Land Prices Heading Skyward? An Analysis of Farmland Values Across Tanzania

Ayala Wineman and Thomas S. Jayne

Michigan State University

Presentation at MSU Workshop on Rising Land Prices

Dar es Salaam, May 29, 2017

Why study about land values in a setting of (primarily) small-scale farmers?

- Population densities rise… land gets scarce…
  …Youth will rely on the market *more and more*.

- Insights into future land market activity and labor movements.

- Trends /drivers of land values will affect the trajectory of agricultural systems & broader economic transformation processes.

Background: Correlates of farmland prices

- **Agricultural productivity** (Ricardo 1817)
    - **Soil characteristics** (Huang et al. 2006; Maddison 2000)
    - **Climate characteristics** (Mendelsohn et al. 1994)
    - **Farm returns or yields** (Borchers et al. 2014; Livanis et al. 2006)

- **Market access** (von Thünen 1842)
    - Proximity to agricultural markets (Merry et al. 2008)
    - High-value crops closer to cities (Livanis et al. 2006)

Background: Correlates of farmland prices

- Other factors
  - **Tenure status** (Choumert and Phélinas 2015)
  - **Plot size** – The "small parcel size premium" (Tsoodle et al. 2006; Brorsen et al. 2015)
  - Local **population density** or population growth rates (Devadoss and Manchu 2007; Goodwin et al. 2003)
  - **Urban pressure:**
    - Land prices bid up today for alternate usage
    - Option to convert land later (Plantinga et al. 2002; Borchers et al. 2014)

Possible causes of rising land prices

Better access to markets?

Urban pressure?

Population pressure?

Higher productivity?

Land scarcity: large-scale land acquisitions?

Farm fragmentation?

Data and methods

- 3+ waves of the Tanzania National Panel Survey (NPS/LSMS-ISA) data set (2009–2013, with some 2015)
    - Tracks households **and plots**
    - Our focus is "non-commercial" farmland
    - Respondents provide the value of a plot "*if it were sold today*".
- Description of land prices over space and time
- Correlates of land values (hedonic model estimation):

$$P_{it} = \alpha + \boldsymbol{X_{it}}'\boldsymbol{\theta} + \varepsilon_{it}$$

Dependent variable:
Value per acre of plot i in year t
(Real values, adjusted for inflation)

Agricultural and location-related characteristics associated with the plot

Plus:
Year fixed effects,
Plot fixed effects
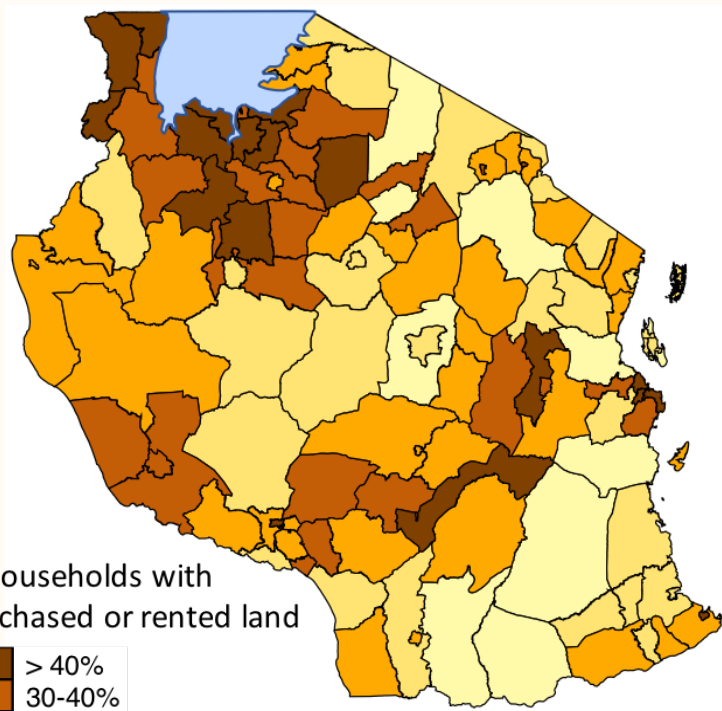
Data and methods

- Description of time trends among *potential* drivers of higher land prices

- Tie it all together:

  - Discussion of some of the *most likely factors* placing upward pressure on land prices

Land market activity in Tanzania
- *Households* -

2007/08 (Source: ASC)

% households with purchased or rented land

- > 40%
- 30-40%
- 20-30%
- 10-20%
- 1-10%

2014/15 (Source: NPS)

Household has some land acquired through:	All	Rural
Inheritance / gift	53.84%	56.45%
Purchase	**38.46%**	**38.40%**
Borrowed	17.10%	16.92%
Rented	**15.74%**	**15.03%**
Other	9.05%	10.05%
Household has acquired land ONLY through:		
Inheritance / gift	33.43%	33.98%
Purchase	**17.12%**	**15.56%**
Rental	**5.19%**	**3.81%**
Observations (households that access land)	2,092	1,744

19.4% possessed purchased land

10.7% rented land

27.4% rented *or* possessed purchased land

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Land market activity in Tanzania
- *Plots* -

Percent of plots

Inherited	33.17%
Gifted	10.33%
Purchased	**29.63%**
Borrowed	11.09%
Rented	**9.63%**
Other (squatting / cleared land/ allocated)	6.16%
Observations	4,291

Percent of area
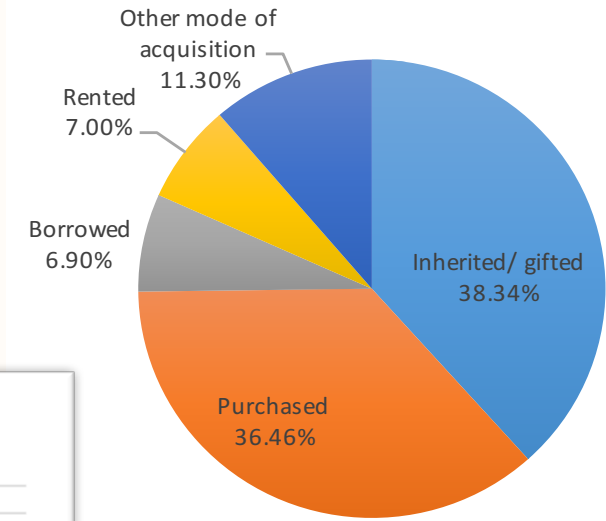
Plot acquisition dates by mode of acquisition
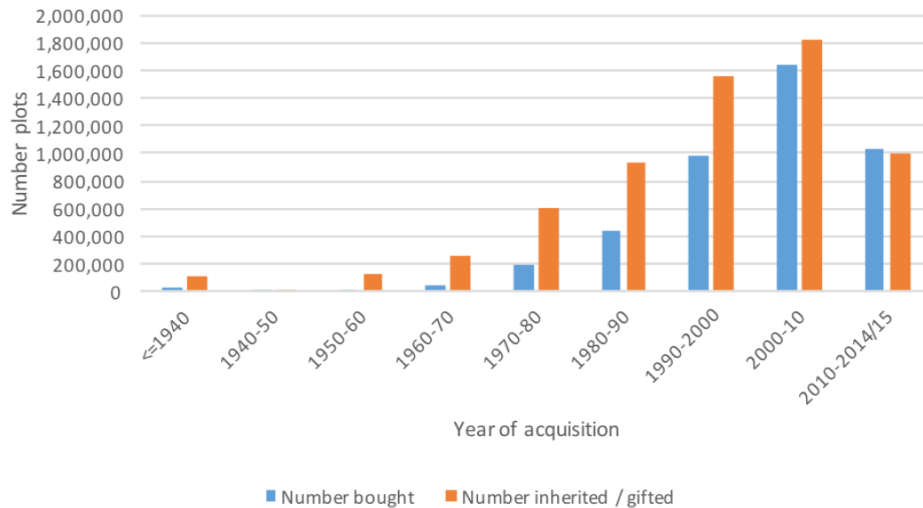
Source:
NPS 2014/15

Land value and net value of crop production

2009, 2011, 2013 (pooled)
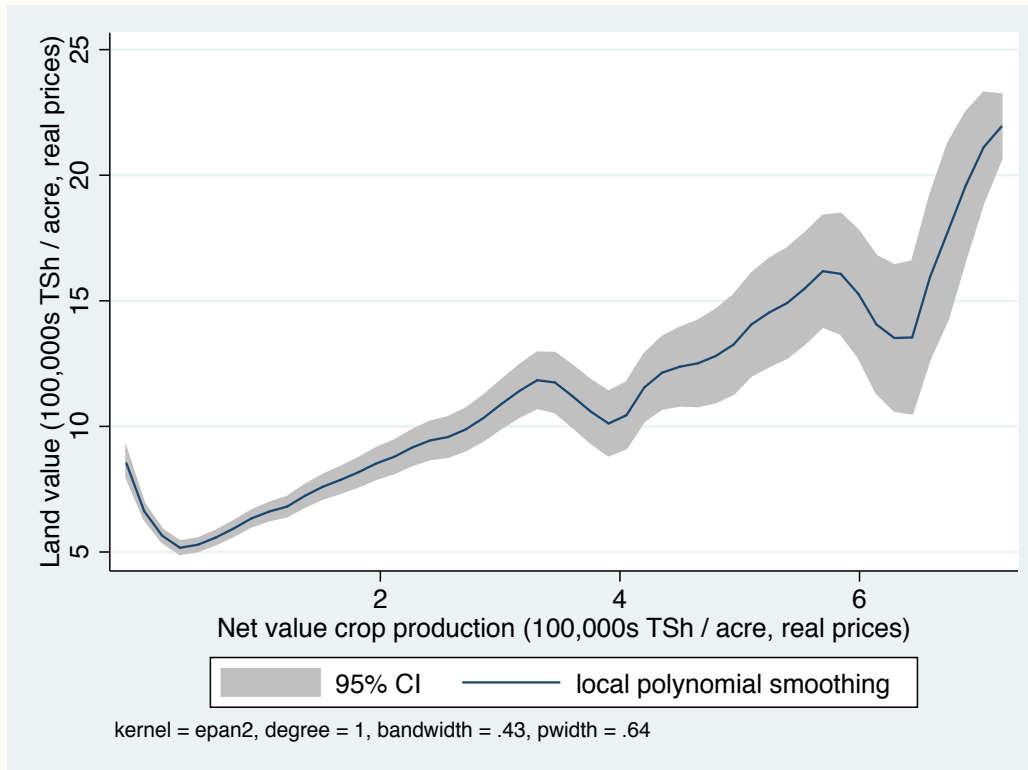
Monetary values adjusted for inflation:

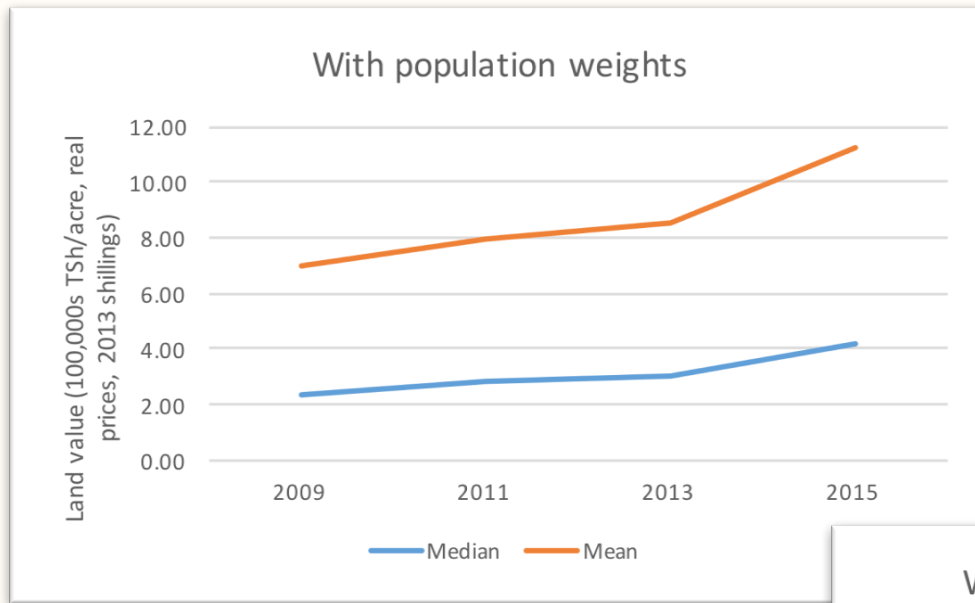| Survey year	Multiply by
2009	(1/0.67)
2011	(1/0.84)
2013	1
2015	0.89

…The farmer-estimated land values are suitable for further analysis.

Land values across Tanzania, 2009 to 2013

| | Land value (100,000s TSh/acre, real prices) | | | | | | Δ 2009 to 2013 (per year) | | Test[a] 2009 = 2013 |
| | **2009** | | **2011** | | **2013** | | | | |
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	P-value
PANEL A									
Whole country	2.39	6.98	2.87	7.93	3.00	8.57	+0.15	+0.40	0.000
Zone									
Western	2.00	3.70	2.39	4.68	2.00	3.89	+0.001	+0.05	0.529
Northern	6.24	15.38	8.97	17.65	10.00	17.91	+0.94	+0.63	0.009
Central	1.20	1.89	1.20	2.19	1.50	2.70	+0.08	+0.20	0.004
Southern Highlands	1.80	5.14	2.39	6.11	3.00	7.73	+0.30	+0.65	0.000
Lake	3.99	8.87	4.79	10.83	5.00	9.63	+0.25	+0.19	0.278
Eastern	2.99	8.82	3.59	8.82	4.29	11.28	+0.32	+0.61	0.009
Southern	1.80	4.94	2.05	4.84	2.00	5.46	+0.05	+0.13	0.142
Zanzibar	7.48	13.87	7.18	12.12	8.33	12.07	+0.21	-0.45	0.053
PANEL B									
Plot size category									
0-5 ha	2.39	7.02	2.99	8.00	3.33	8.63	+0.23	+0.40	0.000
5-100 ha	1.50	4.90	1.20	3.71	1.41	5.78	-0.02	+0.22	0.572
PANEL C									
Distance category (Distance from town)									
Tercile 1	2.99	10.14	3.99	10.83	5.00	12.70	+0.50	+0.64	0.000
Tercile 2	2.25	5.98	2.87	6.98	3.00	7.28	+0.19	+0.33	0.000
Tercile 3	1.87	4.75	2.39	5.95	2.25	5.83	+0.09	+0.27	0.001

Prices have continued to rise up to 2015…

With population weights

Land value (100,000s TSh/acre, real prices, 2013 shillings)

Median — Mean

Source:
NPS 2009, 2011, 2013, 2015

With population weights adjusted for plot area

Land value (100,000s TSh/acre, real prices, 2013 shillings)

Median — Mean
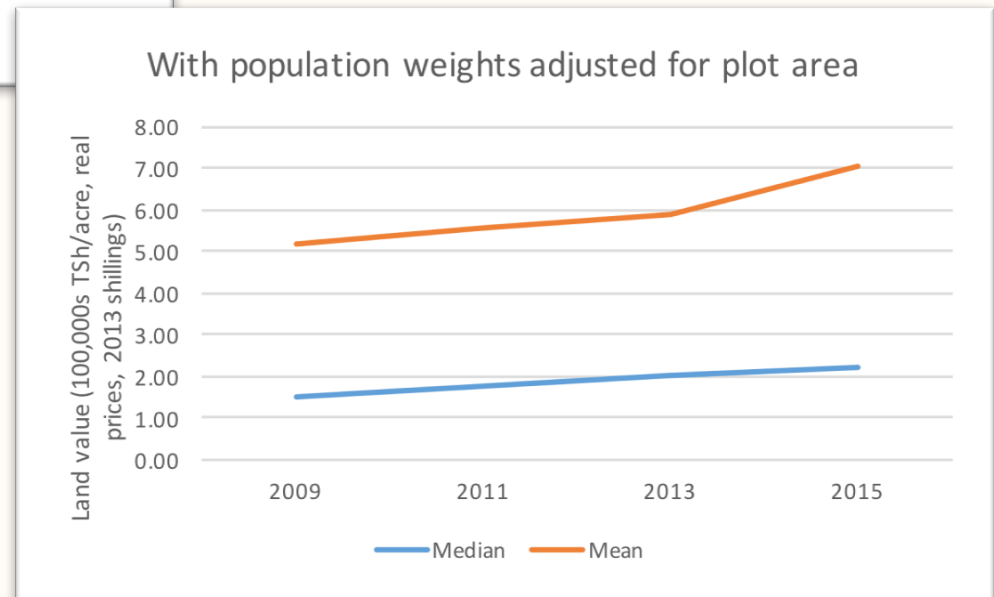
Hypothesized correlates of land values in Tanzania

Topic	Factor	Hypothesized relationship
Miscellaneous	Plot size	Convex
	Population density	+
	Tenure security	+
	Forest / fallow / other use	+
Agricultural potential	Soil quality	+
	Slope	-
	Average rainfall / temperature	+ / -
	On-farm amendments	+
	Pre-harvest crop losses	-
Market access / urban pressure	Rural location of homestead	-
	Distance from road / town / market	-
	Household's market orientation	+

Correlates of land values (pooled OLS, cultivated plots)

Dependent variable: Land value (ln, TSh/ acre, real prices)

	Coef.	P-value		Coef.	P-value
Area (acres, estimated)	-0.07***	0.00	Distance to road (km)	-0.02***	0.00
Area^2	0.001***	0.00	Distance to town (km)	-0.004***	0.001
1= At residence	0.26***	0.00	Distance to major market (km)	-0.002**	0.04
1= Formal document	0.22**	0.02	Population density (100s persons / km^2)	0.01***	0.003
1= Less formal document	0.25***	0.00	Average annual temperature (10s °C)	-0.002	0.55
1= Can be left uncultivated	0.11	0.16	Average annual rainfall (100s mm)	0.04**	0.01
1= Good soil quality	0.12***	0.00	1= Agro-ecological zone (AEZ) is warm / semiarid[b]	-0.24	0.34
1= Bad soil quality	-0.09	0.14	1= AEZ is warm / humid	0.16	0.63
1= No slope (flat)	0.01	0.74	1= AEZ is cool / semiarid	-0.08	0.69
1= Steep slope	-0.02	0.82	1= AEZ is cool / subhumid	-0.05	0.67
1= Pre-harvest crop loss on plot	-0.02	0.54	1= AEZ is cool / humid	0.59**	0.04
1= Erosion control	0.15***	0.01	1= Year 2011	0.19***	0.004
1= Irrigated	0.35**	0.03	1= Year 2013	0.16***	0.00
1= Contains fruit trees or permanent crops	0.39***	0.00	Constant	12.21***	0.00
Proportion of crop value marketed	0.28***	0.00	Region fixed effects (FE)	Y	
1= Rural household	-0.22**	0.02	Observations	15,069	
			Adjusted R-squared	0.35	
			Mean variance inflation factor (VIF)	1.95	

Standard errors clustered at district; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Correlates of land values in Tanzania

Topic	Factor	Hypothesis	Results
Miscellaneous	Plot size	Convex	✓
	Population density	+	✓
	Tenure security	+	✓
	Forest / fallow / other use	+	✗
Agricultural potential	Soil quality	+	✓
	Slope	-	✗
	Average rainfall / temperature	+ / -	✓ / ✗
	On-farm amendments	+	✓
	Pre-harvest crop losses	-	✓
Market access / urban pressure	Rural location of homestead	-	✓
	Distance from road / town / market	-	✓
	Household's market orientation	+	✓

What has been changing *in tandem* with rising land prices?

	Cultivated plots		Test	
	Year = 2009	Year = 2013	2009 = 2013	
	Mean	Mean	P-value	Sig.
Area (acres)	2.37	2.44	0.5247	
1= Formal document	0.02	0.04	0.0000	***
1= Less formal document	0.05	0.08	0.0000	***
1= Can be left uncultivated	0.88	0.88	0.5622	
1= Good soil quality	0.49	0.47	0.0486	
1= Bad soil quality	0.05	0.07	0.0020	**
Net value of crop production in past year (IHST, TSh/ acre)	10.04	10.41	0.0105	
1= Pre-harvest crop loss on plot	0.46	0.40	0.0000	***
1= Contains fruit trees or permanent crops	0.50	0.56	0.0000	***
Proportion of crop value marketed	0.34	0.38	0.0000	***
Distance to road (km)	2.01	2.13	0.1522	
Distance to town (km)	54.85	55.15	0.7173	
Distance to major market (km)	78.96	77.70	0.2716	
Average annual rainfall (100s mm)	10.86	10.76	0.1735	
Obs.	4,176	6,074		

Discussion

- Better conditions for farmers may have recently made farming more profitable:
  - Plot-holders marketed more of their crop harvest
  - Lower likelihood of pre-harvest crop loss
  - Net profits per acre ↑ (rising food prices - Ivanic et al. 2012)
  - So, are rising land prices a cause for concern?

- Population and population densities are rising.
  - Demand for land from young adults as they leave their parents' homes
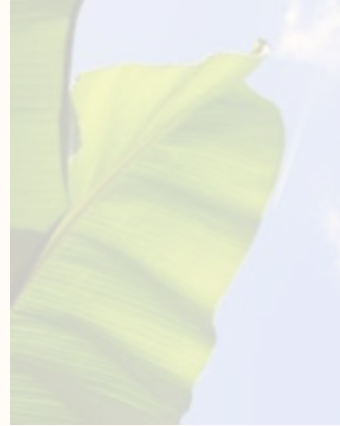 - Plots near town experienced the sharpest increase in land values.

Discussion

- Land tenure security may be improving:

  - Higher likelihood of formal and informal documents (maybe stemming from the Land Laws)

  - Strong correlations between documentation and land values

  - Potentially endogenous with land values

- Other factors not captured in this study:

  - Large-scale land acquisitions (urban investors)

  - *Maybe* stricter enforcement of Reserve Land rules?

  - *Maybe* farm support / production incentives?

Findings

- There's an active, above-ground land market in Tanzania.

- Land prices have been rising from 2009 to 2015.
  - Heterogeneity over space
  - Rising significantly for small plots
  - Rising faster for plots near town

- Correlates of land prices reflect those seen elsewhere in the world.
  - Agricultural potential, tenure security, population density, and access to markets

- Farmer-estimated land values tell a logical story.
  ...This suggests to us they can be trusted.
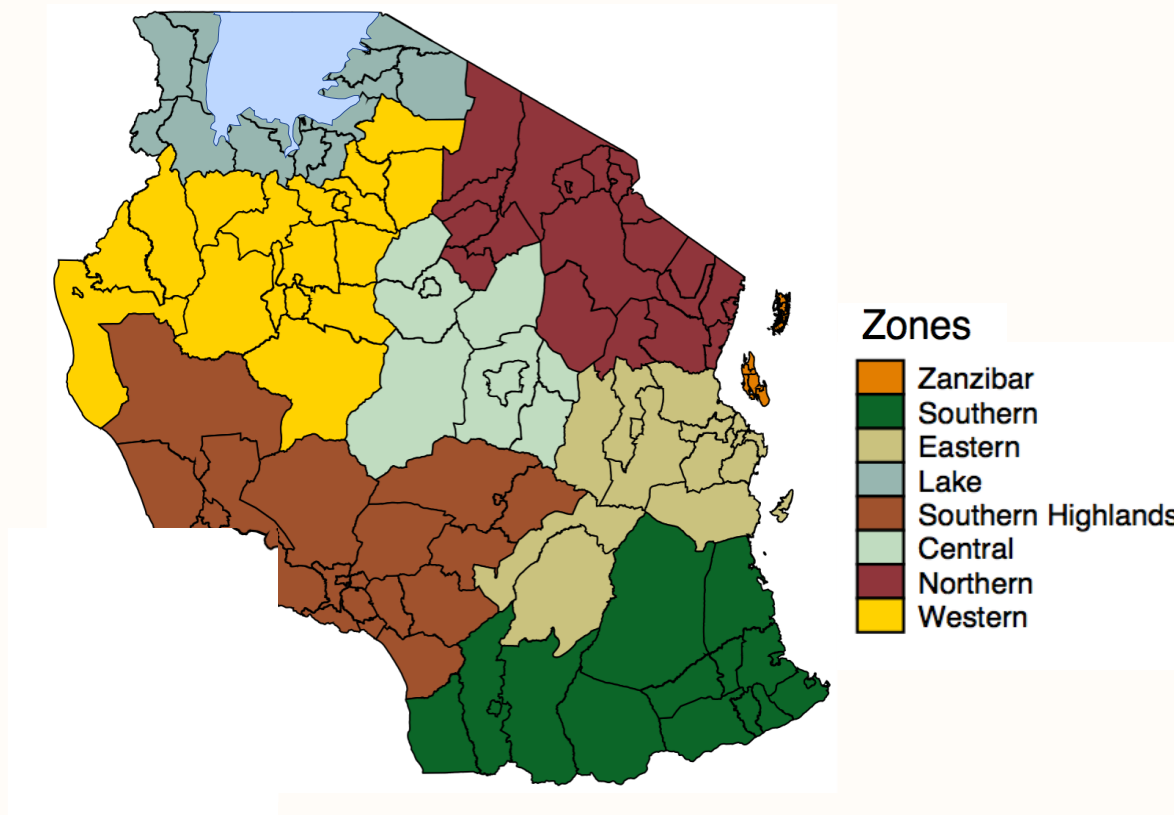
Directions for Future Research

- Further exploration of causality.
- Effects of large-scale land acquisitions (Jayne et al. 2016) on local land prices.
- Effects of local institutions / market structures.

- Implications of rising land prices for landholders and for poor / aspiring farmers.

- Relationship between farmer-estimated land values and realized sales prices.

Thank you!
Questions? Suggestions?

Extra Slides

Zones of Tanzania

Variable	Definition	Level[a]
Plot area (acres)	Estimated area[b]	P
Land value (TSh/ acre)	Estimated sales value of plot/ estimated area[b]	P
Net value crop production (IHST, TSh/ acre)	(Value of crop production on plot over previous 12 months, minus costs of seed, fertilizer, agro-chemicals, and hired labor applied to the plot)/ estimated area.[b] This is transformed using an inverse hyperbolic sine transformation (IHST) to account for values of zero.	P
At residence	1=Plot is right at residence	P
Formal document/ Less formal document	1= Plot has a granted right of occupancy, certificate of customary right of occupancy (CCRO), or residential license *or* 1= Plot has a purchase agreement, letter of inheritance, or other less formal document	P
Can be left uncultivated	1= Respondent is comfortable leaving plot uncultivated for several months	P
Good/ bad soil quality	1= Soil quality categorized by respondent as 'good' *or* 1= Soil quality categorized as 'bad', relative to 'average'	P
Flat/ steep slope	1= Slope categorized as 'bottom flat' or 'top flat' *or* 1= Slope categorized as 'very steep', relative to 'slightly sloped'	P
Slope (%)	Slope of plot (from the SRTM 90m Digital Elevation Database, available for GPS-measured plots in 2013)	P
Pre-harvest crop loss	1= There was pre-harvest crop loss on this plot in the previous main growing season	P
Erosion control	1= Any type of erosion control implemented on the plot	P
Irrigated	1= Plot was irrigated	P
Permanent crops	1= Plot contains some fruit trees or permanent crops	P
Proportion of crop value marketed	Proportion of crop value produced by the household in the past year that was sold	HH
Rural household	1= Household resides in rural area[c]	H
Distance to road (km)	Plot distance to road (km), estimated	P
Distance to town (km)	Distance to home (estimated)[b] + Homestead distance to nearest town of $\geq$ 20,000 population (from Statoids)	P
Distance to major market (km)	Distance to home (estimated)[b] + Homestead distance to nearest major market (from Statoids)	P
Population density (100s persons / km^2)	2010 population density (persons/ km^2) (from WorldPop), estimated at midpoint of a range	H
Average annual temperature (10s °C)	Average annual temperature (from WorldClim, 1960-90 reference period)	H
Average annual rainfall (100s mm)	Average annual rainfall (from WorldClim, 1960-90 reference period)	H
Agro-ecological zones	Standardized agro-ecological zones (dummy variables) (from HarvestChoice)	H
Forest/ Fallow	1= Plot was forested *or* 1= Plot was fallow in previous year. In some cases, tree crops were harvested from these plots.	P

Land values across Tanzania, 2009 to 2013
- *Area-adjusted weights* -

	Land value (100,000s TSh/acre, real prices)						Δ 2009 to 2013 (per year)		Test[a] 2009 = 2013
	2009		**2011**		**2013**				
	Median	Mean	Median	Mean	Median	Mean	Median	Mean	P-value
PANEL A									
Whole country	1.50	5.20	1.79	5.55	2.00	5.87	+0.13	+0.17	0.040
Zone									
Western	1.50	2.81	1.20	2.56	1.33	2.61	-0.04	-0.05	0.572
Northern	4.04	11.64	4.49	11.68	3.85	10.80	-0.05	-0.21	0.534
Central	0.90	1.62	1.20	1.88	1.14	2.23	+0.06	+0.15	0.016
Southern Highlands	1.50	4.33	1.60	5.24	1.79	5.53	+0.07	+0.30	0.055
Lake	2.99	7.10	2.99	8.41	3.33	7.57	+0.08	+0.12	0.710
Eastern	2.00	6.82	3.59	8.33	3.50	9.89	+0.38	+0.77	0.008
Southern	1.50	3.92	1.60	3.77	1.67	4.65	+0.04	+0.18	0.188
Zanzibar	7.48	16.08	7.18	12.16	8.00	12.09	+0.13	-1.00	0.011
PANEL B									
Plot size category									
0-5 ha	1.80	5.53	2.39	6.13	2.14	6.23	+0.09	+0.18	0.008
5-100 ha	1.50	3.79	1.09	3.00	1.41	4.64	-0.02	+0.21	0.438
PANEL C									
Distance category									
Tercile 1	2.25	7.77	2.39	8.01	2.80	9.10	+0.14	+0.33	0.066
Tercile 2	1.50	4.37	1.79	4.49	2.00	4.67	+0.13	+0.08	0.511
Tercile 3	1.50	3.50	1.20	4.12	1.67	3.85	+0.04	+0.09	0.341

Correlates of land values, 2013 – based on GPS measurements (OLS, cultivated plots)

	Coef.	P-value		Coef.	P-value
Area (acres, *measured*)	-0.09***	0.00	Distance to road (km)	-0.01*	0.07
Area^2	0.001***	0.00	Distance to town (km)	-0.01***	0.00
1= At residence	0.43***	0.00	Distance to major market (km)	-0.002*	0.05
1= Formal document	0.11	0.45	Population density (100s persons / km^2)	0.01***	0.003
1= Less formal document	0.12	0.22	Average annual temperature (10s °C)	-0.002	0.57
1= Can be left uncultivated	0.07	0.57	Average annual rainfall (100s mm)	0.07***	0.001
1= Good soil quality	0.27***	0.00	1= Agro-ecological zone (AEZ) is warm / semiarid	-0.04	0.89
1= Bad soil quality	-0.12	0.31	1= AEZ is warm / humid	0.14	0.74
Plot slope (%)	-0.004	0.46	1= AEZ is cool / semiarid	0.07	0.75
1= Pre-harvest crop loss on plot	-0.05	0.42	1= AEZ is cool / subhumid	-0.11	0.40
1= Erosion control	0.20*	0.06	1= AEZ is cool / humid	0.56	0.12
1= Irrigated	0.08	0.68	Constant	12.30***	0.00
1= Contains fruit trees or permanent crops	0.43***	0.00			
Proportion of crop value marketed	0.26**	0.01			
1= Rural household	-0.12	0.44	Region fixed effects (FE)	Y	
			Observations	4,593	
			Adjusted R-squared	0.42	
			Mean variance inflation factor (VIF)	1.98	

Standard errors clustered at district; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Correlates of land values, 2009, 2011, 2013 (plot fixed effects regression)

	Dependent variable: Land value (ln, TSh/ acre, real prices)	
	Coef.	P-value
Area (acres)	-0.09***	0.000
Area^2	0.000***	0.001
1= Formal document	0.07	0.49
1= Less formal document	0.21***	0.005
1= Can be left uncultivated	0.16**	0.03
Net value of crop production in past year (IHST, TSh/ acre)	0.01***	0.001
1= There was pre-harvest crop loss on this plot	-0.10***	0.005
1= Any type of erosion control on this plot	0.06	0.33
1= Plot was irrigated in main season	-0.01	0.97
1= Plot contains some fruit trees or permanent crops	0.11*	0.05
Proportion of crop value produced that was sold in this year	0.06	0.50
Distance to road (km)	-0.01	0.15
Distance to major market (km)	-0.004*	0.08
1= Year 2011	0.18***	0.000
1= Year 2013	0.26***	0.000
Constant	12.86***	0.000
Plot FE	Y	
Observations	6,951	
Number of plots	2,317	
Within R-squared	0.05	

Standard errors clustered at household; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Inverse probability weights used to account for likelihood of tracking in all 3 waves