
Plan to eventually buy(sell) this rented-in(out) sub-plot	63%	4%

Table 3: Main reason for engaging in rental market

Landlords

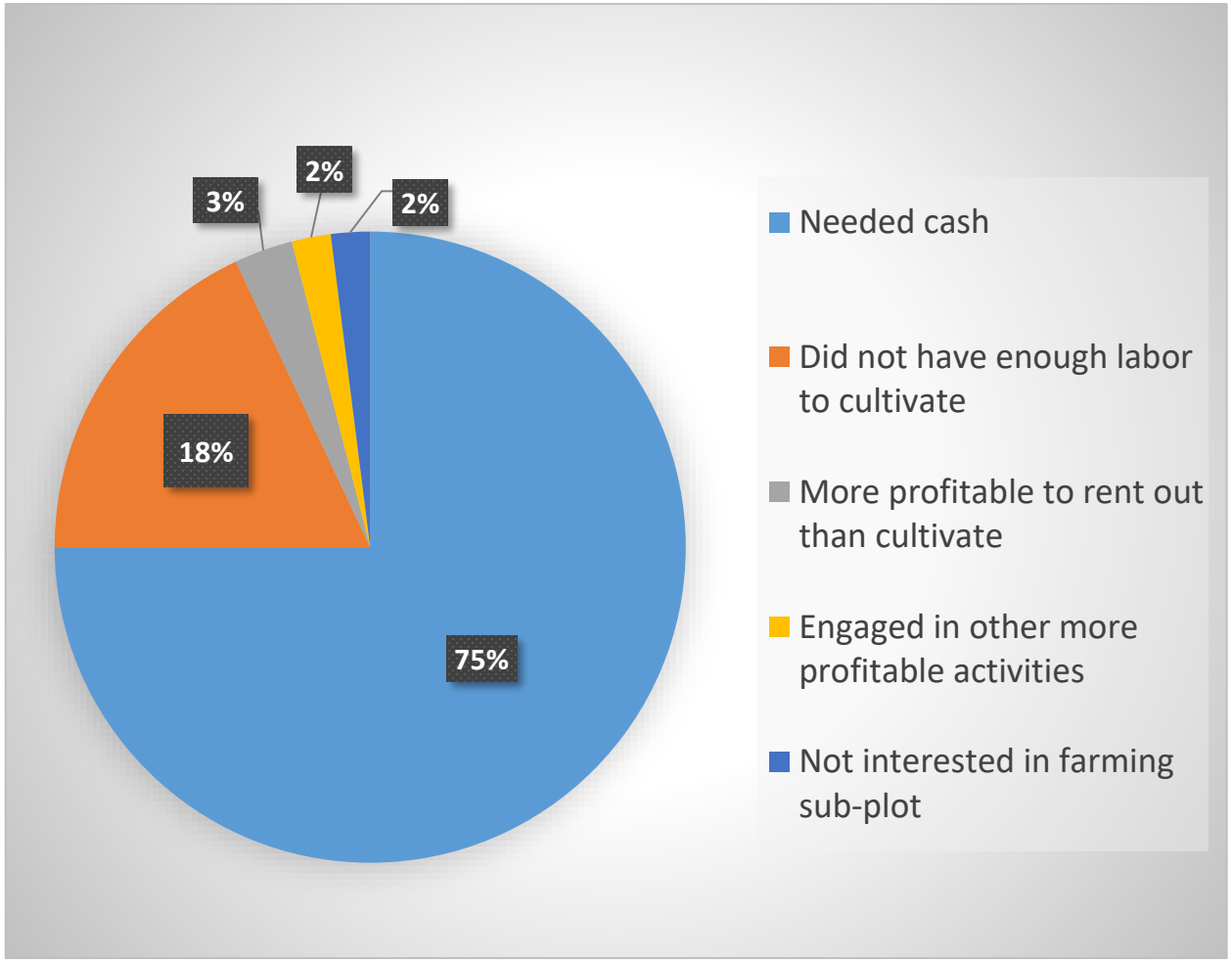
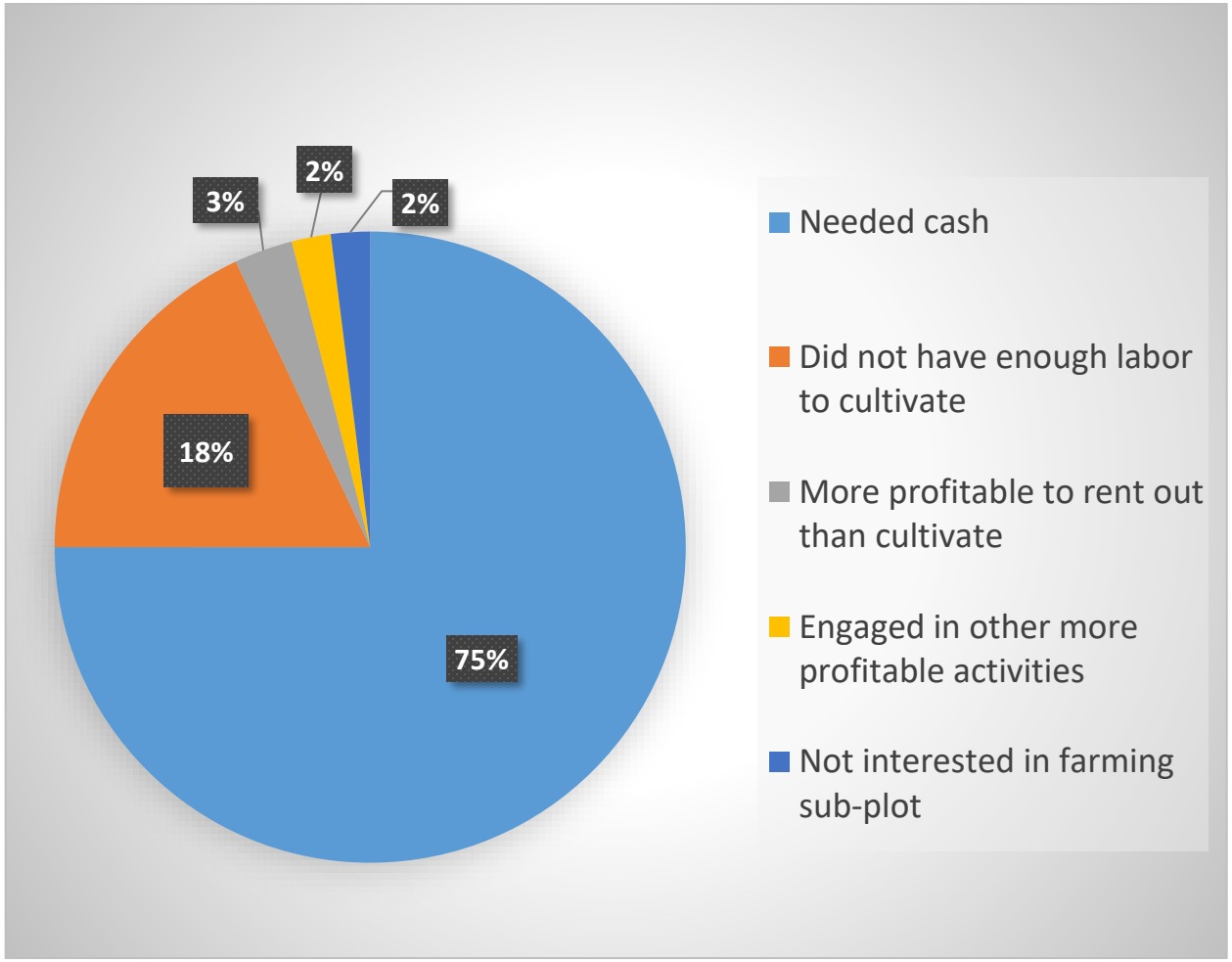


Table 3: Main reason for engaging in rental market

Landlords



Tenants

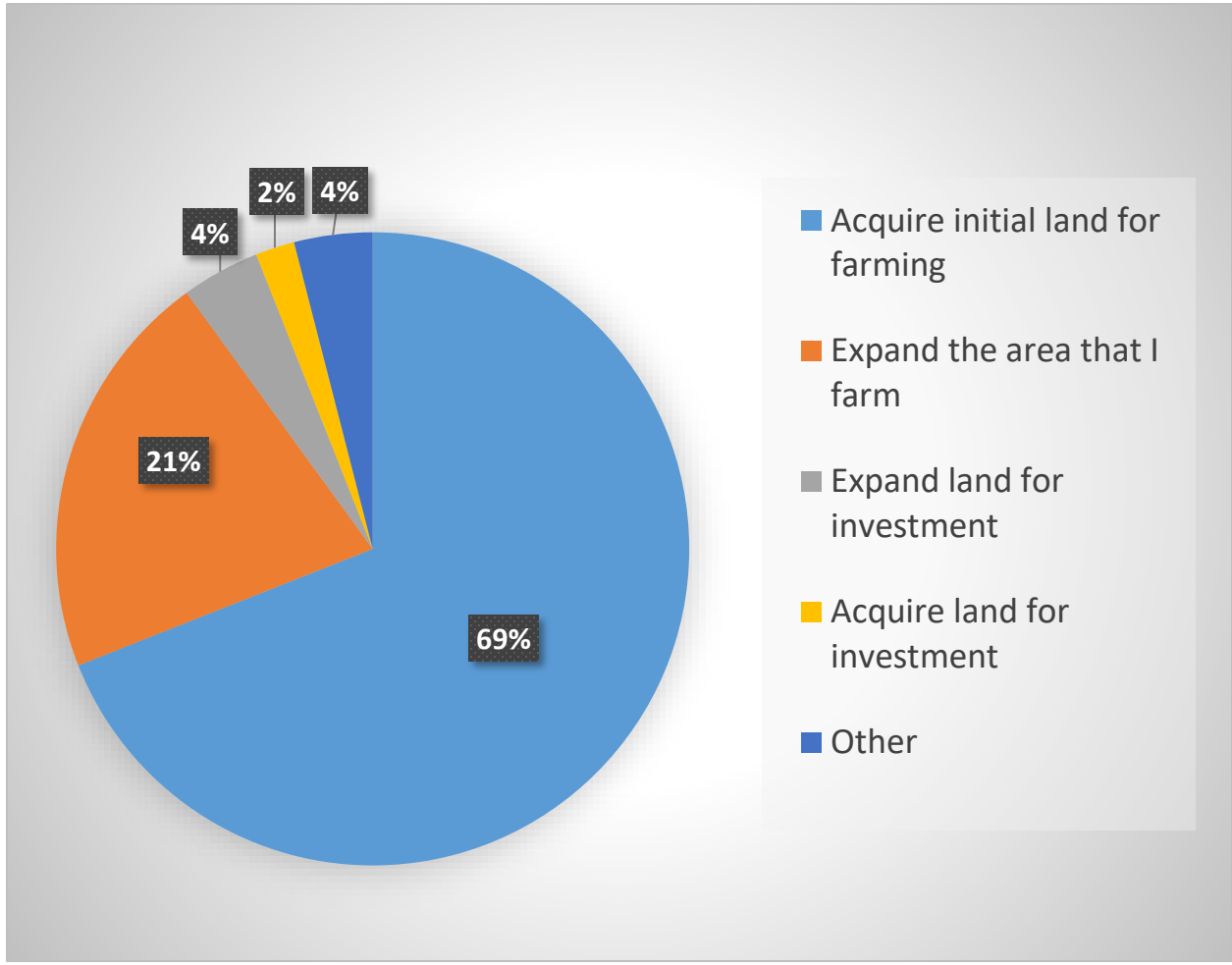


Table 4: Factors affecting area rented in by households

Dependent variable = area rented in (ha)	Pair FE estimator (1)–(6)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education of HH head	0.06***				0.06***	0.02
	(.000)				(.001)	(.212)
Grit score		0.02***			0.01	–0.02
		(.009)			(.336)	(.115)
Present bias			0.00		0.00	–0.00
			(.262)		(.787)	(.549)
Risk aversion				–0.00	0.00	0.00
				(.835)	(.807)	(.780)
Prerental landholding in hectare	–0.23***	–0.26***	–0.27***	–0.27***	–0.23***	–0.18***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.001)
Number of HH members	0.09***	0.11***	0.11***	0.11***	0.09***	0.04
	(.004)	(.002)	(.002)	(.002)	(.009)	(.168)
=1 if HH head is female						0.04
						(.828)
=1 if migrant HH head						0.31**
						(.013)
Age of household head*10						–0.06
						(.181)
IHS of savings in USD						0.05
						(.216)
IHS of value of assets in USD						0.18***
						(.000)
Number of observations	346	346	346	346	346	346
R^2	.26	.19	.18	.17	.26	.39
Number of matched pairs	173	173	173	173	173	173

Note. Dependent variable is the amount of land rented in, measured in hectares. Landlords have zero-valued outcomes in all models, expect for the less than 5% of landlords who also rent in a small amount of land. Autarkic households are not included in the pair FE models, but are included in the Tobit model (in which they have zero-valued outcomes). *, **, and *** indicate that the corresponding means are different from each other at the 10%, 5%, and 1% level, respectively; *p*-values in parentheses. Tobit estimates include district dummies but pair FE estimates do not; coefficient estimates from Tobit estimator are average partial effects. Standard errors in pair FE and double hurdle clustered at matched pair level. IHS stands for inverse hyperbolic sine transformation. It is interesting to note that the coefficient estimate for number of household members loses statistical significance in columns 6 and 12 when other factors such as value of assets are added to the model. This is likely due to multi-collinearity as the correlation between number of family members and value of assets is 0.275. Multi-collinearity affects statistical significance but does not bias coefficient estimates.

Table 4: Factors affecting area rented in by households

Dependent variable = area rented in (ha)	Pair FE estimator (1)–(6)						Tobit estimator (7)–(12)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Education of HH head	0.06***				0.06***	0.02	0.05***				0.04***	0.01**
	(.000)				(.001)	(.212)	(.000)				(.000)	(.024)
Grit score		0.02***			0.01	–0.02		0.01***			0.01	–0.002
		(.009)			(.336)	(.115)		(.009)			(.222)	(.600)
Present bias			0.00		0.00	–0.00			0.00		0.00	0.00
			(.262)		(.787)	(.549)			(.378)		(.898)	(.571)
Risk aversion				–0.00	0.00	0.00				0.00	–0.00	–0.00
				(.835)	(.807)	(.780)				(.798)	(.956)	(.889)
Prerental landholding in hectare	–0.23***	–0.26***	–0.27***	–0.27***	–0.23***	–0.18***	–0.11***	–0.12***	–0.12***	–0.12***	–0.11***	–0.11***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Number of HH members	0.09***	0.11***	0.11***	0.11***	0.09***	0.04	0.04***	0.05***	0.05***	0.05***	0.04***	0.02
	(.004)	(.002)	(.002)	(.002)	(.009)	(.168)	(.000)	(.000)	(.000)	(.000)	(.000)	(.113)
=1 if HH head is female						0.04						–0.06
						(.828)						(.415)
=1 if migrant HH head						0.31**						0.19***
						(.013)						(.000)
Age of household head* 10						–0.06						–0.08***
						(.181)						(.000)
IHS of savings in USD						0.05						0.02
						(.216)						(.110)
IHS of value of assets in USD						0.18***						0.13***
						(.000)						(.000)
Number of observations	346	346	346	346	346	346	533	533	533	533	533	533
R^2	.26	.19	.18	.17	.26	.39	.09	.04	.04	.03	.09	.20
Number of matched pairs	173	173	173	173	173	173	–	–	–	–	–	–

Note. Dependent variable is the amount of land rented in, measured in hectares. Landlords have zero-valued outcomes in all models, expect for the less than 5% of landlords who also rent in a small amount of land. Autarkic households are not included in the pair FE models, but are included in the Tobit model (in which they have zero-valued outcomes). *, **, and *** indicate that the corresponding means are different from each other at the 10%, 5%, and 1% level, respectively; *p*-values in parentheses. Tobit estimates include district dummies but pair FE estimates do not; coefficient estimates from Tobit estimator are average partial effects. Standard errors in pair FE and double hurdle clustered at matched pair level. IHS stands for inverse hyperbolic sine transformation. It is interesting to note that the coefficient estimate for number of household members loses statistical significance in columns 6 and 12 when other factors such as value of assets are added to the model. This is likely due to multi-collinearity as the correlation between number of family members and value of assets is 0.275. Multi-collinearity affects statistical significance but does not bias coefficient estimates.

Table 5: Factors affecting area rented out by households

Dependent variable = area rented out (ha)	Pair FE estimator (1)–(6)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education of HH head	–0.01				–0.01	0.009
	(.361)				(.531)	(.503)
Grit score		–0.02*			–0.01	–0.01
		(.081)			(.174)	(.654)
Present bias			0.00		0.00	0.00
			(.295)		(.279)	(.261)
Risk aversion				0.00	0.00	0.00
				(.497)	(.475)	(.669)
Prerental landholding in hectare	0.51***	0.52***	0.52***	0.52***	0.51***	0.50***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Number of HH members	–0.09***	–0.10***	–0.10***	–0.10***	–0.09***	–0.07***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
=1 if HH head is female						0.07
						(.508)
=1 if migrant HH head						0.06
						(.560)
Age of household head* 10						0.04
						(.320)
IHS of savings in USD						0.02
						(.528)
IHS of value of assets in USD						–0.11***
						(.002)
Number of observations	346	346	346	346	346	346
R^2	.57	.57	.57	.57	.58	.61
Number of matched pairs	173	173	173	173	173	173

Note. Dependent variable is the amount of land rented out, measured in hectares. Tenants have zero valued outcomes in all models, expect for the less than 5% of tenants who also rent out a small amount of land. Autarkic households are not included in the pair FE models but are included in the Tobit model (in which they have zero-valued outcomes). *, **, and *** indicate that the corresponding means are different from each other at the 10%, 5%, and 1% level, respectively; *p*-values in parentheses. Tobit estimates include district dummies but pair FE estimates do not. Coefficient estimates from Tobit estimator are average partial effects. Standard errors in pair FE and double hurdle clustered at matched pair level. IHS stands for inverse hyperbolic sine transformation.

Table 5: Factors affecting area rented out by households

Dependent variable = area rented out (ha)	Pair FE estimator (1)–(6)						Tobit estimator (7)–(12)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Education of HH head	–0.01				–0.01	0.009	–0.02***				–0.01***	–0.01*
	(.361)				(.531)	(.503)	(.000)				(.003)	(.093)
Grit score		–0.02*			–0.01	–0.01		–0.01***			–0.01***	–0.01*
		(.081)			(.174)	(.654)		(.000)			(.002)	(.079)
Present bias			0.00		0.00	0.00			–0.00		–0.00	–0.00
			(.295)		(.279)	(.261)			(.599)		(.766)	(.888)
Risk aversion				0.00	0.00	0.00				0.00	0.00	0.00
				(.497)	(.475)	(.669)				(.666)	(.755)	(.926)
Prerental landholding in hectare	0.51***	0.52***	0.52***	0.52***	0.51***	0.50***	0.18***	0.18***	0.18***	0.18***	0.18***	0.20***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Number of HH members	–0.09***	–0.10***	–0.10***	–0.10***	–0.09***	–0.07***	–0.02***	–0.03***	–0.03***	–0.03***	–0.02**	–0.01
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.009)	(.005)	(.003)	(.004)	(.012)	(.280)
=1 if HH head is female						0.07						–0.03
						(.508)						(.587)
=1 if migrant HH head						0.06						0.02
						(.560)						(.653)
Age of household head* 10						0.04						–0.02
						(.320)						(.216)
IHS of savings in USD						0.02						–0.01
						(.528)						(.617)
IHS of value of assets in USD						–0.11***						–0.07***
						(.002)						(.000)
Number of observations	346	346	346	346	346	346	533	533	533	533	533	533
R^2	.57	.57	.57	.57	.58	.61	.17	.17	.15	.15	.18	.22
Number of matched pairs	173	173	173	173	173	173	–	–	–	–	–	–

Note. Dependent variable is the amount of land rented out, measured in hectares. Tenants have zero valued outcomes in all models, expect for the less than 5% of tenants who also rent out a small amount of land. Autarkic households are not included in the pair FE models but are included in the Tobit model (in which they have zero-valued outcomes). *, **, and *** indicate that the corresponding means are different from each other at the 10%, 5%, and 1% level, respectively; *p*-values in parentheses. Tobit estimates include district dummies but pair FE estimates do not. Coefficient estimates from Tobit estimator are average partial effects. Standard errors in pair FE and double hurdle clustered at matched pair level. IHS stands for inverse hyperbolic sine transformation.

Article 2: Input or investment X, on sub-plot i, HH j, in rental pair p

$$X_{ijp} = \beta_1 R_{ijp} + \beta_2 T_{jp} + \boldsymbol{H_{jp}\beta_3} + c_p + \mu_{ijp}$$

- R =1 if sub-plot is rented (operated by tenant)
  - H_{o1}: $\hat{\beta}_1 = 0$, test if rented-in plots receive more of a specific input or investment (by tenant) than LL
- T =1 if sub-plot is owner-operated by tenant

  H_{o2}: $\hat{\beta}_2 = 0$, test if tenants use more of a specific input or investment on owned plot than LL

- H are household demographic controls
- c_p = pair-specific FE, captures unobserved differences within T/LL pair
- μ_{ijp} = sub-plot specific error term, i.i.d normal, conditional on the observed covariates and c.

Identification strategy

- Model estimated with pair FE.
- Binary dependent variables estimated via LPM, Std. Err. Clustered at rental pair level

Landlord j's decision which sub-plot i to rent out Y, and which to cultivate.

$$Y_{ij} = \alpha_1 S_{ij} + \boldsymbol{V_{ij}\alpha_2} + \boldsymbol{I_{ij}\alpha_3} + \boldsymbol{Q_{ij}\alpha_4} + a_j + \varepsilon_{ij}$$

S = self-assessed soil quality

V = perceived insecurity (=1 if someone may challenge LL for plot ownership)

I = investments (fruit tree on plot)

Q= measured soil fertility (P, OM and pH)

- a_j= Household FE, captures unobserved differences within household
- ε_{ij}= sub-plot specific error term, i.i.d normal, conditional on the observed covariates and a.

Identification strategy

- Model estimated with HH level FE.
- Binary dependent variables estimated via LPM. Std Err. Clustered at HH level

Annual inputs

i) Number of weeding

ii) Application of herbicides

iii) Inorganic fertilizer application in kg/ha

iv) Hybrid maize is main crop

Investments

i) Intercropping maize and legume

ii) Apply animal manure

iii) Apply green compost

iv) Use minimum tillage

Table 4

Factors Affecting Plot-Level Input Use

Variable	(1) No. Times Plot Was Weeded	(2) 1=Applied Herbicide	(3) Inorganic Fertilizer Applied (kg/ha)	(4) 1=Hybrid Maize as Main Crop
=1 if plot rented in and cultivated by tenant $\hat{\beta}_1$	−0.04	0.07	61.01**	−0.03
	(0.131)	(0.047)	(29.107)	(0.059)
=1 if plot owned and cultivated by tenant $\hat{\beta}_2$	−0.03	0.08*	78.07***	0.08
	(0.116)	(0.047)	(27.846)	(0.061)
Education of household head in years of schooling	−0.00	−0.01**	3.04	0.01*
	(0.010)	(0.005)	(2.624)	(0.006)
Area owned by household pre-land-renting, in ha	0.01	0.02	−1.81	0.01
	(0.032)	(0.016)	(11.136)	(0.021)
Number of members in household	−0.01	0.01	−14.91***	−0.01
	(0.022)	(0.009)	(5.402)	(0.013)
=1 if HH is female	0.15	−0.06	16.89	−0.05
	(0.154)	(0.045)	(28.820)	(0.077)
Age of household head in years	−0.00	−0.01***	0.33	0.00
	(0.004)	(0.002)	(0.760)	(0.002)
Savings in USD*1,000	0.00	−0.00	0.01	−0.00
	(0.000)	(0.000)	(0.030)	(0.000)
Value of assets in USD*100	−0.00	−0.00	0.00	−0.00*
	(0.000)	(0.000)	(0.002)	(0.000)
Number of plots cultivated by household	−0.02	0.03**	2.31	0.01
	(0.025)	(0.014)	(6.455)	(0.014)
Plot distance from house (walking minutes)	0.003*	−0.00	0.02	−0.00
	(0.001)	(0.001)	(0.517)	(0.001)
= 1 if member of household is in a village savings and loan association	0.00	−0.06	9.95	0.07
	(0.106)	(0.044)	(22.386)	(0.060)
Distance to the nearest ag. extension officer from residence (walking minutes)	−0.00	0.00	0.05	0.0002**
	(0.000)	(0.000)	(0.099)	(0.000)
$\beta_1 - \beta_2 = 0$	−0.01	−0.02	−17.05	−0.11**
	(0.074)	(0.026)	(0.371)	(0.040)
Rental-pair fixed effects	Yes	Yes	Yes	Yes
R-squared	0.017	0.103	0.047	0.021
Observations	948	948	948	948

control is landlord's owner cultivated plot

Tenants more likely to apply:
- herbicide to owned plot (8 pp more land LL)
- use more inorganic fertilizer on owned and rented plots than LL

Tenants more likely to grow hybrid maize on owned plot
grow cash crops on rented plot, 11 pp different.

Note: The base category for comparing β̂ estimates is a landlord's owner-operated plot(s). Standard errors in parentheses. Models include a constant and district-level fixed effects. Districts are not completely collinear with the rental-pair location because we found four cases of tenants and landlord pairs residing in different districts. Number of observations = 948, with 169 matched tenant-landlord pairs; β̂_1 and β̂_2 are compared with landlord's owner cultivated plot.
***, **, and * Significance at the 1%, 5%, and 10% levels, respectively.

Table 5

Factors Affecting Plot-Level Soil Fertility Investments

Variable	(1) 1=Intercropped Maize and Legume	(2) 1=Applied Animal Manure	(3) 1=Applied Green Compost	(4) 1=Used Minimum Tillage
=1 if plot rented in and cultivated by tenant $\hat{\beta}_1$	0.04	−0.05	−0.07**	−0.02
	(0.048)	(0.049)	(0.034)	(0.051)
=1 if plot owned and cultivated by tenant $\hat{\beta}_2$	0.08	0.06	−0.02	0.03
	(0.047)	(0.054)	(0.038)	(0.051)
Education of household head in years of schooling	−0.00	−0.01	0.00	−0.00
	(0.005)	(0.006)	(0.004)	(0.006)
Area owned by household pre land-renting, in hectares	−0.02	0.01	−0.02	0.03
	(0.020)	(0.021)	(0.012)	(0.024)
Number of members in household	0.02**	−0.02***	−0.01	0.01
	(0.009)	(0.009)	(0.007)	(0.010)
=1 if household head is female	0.06	−0.10*	−0.00	0.01
	(0.063)	(0.059)	(0.034)	(0.046)
Age of household head in years	0.00	0.00	0.00*	0.00
	(0.001)	(0.002)	(0.001)	(0.001)
Savings in USD*1,000	0.00*	0.0002*	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)
Value of assets in USD*1,000	−0.00	−0.00	−0.008***	−0.01***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of plots cultivated by household	−0.05***	−0.01	0.00	−0.01
	(0.013)	(0.018)	(0.009)	(0.013)
Plot distance from house (walking minutes)	0.00	−0.00	−0.00	−0.00
	(0.001)	(0.001)	(0.001)	(0.001)
=1 if member of household is in a village savings and loan association	0.07*	0.01	0.03	0.03
	(0.042)	(0.057)	(0.042)	(0.036)
Distance to the nearest ag. Extension officer from residence (walking minutes)	0.0002*	0.00	0.00	−0.00
	(0.000)	(0.000)	(0.000)	(0.000)
$\hat{\beta}_1 - \hat{\beta}_2 = 0$	−0.04	−0.11***	−0.05**	−0.05*
	(0.028)	(0.034)	(0.022)	(0.026)
Rental-pair fixed effects	Yes	Yes	Yes	Yes
R-squared	0.046	0.041	0.038	0.046
Observations	948	948	948	948

Tenants less likely to apply:
- compost to rented plot than landlords (7 pp less)

Tenants less likely to apply animal manure, compost, and use min tillage on rented-in than their own plots.

Note: Standard errors are in parentheses. Models include a constant and district-level fixed effects. Districts are not completely collinear with the rental-pair location because we found four cases of tenants and landlord pairs residing in different districts. Number of observations = 948, with 169 matched tenant-landlord pairs; $\hat{\beta}_1$ and $\hat{\beta}_2$ are compared to landlord's owner cultivated plot; models include a constant and district fixed effects.
***, **, and * Significance at the 1%, 5%, and 10% levels, respectively.

Table 6

Factors Affecting the Plot the Landlord Decides to Rent Out

Dependent Variable (=1 if plot rented out, =0 if owner cultivated)	(1)	(2)	(3)	(4)	(5)
=1 if landlord views soil as good or very good	0.11				0.02
	(0.167)				(0.160)
=1 if topsoil is acidic (<5.2 pH) in topsoil		−0.05			−0.04
		(0.156)			(0.145)
Organic matter (%) in topsoil		−0.07			−0.06
		(0.042)			(0.043)
Phosphorus (ppm) in topsoil		0.00			0.00
		(0.003)			(0.003)
Fruit trees on the plot			−0.49***		−0.51***
			(0.121)		(0.120)
= 1 if landlord perceives someone likely to challenge tenure status of plot				0.29	0.33*
				(0.197)	(0.182)
Landlord fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.004	0.018	0.097	0.016	0.137
Observations	245	245	245	245	245

Note: Standard errors are in parentheses. Models include a constant and district-level FEs. Districts are not completely collinear with the rental-pair location because we found four cases of tenants and landlord pairs residing in different districts. The number of observations = 245, with 137 owner-operated plots and 108 rented-out plots.

***, **, * Significance at the 1%, 5%, and 10% levels, respectively.

Models LL decision of which plot to rent.

Both perceived and objective soil fertility measures are not associated with the decision

Main factor associated with decision is presence of fruit trees

Some evidence that tenure insecurity is related with a higher probability of renting land.

- Get money while you can?

Conclusions: Matched Tenant-Landlord sample from Malawi

I. T and LL pair are mainly of same ethnicity and live in same communities

i) Therefore, missing LL in other studies likely due LL not wanting to talk or way surveys are conducted

ii) Not some unobserved land-grab

- although that may be happening……
- but population based surveys wont capture it.

II. Matched sample supports previous work using unbalanced samples

i) Rental markets create production efficiency

ii) Rental markets create land and labor equity (ie: equality)

iii) i) and ii) consistent with previous literature

iv) but T wealthier than LL pair on all other dimensions, so is that equity?

Conclusions:

III. Evidence of stress rental by landlords

i) Renting out most valuable assets to meet consumption needs

ii) Is this evidence of a poverty trap?

iii) Social dynamics between T and LL pairs need to be explored

- Are LL so desperate that they allow soil to be mined?

iv) Is this evidence of a **poverty trap** for landlords?

IV. Tenants bringing management ability and capital into agriculture

i) Seems good on the surface

ii) But mostly going for short term gains

iii) At the expense of longer-term soil fertility

- Likely due to the nature of the rental arrangements

Policy Implications

Malawi passed land bill in 2016

i) If tenure security improves land rental markets may grow
ii) Right now seems to be a trade-off between short term yield gains and longer-term soil fertility by tenants and rented plots.
iii) Would tenure security lead to better (re: written) rental contracts?
    -Less stress-renting, and soil mining?

Need to recognize that rental markets are an important part of structural transformation process.

i) Need to shift resources towards training farmers on soil fertility management
ii) Provide support for would be landlords (ie: credit, extension) as they are incentivized to farm sustainably on their own plots if they want to.

Thank you for your time. Questions?

jrickerg@purdue.edu

PURDUE UNIVERSITY

CIMMYT MR International Maize and Wheat Improvement Center

LUANAR

Government of Malawi

BILL & MELINDA GATES foundation

Appendix I: GRIT SCALE QUESTIONS

I. New ideas and projects sometimes distract me from previous ones.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

II. Setbacks don't discourage me.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

III. I have been obsessed with a certain idea or project for a short time but later lost interest.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

IV. I am a hard worker

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

V. I often set a goal but later choose to pursue a different one.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

VI. I have difficulty maintaining my focus on projects that take more than a few months to complete.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

VII. I finish whatever I begin.

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

VIII. I am diligent

1) Very much like me
2) Mostly like me
3) Somewhat like me
4) Not much like me
5) Not like me at all

Note: Statements with positive connotations are scored in reverse (eg: more points given if statement describes the person).

Appendix II: DISCOUNT RATE AND RISK AVERSION QUESTIONS

DISCOUNT RATE AND PRESENT BIAS QUESTIONS

Suppose you win a raffle today. The lottery administrator gives you options for how you would like to accept your cash prize. One option will be to accept your cash prize today; the other option would be to accept a larger cash prize, but with a three months delay. You will be asked to pick the option you prefer. Please make your decisions based on how you expect you would answer if the choice were actual and not hypothetical.	
1. Do you prefer a MK 10 000 prize guaranteed today or a MK 12 500 prize guaranteed 3 months from now?	MK 10 000 today..... A MK 12 500 in 3 months..... B
2. Do you prefer a MK 10 000 prize guaranteed today or a MK 15 000 prize guaranteed 3 months from now?	MK 10 000 today..... A MK 15 000 in 3 months..... B
3. Do you prefer a MK 10 000 prize guaranteed today or a MK 17 500 prize guaranteed 3 months from now?	MK 10 000 today..... A MK 17 500 in 3 months..... B
4. Do you prefer a MK 10 000 prize guaranteed today or a MK 20 000 prize guaranteed 3 months from now?	MK 10 000 today..... A MK 20 000 in 3 months..... B
IF ANSWER IS (A) TO 1 AND 2 AND 3 AND 4, ASK: 5. How much would the prize have to be for you to choose to wait?	MK _____

RISK AVERSION QUESTIONS

I am going to give you a series of choices. Please tell me which choice you would like to take, imagining that they are real choices.	
1. Do you prefer a gift of MK 20 000, or participating in a lottery which gives you 50% chance to win MK 40 000 and 50% chance to win nothing?	Gift of MK 20 000..... A Lottery for MK 40 000..... B
2. Do you prefer a gift of MK 20 000, or participating in a lottery which gives you 50% chance to win MK 50 000 and 50% chance to win nothing?	Gift of MK 20 000..... A Lottery for MK 50 000..... B
3. Do you prefer a gift of MK 20 000, or participating in a lottery which gives you 50% chance to win MK 60 000 and 50% chance to win nothing?	Gift of MK 20 000..... A Lottery for MK 60 000..... B
4. Do you prefer a gift of MK 20 000, or participating in a lottery which gives you 50% chance to win MK 70 000 and 50% chance to win nothing?	Gift of Q200..... A Lottery for Q 70 000..... B
IF ANSWER IS (A) TO 1 AND 2 AND 3 AND 4, ASK: 5. How much would you have to be paid to choose the lottery?	MK _____

MK = Malawi Kwacha
USD 1.00 ≈ 700 MK during survey

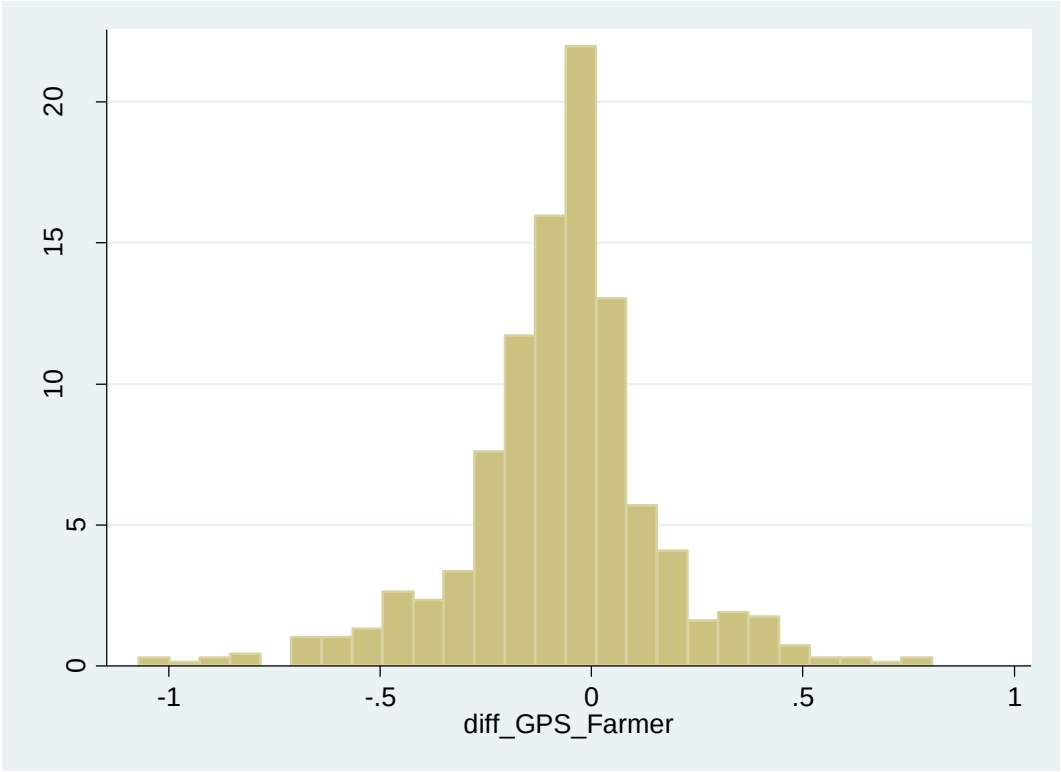
Table 4: Input use and investment by plot management and rental status

	(a) Rented in plots	(b) Owner cultivated plots	(a-b) Difference	(c) Tenant household	(d) Landlord household	(c-d) difference
Input use and yield						
Number of weedings	1.60	1.69	-0.09	1.69	1.62	0.08
Apply herbicides	0.22	0.15	0.07***	0.23	0.09	0.14***
Apply inorganic fertilizer	0.57	0.55	0.02	0.58	0.51	0.07**
Inorganic fert. application in kg/ha	128	107	21**	132	87	45***
Maize is main crop	0.55	0.53	0.08***	0.57	0.64	-0.07**
Hybrid maize is main crop	0.35	0.38	-0.03	0.38	0.35	0.03
Maize yield kg/ha	963	813	150*	1,043	596	447***
Investments						
Intercropping	0.21	0.25	-0.04**	0.20	0.28	-0.08***
Apply animal manure	0.13	0.23	-0.10***	0.18	0.20	-0.02
Apply green compost	0.06	0.12	-0.06***	0.08	0.14	-0.06***
Erosion control	0.12	0.26	-0.14***	0.17	0.27	-0.10***
Minimum tillage used	0.05	0.12	-0.07***	0.08	0.11	-0.03*
Crop residue left on plot	0.46	0.66	-0.20***	0.57	0.62	-0.05*
Soil is self-assessed as good	0.40	0.49	-0.09***	0.43	0.51	-0.08**

Note: *, **, *** indicates that the corresponding means are different from each other at the 10%, 5%, and 1% level respectively.

Difference between GPS and farmer area estimates of same plots.

GPS area estimate - Farmer area estimate



N=683, 5 plots removed whose difference > | 2|

Mean difference = -0.072 ha

Median difference = -0.055 ha

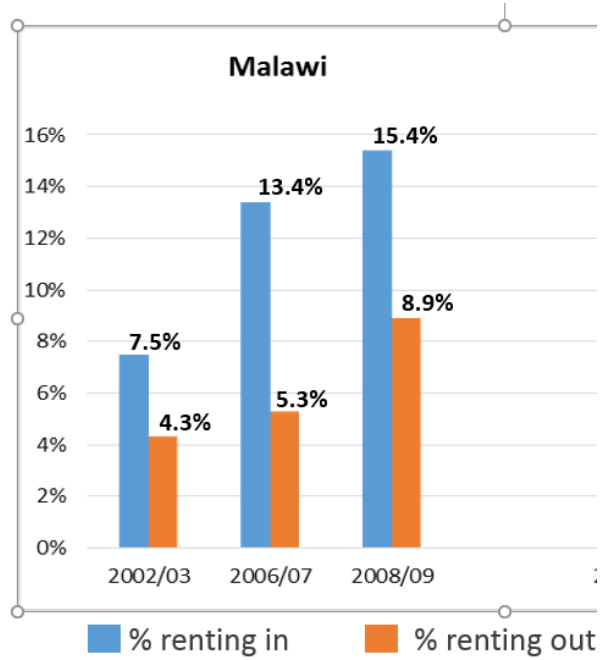
Background: Two main types of land in Malawi

- **Private:** Freehold or Leasehold
  - Owner has title; can sell, buy or rent
- **Customary**
  - Households have cultivation rights, granted by chiefs/traditional authorities
  - Land is passed down but households have no formal rights to it
  - Can be re-allocated by chiefs
  - Land renting not explicitly allowed, may be endorsed by chief.

- Vast majority of smallholders cultivate in **customary** system
  - LSMS-IHS3 from 2010 indicates that 98% of smallholder plots were acquired without title
  - In terms of total land area much more may be in freehold or leasehold (Anseeuw et al. 2016)

Though not explicitly allowed, smallholder land renting increasing

- Fixed rent cash >=95%
- Participation growing
  - Especially in high pop. density areas.
- Rental costs relatively high
- Tenants richer than landlords on all dimensions besides land
- Some *prima facie* evidence of stress renting by landlords
- Short-term contracts
- Informal



Share of land rental costs in total input costs

MALAWI	Land rental costs Total input costs (fert, seed, hired labor, land rental)					
Percentiles:	10th	25th	50th	75th	90th	Mean
Tenants only	0.06	0.13	0.27	0.52	0.91	0.37

Source: Chamberlin and Ricker-Gilbert (2016)

Benchmark: in US, land rental costs 10% of input costs on tenants' farms (Kirwan and Roberts, 2016)

Second half of 2016, Malawi passed new land bill

- Circulating in Parliament since 2002
- Smallholders can obtain titles to customary land from central government (for free)
- Significant: can go around chiefs/local authorities to secure tenure

- If bill improves tenure security: Land renting likely to increase
  - Would-be landlords can rent out without fear of losing land
  - Maybe can facilitate landlords engaging in off-farm or non-farm activities

- Increases the policy relevance of this study to understand T/L dynamics *ex ante.*