

# **Land Property Rights, Financial Frictions, and Resource Allocation in Developing Countries**

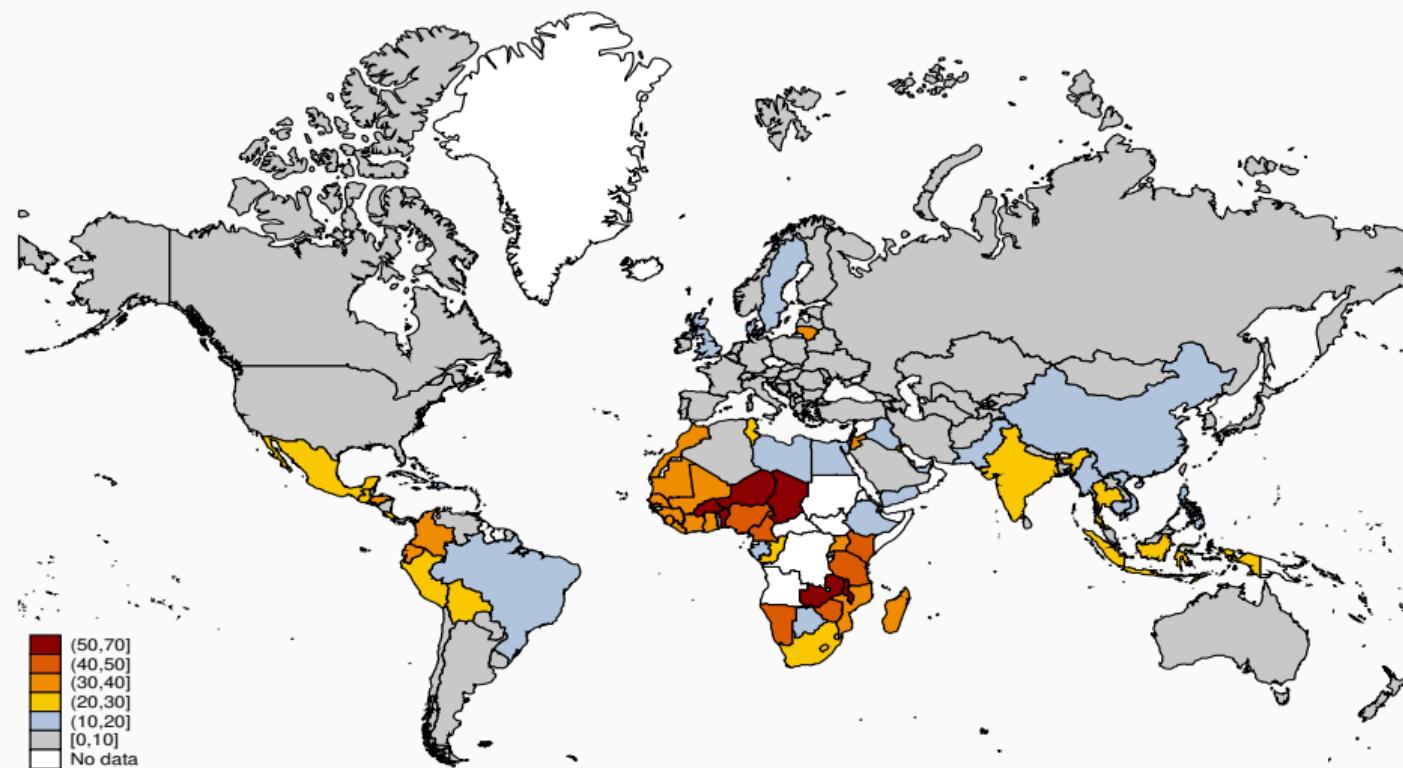
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# Low Financial Development & Insecure Property Rights in Developing World



Share of Land with No Documentation (2020)

map insecurity

## Lack of Land Formalization & Communal Land

As a result, **LAND**

- ... can't be sold/rented out
- ... subject to expropriation risk
- ... *can't be used as collateral*

**Literature:** Land Reform  $\Rightarrow$   $\uparrow$  Agricultural Productivity (Up to 2-3 digits %)

**De Soto:** Land Reform  $\Rightarrow$  Access to finance & Economic Growth

**Data:** Small effects of Land Reforms even after 10-20 yrs (Tanzania, Rwanda, etc.)

# This Paper: Land, Finance and Economic Development

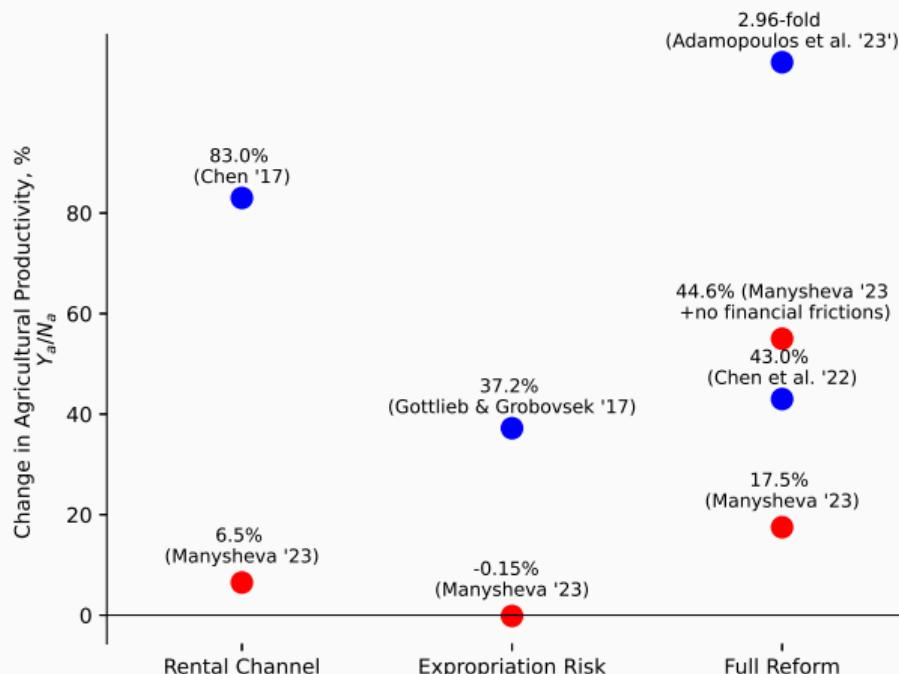
How presence of multiple frictions, **land & financial**, affect productivity and policy reforms? Role of their **interaction**?

- Incorporate *both* land and financial market frictions into HA macro model
- Use micro data from Tanzania to estimate model & validate it's mechanisms
- Quantify effects of various reforms in GE setting
- Assess importance of multiple frictions on these effects

## Preview of the Results

- Model  $\Leftrightarrow$  Data: resource misallocation linked to land & credit market frictions
- **Full** land titling reform in model with land and financial market frictions:
  - ▶ Higher economic efficiency  $\Rightarrow \uparrow$  agric. and non-agric. output ( $\approx 8\%$ ),  $\downarrow$  farmers
  - ▶ Collateral channel  $\approx$  to financial reform  $\Rightarrow \uparrow$  financial inclusion, but  $\downarrow$  inequality
  - ▶ Presence of multiple frictions  $\Rightarrow \downarrow$  productivity gains from individual market reforms
- Land reform w/**selection** to land certification (Tanzania) + **financial frictions**:
  - ▶ Little change in occupational shares & non-agricultural output
  - ▶  $\uparrow$  consumption inequality: most benefits to large communal land holders & wealthy

# Literature: Results of Quantitative Studies of Various Aspects of Land Reform



# Plan of the Talk

1. Model Framework
2. Data & Model Calibration
3. Allocation of Resources: Model & Data
4. Counterfactuals: Full Land Reform
5. Land Certification Reform w/Selection

## Organizing Framework

- Heterogeneous agent model (in wealth, land ownership, and ability)
- Infinite horizon and discrete time
- Measure one of households indexed by  $i \in [0, 1]$
- Model incorporates
  - ▶ Endogenous occupational choice
  - ▶ Endogenous evolution of communal land
  - ▶ Forward-looking saving decision
  - ▶ Incomplete markets

## Model: Main Features

- Household's state
  - ▶ productive skill in agricultural sector,  $z_a > 0$
  - ▶ productive skill in entrepreneurship,  $z_e > 0$
  - ▶ land endowment ,  $l \geq 0$
  - ▶ property right regime,  $pr = \{c, p\}$ 
    - communal (weak)
    - private (strong)
  - ▶ level of assets,  $a \geq 0$
- Skills exogenous and given by stationary transition process (AR1 in logs)
- Land and financial markets are incomplete

## Land Market Imperfections

- Economy's aggregate land endowment is  $L$ 
  - ▶  $\mu_I \in [0, 1]$ : communal
  - ▶  $1 - \mu_I$ : private
- Communal land
  - ▶ can't be rented out
  - ▶ subject to expropriation risk if not used
  - ▶ can't be used as collateral

## Financial Market Imperfections

- Competitive financial intermediary receives deposits and makes loans ( $r_t^k = r_t + \delta$ )
- No state-contingent bonds, and financial wealth is non-negative

$$a_{i,t+1} \geq 0 \text{ for all } t$$

- Only within-period credit to finance capital
- Obtained *loan and assets* are costlessly transformed into capital
- Due to limited enforceability borrowing limited by collateral constraint
- Private land can also be used as collateral
- Within-period borrowing to finance capital up to the limit

$$k_t \leq \lambda_k a_t + (\lambda_k - 1) q_t^I l_t \mathbb{I}_{\{land=private\}}$$

## Occupational Choice

- Household can choose to be
  - ▶ entrepreneur
  - ▶ worker
  - ▶ farmer
- Single final good is produced both by farmers and entrepreneurs
- Workers hired by households that operate their own business

**Assumption:** *Occupational choices mutually exclusive within a period  $t$ , but can be freely changed across periods with no cost.*

## Household Problem Conditional on Occupational Choice – Private Land

$$V_t(s_{it}) = \max_{c_{it}, a_{it+1}, k_{it}^{o \in \{E, F\}}, n_{it}^{o \in \{E\}}, l_{it,d}^{o \in \{F\}}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t[V_{t+1}(s_{it+1}|s_{it})], \text{ where } s_{it} = (a_{it}, z_{it}^a, z_{it}^e, \underline{l}_i)$$

s.t.

$$c_{it} + a_{it+1} \leq y_{it}^o + (1 + r_t) a_{it} + \underline{r}_t^I l_i$$

$$k_{it} \leq \lambda_k a_{it} + (\lambda_k - 1) q_t^I l_i, \quad o \in \{\text{Entrep, Farmer}\} \quad (a_{it+1} \geq 0)$$

And

$$y_{it}^{\text{Entrep}} = z_{it}^e k_{it}^{\alpha_e} n_{it}^{\gamma_e} - w_t n_{it} - r_t^k k_{it}$$

$$y_{it}^{\text{Worker}} = w_t$$

$$y_{it}^{\text{Farmer}} = z_{it}^a k_{it}^{\alpha_a} (l_{it}^d)^{\gamma_a} - r_t^k k_{it} - r_t^I l_{it}^d, \quad \alpha + \gamma < 1$$

## Evolution of Communal Land

Land not used at  $t$  subject to expropriation risk at  $t + 1$  with probability  $\pi_E$ :

$$\pi_E = \begin{cases} \in (0, 1] & \text{if } l_{\{land=communal\}} - l^d \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Expropriated land reallocated via *endogenous* lump-sum transfer  $\eta_t$  with probability  $\pi_R$ :

$$\pi_R = \begin{cases} \in (0, 1] & \text{if } occupation = farmer \\ 0 & \text{otherwise} \end{cases}$$

Both  $\pi_E$  and  $\pi_R$  can be generalized to any function that is state dependent

## Household Problem of a Farmer – Communal Land

$$V_t^{Farmer}(a_{it}, z_{it}^a, z_{it}^e, l_{it}) = \max_{c_{it}, a_{it+1}, k_{it}, l_{it}^d} \frac{c_{it}^{1-\sigma}}{1-\sigma} +$$

$$+ \beta \{ \pi_R \mathbb{E}_t [V_{t+1}(s_{it+1}, l_{it+1} = l_{it} + \eta_t | s_{it})] + (1 - \pi_R) \mathbb{E}_t [V_{t+1}(s_{it+1}, l_{it+1} = l_{it} | s_{it})] \}$$

s.t.

$$c_{it} + a_{it+1} \leq y_{it} + (1 + r_t) a_{it}$$

$$k_{it} \leq \lambda_k a_{it} \quad \text{and} \quad a_{it+1} \geq 0$$

where

$$y_{it} = z_{it}^a k_{it}^{\alpha_a} (l_{it}^d)^{\gamma_a} - r_t^k k_{it} - r_t^l (l_{it}^d - l_{it}) \mathbb{I}_{\{l_{it}^d \geq l_{it}\}}$$

## Household Problem of Worker and Entrepreneur – Communal Land

$$V_t^{o \in \{Entrep, Worker\}}(a_{it}, z_{it}^a, z_{it}^e, l_{it}) = \max_{c_{it}, a_{it+1}, k_{it}^{o \in E}, n_{it}^{o \in W}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \\ + \beta \{ \pi_E \mathbb{E}_t[V_{t+1}(s_{it+1}, l_{it+1} = 0 | s_{it})] + (1 - \pi_E) \mathbb{E}_t[V_{t+1}(s_{it+1}, l_{it+1} = l_{it} | s_{it})] \}$$

s.t.

$$c_{it} + a_{it+1} \leq y_{it}^o + (1 + r_t) a_{it}$$

$$k_{it} \leq \lambda_k a_{it}, \quad o \in \{E\} \quad \text{and} \quad a_{it+1} \geq 0$$

And

$$y_{it}^{Entrep} = z_{it}^e k_{it}^{\alpha_e} n_{it}^{\gamma_e} - w_t n_{it} - r_t^k k_{it}$$

$$y_{it}^{Worker} = w_t$$

## Land Certification Reform: Obtain Title for a $\phi$

$$V_t(s_{it})^{com} = \max_{c_{it}, a_{it+1}, k_{it}^{o \in \{E,F\}}, n_{it}^{o \in \{E\}}, l_{it,d}^{o \in \{F\}}, pr_{it+1}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta \left\{ \mathbb{E}_t[V_{t+1}^{com}(s_{it+1}|s_{it})] \times \mathbb{I}_{pr_{it+1}=c} + \mathbb{E}_t[V_{t+1}^{priv}(s_{it+1}|s_{it})] \times \mathbb{I}_{pr_{it+1}=p} \right\},$$

s.t.

$$c_{it} + a_{it+1} + \phi \times \mathbb{I}_{pr_{it+1}=p} \leq y_{it}^o + (1 + r_t)a_{it}$$

$$k_{it} \leq \lambda_k a_{it}, \quad o \in \{Entrep, Farmer\} \quad (a_{it+1} \geq 0)$$

Equilibrium

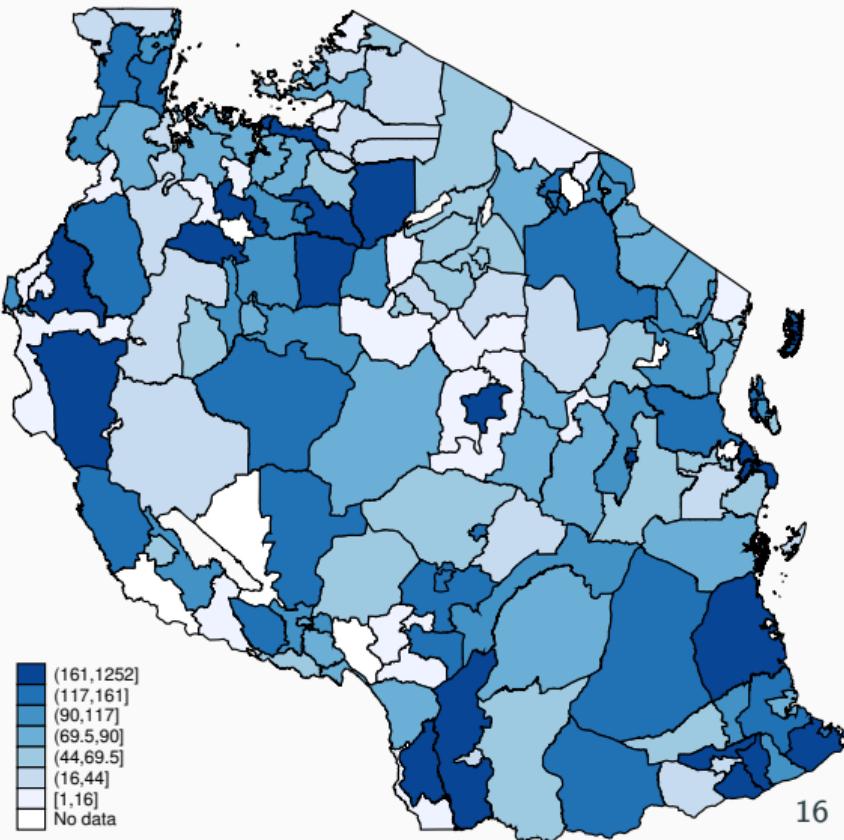
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# Agricultural Data: Tanzania

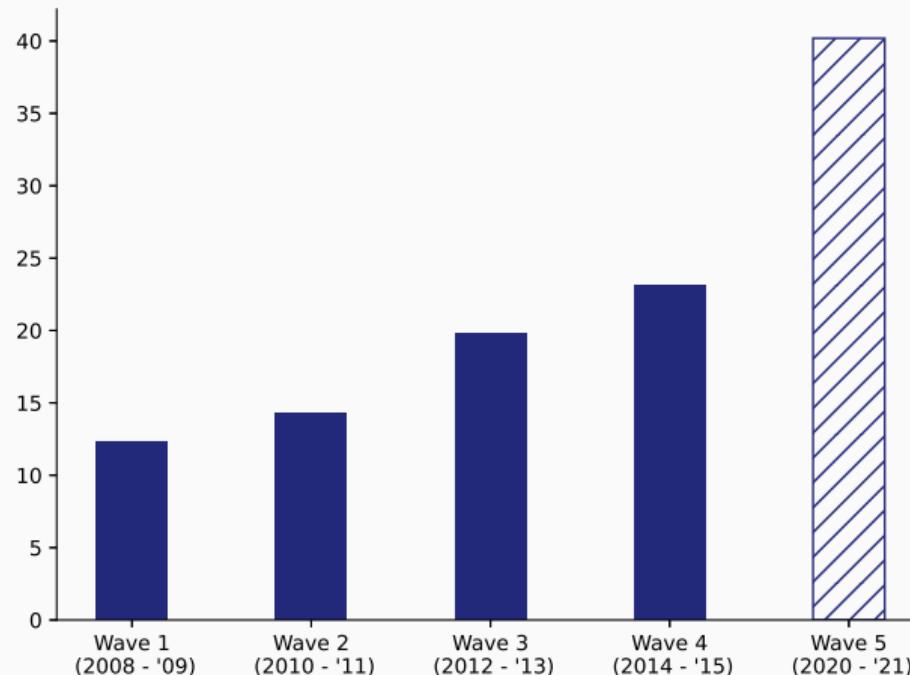
- Agriculture  $\approx$  30% of GDP & 65% of employm.
- Nationally representative panel survey
  - ▶ 4 waves – '08-09, 10-11, 12-13, 14-15 + 20-21
  - ▶ Detailed data on agricultural production
- Dominated by smallholders (mean  $\approx$  2 ha)
- Mean annual harvest  $\approx$  \$500
- On average < 10% is hired labor, low mechanization
- < 15% of land titled,  $\approx$  10% of HH borrow

Distribution of survey sample



# Measure of Land Property Rights

Share of Land that Has Title



# Land Property Rights and Allocation of Land

- Estimate agricultural production function
  - ▶ Dynamic panel approach to address endogeneity Econometric approach Data
  - ▶ Agriculture is labor and land intensive & exhibits *decreasing return to scale* Results
- Efficient static allocation with no market frictions: Conceptual framework

$$\log(L_i^*) \propto \log(e_i)$$

- Test if relationship holds in data and same across households Results
- Find that coefficient is
  - ▶ more than 50% higher for households with land under strong property rights
  - ▶ more than twice as high for households that use credit
- **Land misallocation linked to land and financial market imperfections** Robustness

## Direct Calibration: Tanzania 2012-'14

Parameter	Value	Source/Description
$\mu_I$	0.807	Share of land without any document
$\alpha_a$	0.05	Production function estimates
$\gamma_a$	0.294	Production function estimates
$\rho_a$	0.533	Production function estimates
$\rho_e$	0.262	Autocorellation coefficient on entrepreneurial productivity
$\pi_E$	0.09	Share of undocumented land that HH believed can be expropriated
$\sigma$	1.5	CRRA coefficient (Buera et al., 2021)
$\delta$	0.06	Depreciation rate (Buera et al., 2021)
$\alpha_e$	0.33	Capital share (entrepreneurs) (Buera et al., 2021)

Additional assumptions

## Method of Moments

Target Moment	Data	Model	Parameter	Description
Real interest rate (%)	3.8%	3.75%	$\beta = 0.813$	Discount factor
Share of workers (% of emp.)	20.5%	20.5%	$\nu = 0.535$	Span of control
Share of farmers (% of emp.)	61.0%	61.1%	$\sigma_a = 0.09$	S.d. of prod. shock
Share of entrepren. (% of emp.)	18.5%	18.4%	$\sigma_e = 0.75$	S.d. of prod. shock
Land distribution		graph	$\pi_R = 0.13$	Probability of realloc.
Collateral/loan value	240.2%	240.4%	$\lambda_k=1.416$	Collateral constraint

Non-targeted moments

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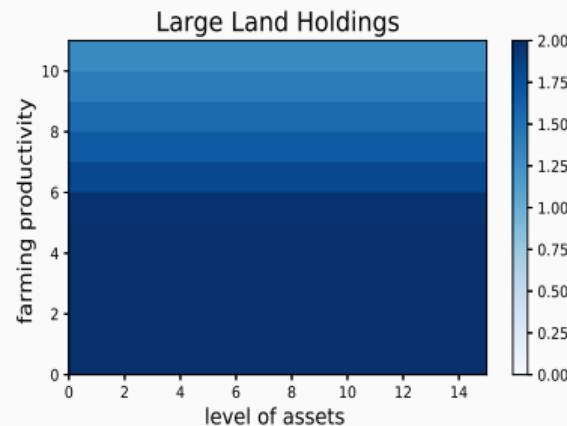
# Land Property Rights and Economic Efficiency

Three main channels:

- Expropriation risk => efficiency of labor allocation
- Inability to rent out land => efficiency of land allocation
- Inability to use land as collateral => access to credit (especially among poorest)

## Mechanism: Land Misallocation

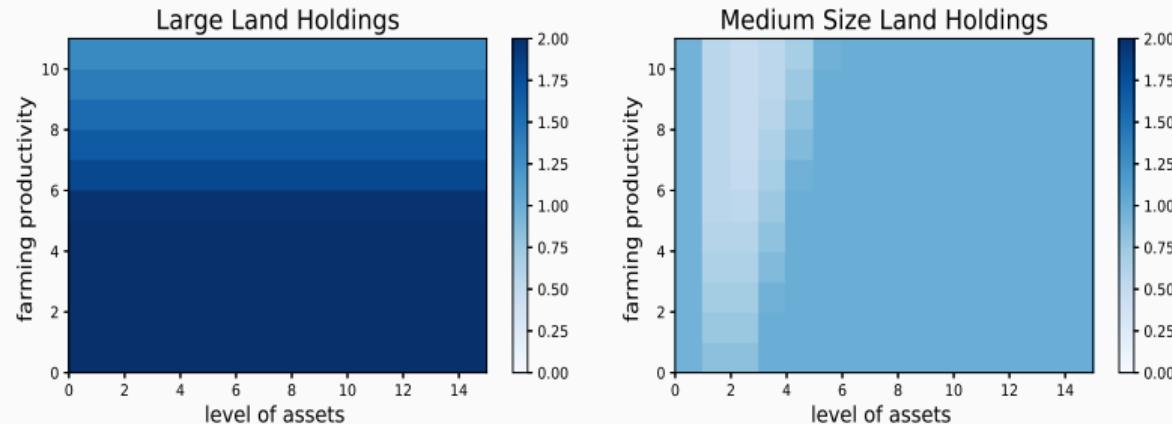
Ratio of Land Usage by Communal Farmers Relative to Private Farmers



Data: HH with titled land are *more* likely to *rent out* their land

# Mechanism: Land Misallocation

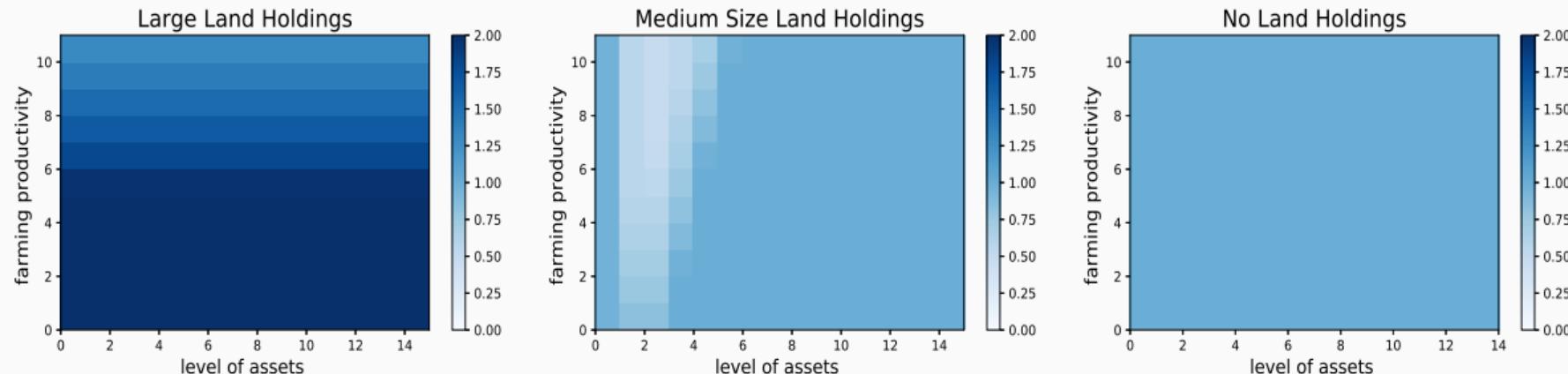
Ratio of Land Usage by Communal Farmers Relative to Private Farmers



Data: HH with titled land are *more* likely to *obtain a loan*, & size of the loan is *larger*

# Mechanism: Land Misallocation

Ratio of Land Usage by Communal Farmers Relative to Private Farmers



Proposition 1

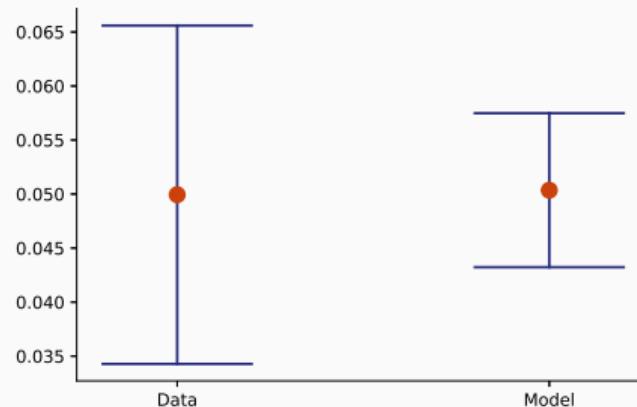
Proposition 2

Full picture

# Land and Productivity Relationship: Data vs Model

Efficient static allocation:

$$\log(L_i^*) \propto \log(e_i)$$

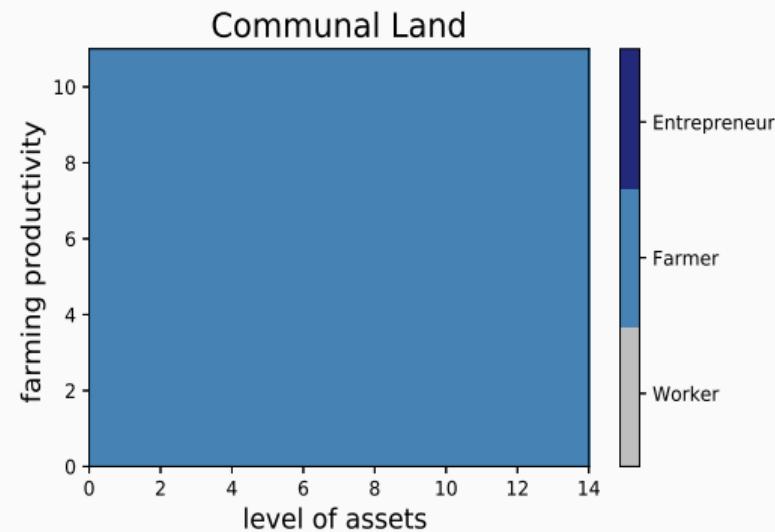
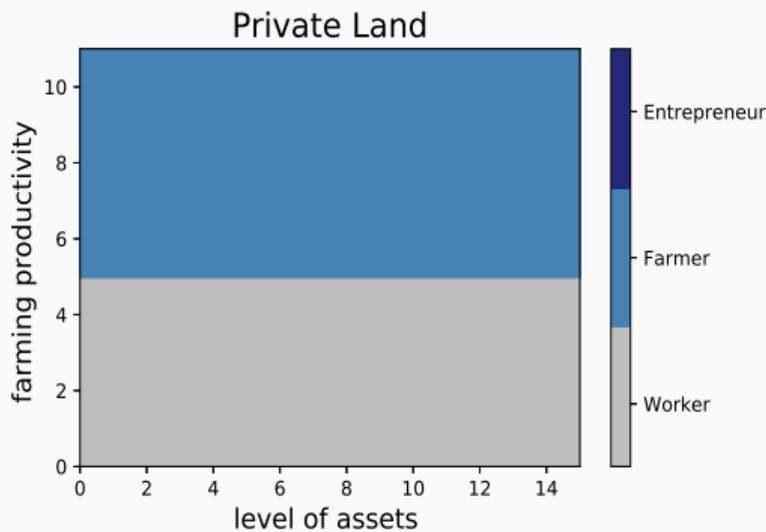


Homogeneous across farmers?

- Data: 50.5%
- Model: 48.8% higher coefficient for farmers with titled land

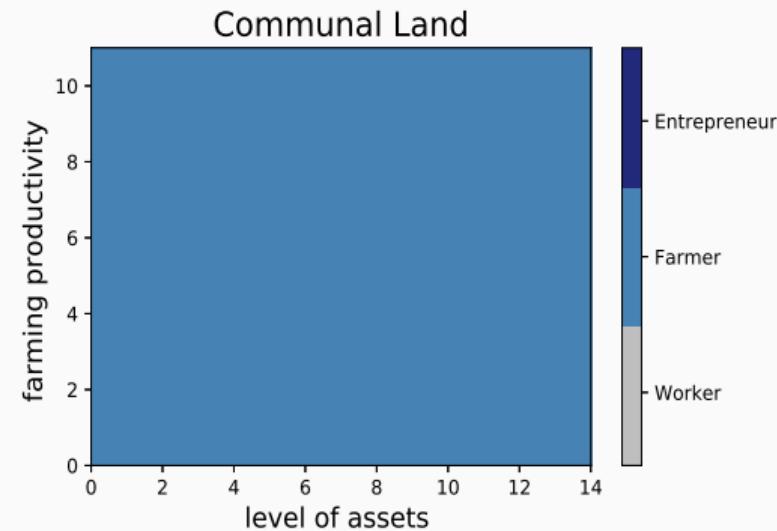
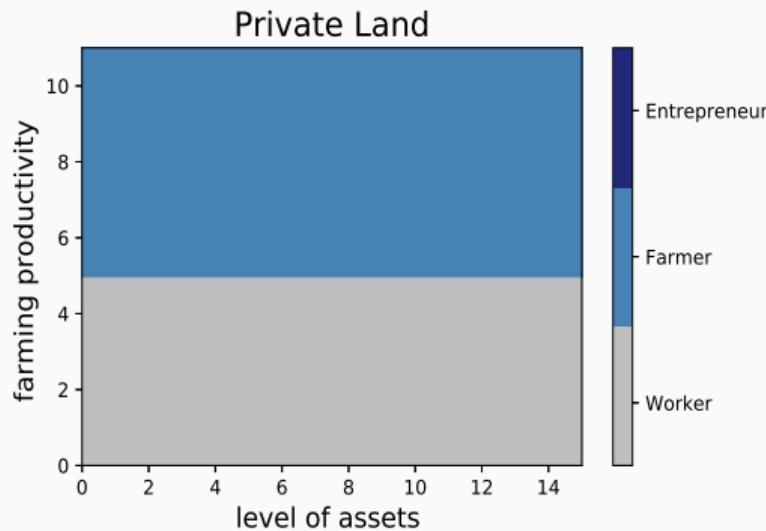
# Mechanism: Labor Misallocation

## Households with Low Entrepreneurial Productivity



# Mechanism: Labor Misallocation

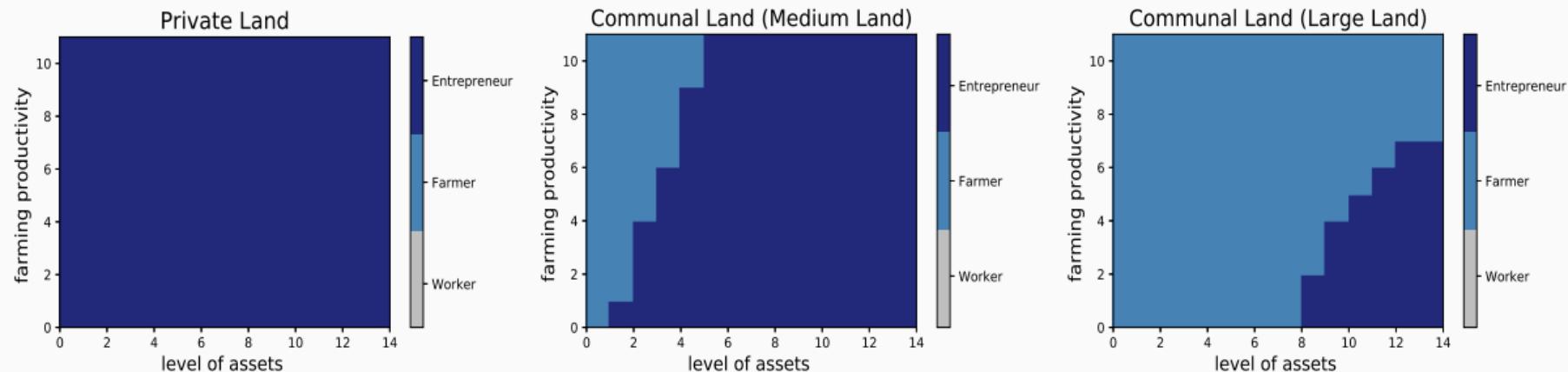
Households with Low Entrepreneurial Productivity



Data: In HH with titled land the probability of head's main employment be (share of working hours) in agriculture is *lower*

# Mechanism: Labor Misallocation

## Households with High Entrepreneurial Productivity



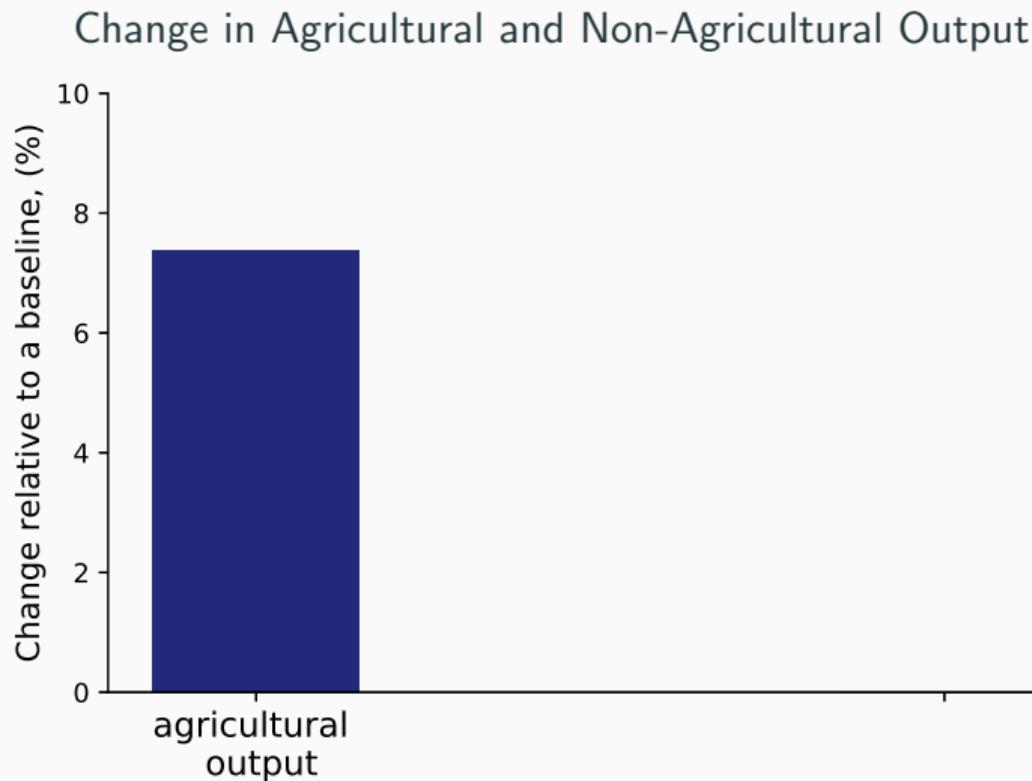
Data: In HH with larger plot size (untitled!) the probability of head's main employment be (share of working hours) in agriculture is *higher*

Full picture

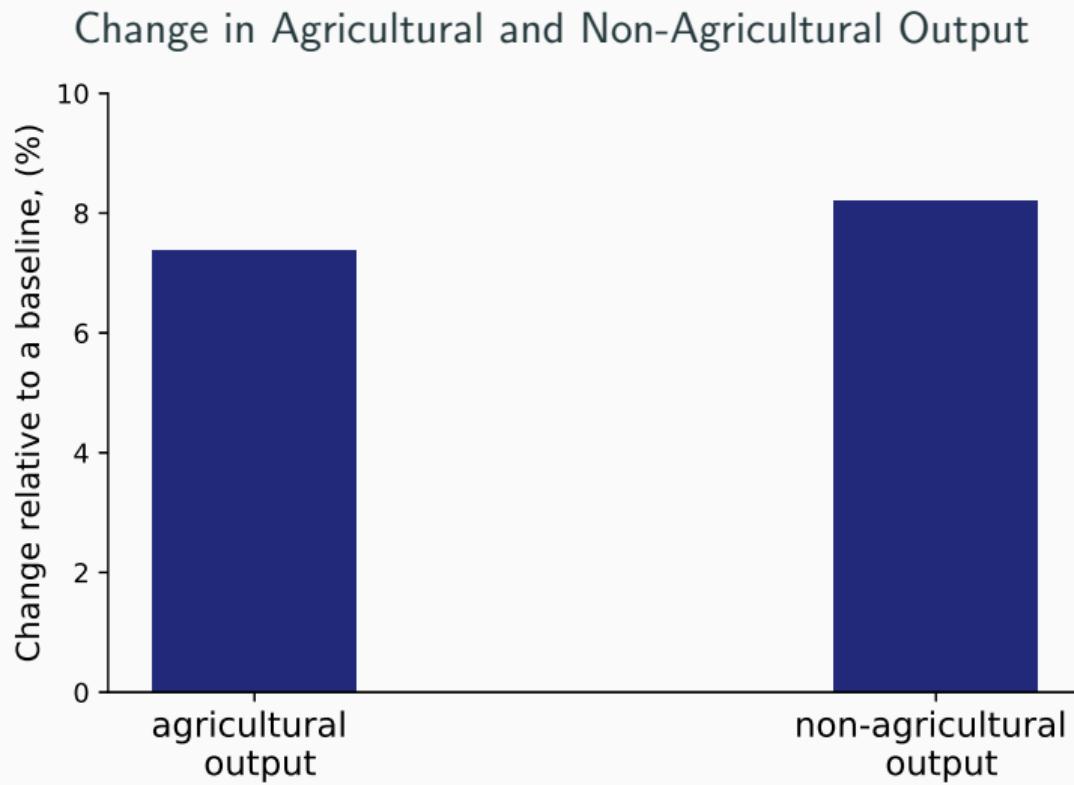
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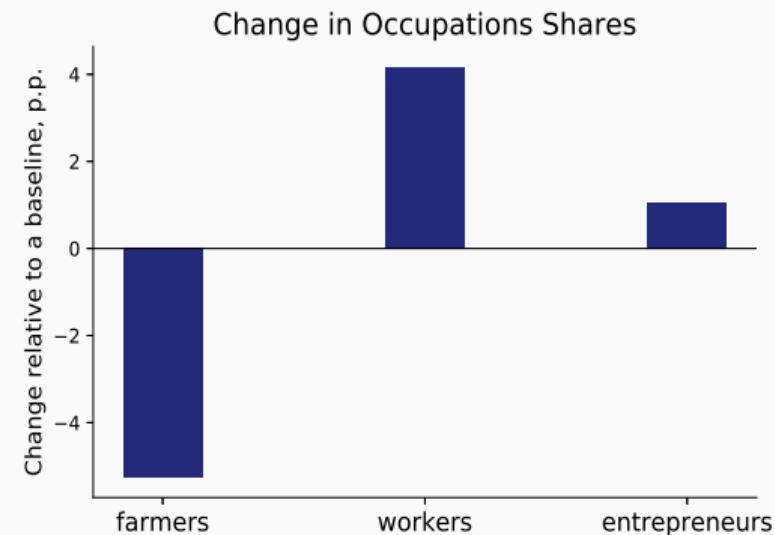
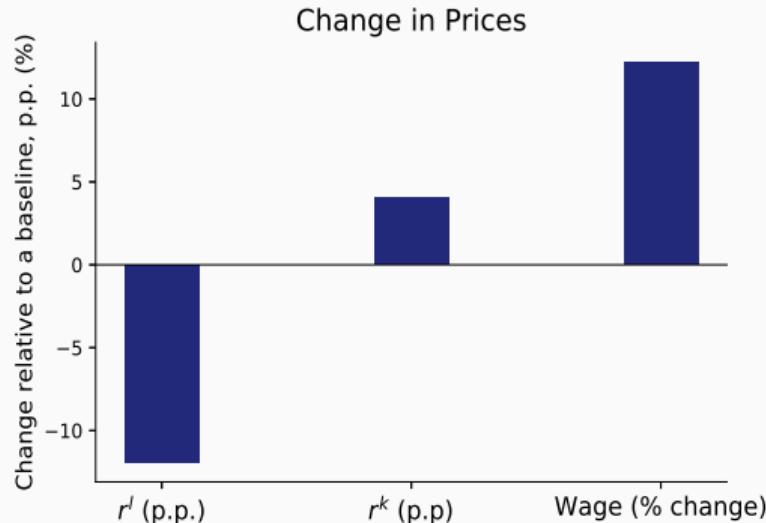
## Land Reform: 100% of Private Land



## Land Reform: 100% of Private Land



# Land Reform: 100% of Private Land



Partial vs General Equilibrium

## Other Counterfactual Exercises

- Exploit different mechanisms of land reform by removing one friction at a time
  - ▶ Different channels affect economy differently
  - ▶ Ability to rent out land  $\Rightarrow \uparrow$  in agricultural output
  - ▶ Ability to use land as collateral + no expropriation risk  $\Rightarrow \uparrow$  non-agricultural output
- Compare Land Reform and Financial Reform
  - ▶ Financial reform has *similar* aggregate effect to collateral channel of land reform, but *different* distributional impact
- Land reform  $\Rightarrow$  positive welfare gains +  $\downarrow$  consumption inequality
- Postreform transition dynamics: most changes  $\approx$  7 yr, new st. st.  $\approx$  15-20 yr

results

results

distribution

plot

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## Land Certification in Tanzania: Obtain Title for a $\phi > 0$

$$V_t(s_{it})^{com} = \max_{c_{it}, a_{it+1}, k_{it}^{o \in \{E, F\}}, n_{it}^{o \in \{E\}}, l_{it,d}^{o \in \{F\}}, pr_{it+1}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta \left\{ \mathbb{E}_t[V_{t+1}^{com}(s_{it+1}|s_{it})] \times \mathbb{I}_{pr_{it+1}=c} + \mathbb{E}_t[V_{t+1}^{priv}(s_{it+1}|s_{it})] \times \mathbb{I}_{pr_{it+1}=p} \right\},$$

s.t.

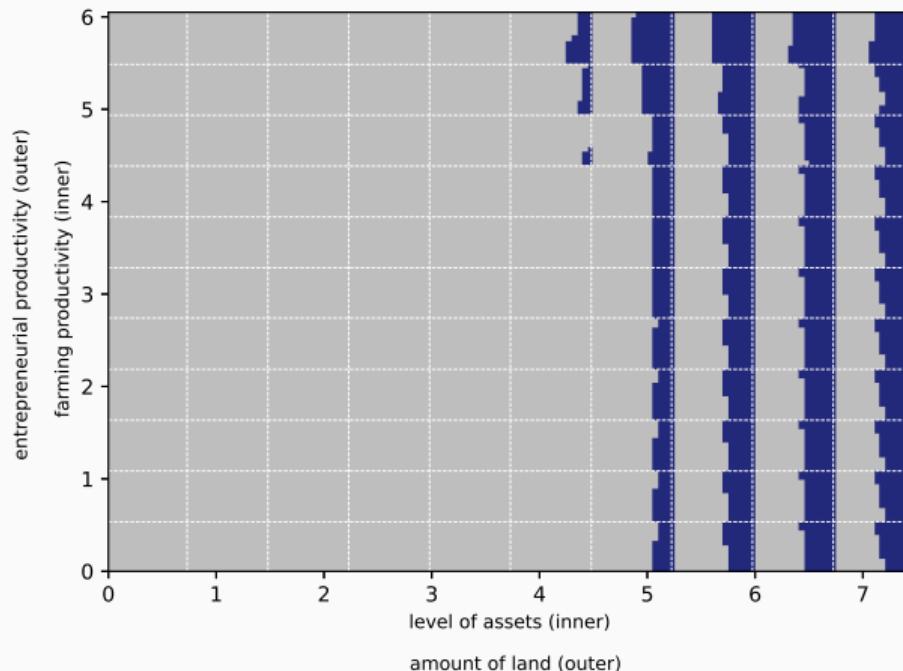
$$c_{it} + a_{it+1} + \phi \times \mathbb{I}_{pr_{it+1}=p} \leq y_{it}^o + (1 + r_t)a_{it}$$

$$k_{it} \leq \lambda_k a_{it}, \quad o \in \{Entrep, Farmer\} \quad (a_{it+1} \geq 0)$$

## Ownership of Titled Plot is not Random

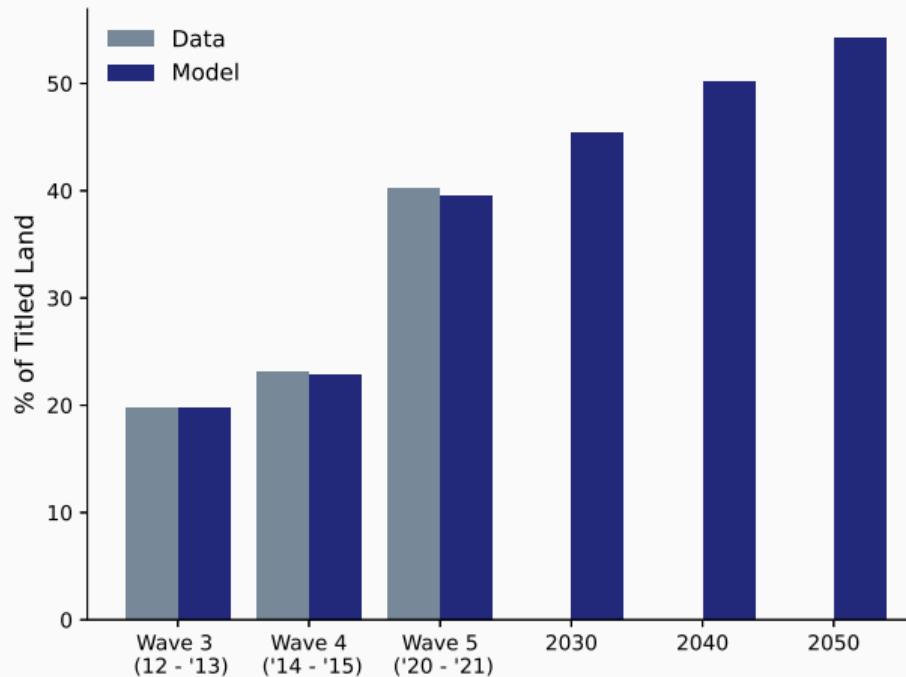
- ≈ 70% of land in Tanzania is Village Land
- Land Reform (mid 2000s): reside or use Village Land ⇒ can obtain title (CCRO)
- Still low level of private land (2020-'21: 40% of land/27% of plots)
- Plots with titles:
  - ▶ Are larger
  - ▶ Are further from home
  - ▶ Owned/Used by richer HH in terms of consumption/assets
  - ▶ Owned/Used by more educated person/male

## Who Decides to Obtain a Title: Model vs Data



Data: Richer, more educated, own/use larger land *more likely to obtain* a title

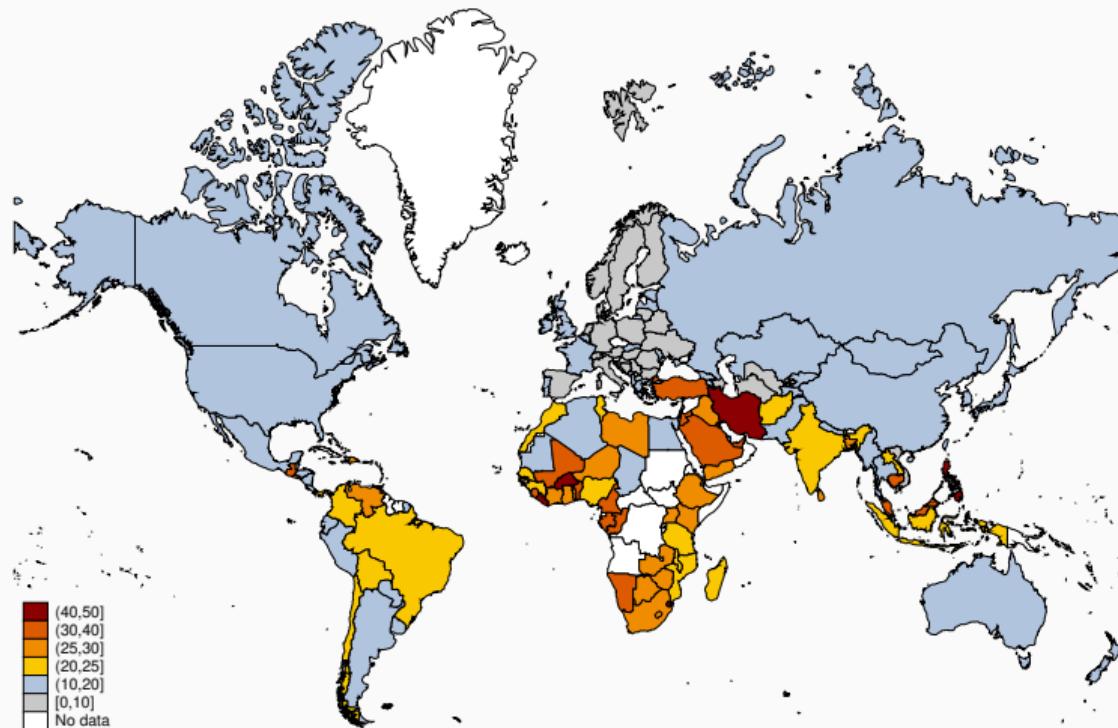
## Get $\phi$ by Matching Titling 2013 => '15, Get Transition



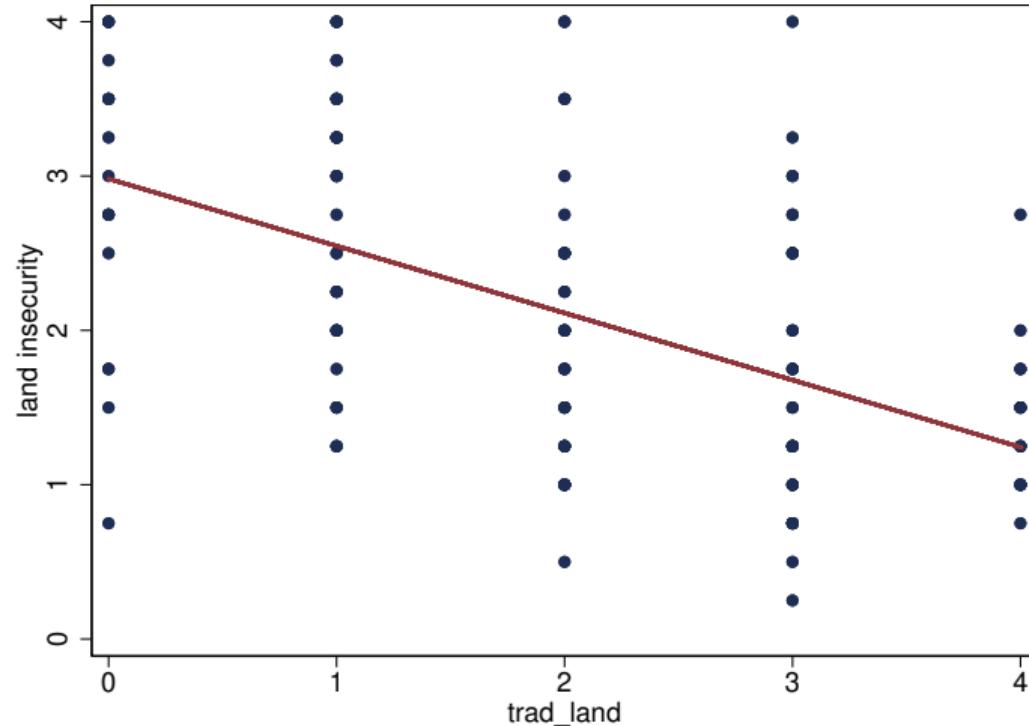
## Conclusions

- In data, insecure property rights are associated with misallocation of resources
- Quantitative model with both land and financial markets frictions:
  - ▶ Land reform  $\Rightarrow \uparrow$  agricultural and non-agricultural output,  $\downarrow$  farmers and  $\uparrow$  entrepr.
  - ▶ Land reform  $\Rightarrow \uparrow$  financial inclusion, *especially among poorest*
- Land reform with endogenous land certification when financial markets incomplete
  - ▶ Slow transition  $\Rightarrow$  only 50% private land in almost 40 years
  - ▶ Little change in occupational shares (consistent with data) & non-agric. output
  - ▶ Higher consumption inequality (consistent with data)
  - ▶ Mostly benefits large communal land holders and those with high wealth

# Share of Adults Who Feel Insecure about Property (2020)



## Communal land and land tenure security



## Contributions

- Model with *both* land and financial markets frictions in GE setting
  - ▶ *Lagakos, Waugh ('13); Gollin et al. ('14); Moll ('14); Bick et al. ('16); Yu, Zheng ('16); Adamopoulos et al. ('17); Chen et al. ('17); Bergquist et al. ('19); Greenwood et al. ('19); Gottlieb, Grobovšek ('19); Ngai et al. ('19); Adamopoulos, Restuccia ('20); Buera et al. ('20); Dabla-Norris et al. ('20); Donovan ('20); Le ('20)*
- Evidence of resource misallocation in developing country
  - ▶ **Misallocation:** *Hsieh, Klenow ('09); Banerjee, Moll ('10); Collard-Wexler et al. ('11); Oberfield ('13); Kalemli-Ozcan, Sørensen ('14); Restuccia, Rogerson ('17); Gollin, Udry ('19); David, Venkateswaran ('19); Baqaee, Farhi ('20)*
  - ▶ **Land Property Rights:** *Bromley ('10); Macours et al. ('10); de Janvry et al. ('15); Chari et al. ('17); Beg ('21)*
- Link between land property rights, access to credit, entrepreneurship & firm growth
  - ▶ *McKenzie D, Woodruff C. ('08); Buera et al. ('15); Lagakos ('16); Meager ('19); Quinn, Woodruff ('19)*

## Competitive Equilibrium

Given an initial distribution of state variables  $\mathcal{F}_t(a_{it}, l_{it}, z_{it}^a, z_{it}^e, p_{rit})$  and a sequence of wages, interest rate of capital and land, and communal land reallocation

$\{w_t, r_t, r_t^l, \eta_t\}_{t=0}^\infty$ , a competitive equilibrium is given by a sequence of allocations  $\{c_t(s), \dots\}_{t=0}^\infty$  and occupational choices

$\{e_t(s) = \{\text{Worker}, \text{Entrepreneur}, \text{Farmer}\}\}_{t=0}^\infty$  such that (i) households maximize utility by solving (...) subject to (...), (ii) the financial intermediary sector makes zero profits and (iii) there is market clearing in the labor market, capital market, and land market.

# Summary Statistics

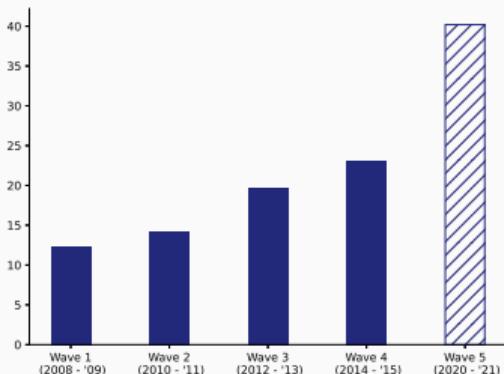
Variable	Mean	Median	Std. Dev.	Variable	% of obs
Total harvest (ths TZS)	722.9	164.4	25,460	HH own/cultivate plot	65.4
Yield (ths TZS/acre)	163.3	62.5	2,288	Plots cultivated	85.0
Land cultivated (acres)	5.5	2.8	12.3	Land utilization	85.2
Land available (acres)	6.2	3.0	14.9	Hire workers	43.1
Total labor (per-day)	172.9	116.0	185.7	Use chemicals	35.5
HH labor (per-day)	158.6	104.0	178.2	Can leave plot	86.5
Hired labor (per-day)	14.3	0	37.9	Right sell/coll	68.4
Daily wage (ths TZS)	3.8	2.5	4.7	Title/certificate	12.5
Capital (ths TZS)	1,887.9	13.5	7,850.4	Took loan (1 yr)	10.5
Chemicals (ths TZS)	2.5	0	7.6	Took loan, ag (1 yr)	1.3
				Took loan, bus (1 yr)	2.7

Average exchange rate in 2013 was  $\approx$  1,600 TZS per 1 USD

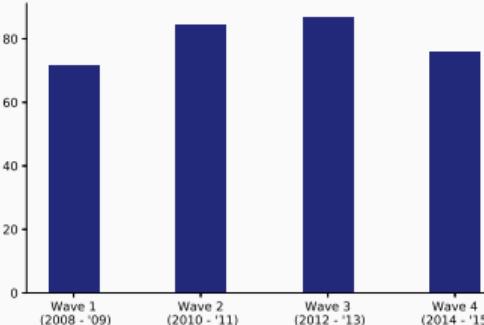
## Entrepreneurship Dynamics in Tanzania

- 90.2% of firms in Tanzania are SME, with 63.2% having employment < 20 empl.
- 95.3% of firms are private domestic firms, and 75.2% are sole proprietorship
- Access to finance is limited by international standards
  - ▶ 18% of firms use banks to finance investment, and ≈ 17% have a loan/credit line
  - ▶ 38% of firms report access to finance as the biggest obstacle for their operations
- Evidence from pilot titling projects in Tanzania that households used their land to obtain credit

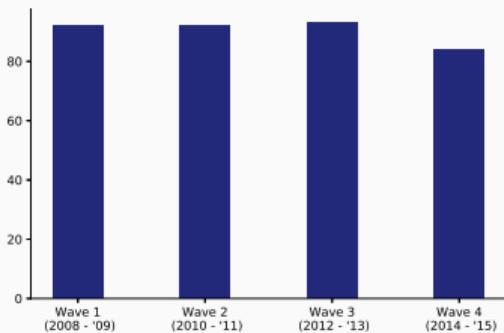
# Other Measures of Land Property Rights



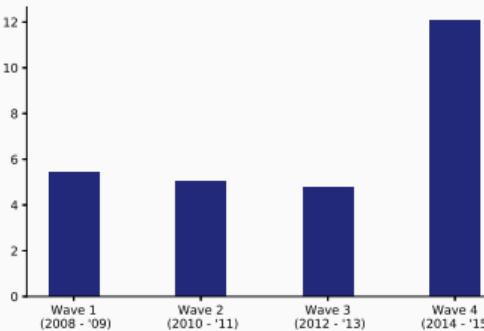
**(a)** Titled Land



**(b)** Can be Sold or Used as Collateral



**(c)** Can be Leaved Falloweed



**(d)** Used Free of Charge

## Production Function

Estimate Cobb-Douglas production:

$$y_{it} = \beta_0 + \beta_I l_{it} + \beta_n n_{it} + \beta_k k_{it} + \omega_{it} + \varepsilon_{it}$$

where

$y_{it}$  is log output,  $l_{it}$  is log of land input,  $n_{it}$  is log labor,  $k_{it}$  – log of capital.

$\varepsilon_{it}$  – shocks to productivity not predictable by farmer before decide on inputs

$\omega_{it}$  – observed/predictable by farmers (soil quality, expected rainfall, etc.)

=> **endogeneity problem** as  $l_{it}, n_{it}, k_{it} \propto \omega_{it}$

Dynamic panel approach to address endogeneity concerns

## Dynamic Panel Approach

Assume  $\varepsilon_{it}$  is i.i.d. over time & uncorrelated with  $\mathcal{I}_{it}$ , and the process for  $\omega_{it}$  is AR(1):

$$\omega_{it} = \rho\omega_{it-1} + \xi_{it}$$

Quasi-difference production function to get estimating equation:

$$y_{it} - \rho y_{it-1} = \beta_0(1-\rho) + \beta_l(l_{it} - \rho l_{it-1}) + \beta_n(n_{it} - \rho n_{it-1}) + \beta_k(k_{it} - \rho k_{it-1}) + \xi_{it} + (\varepsilon_{it} - \rho \varepsilon_{it-1})$$

Assume  $\xi_{it}$  is uncorrelated with  $\mathcal{I}_{it-1}$ , estimate model using the moment conditions

$$\mathbb{E}[\xi_{it} + (\varepsilon_{it} - \rho \varepsilon_{it-1}) | \mathcal{I}_{it-1}] = \mathbb{E}[(\xi_{it} + (\varepsilon_{it} - \rho \varepsilon_{it-1})) \cdot \begin{pmatrix} l_{it-1} \\ n_{it-1} \\ k_{it-1} \end{pmatrix}] = 0$$

## Production Function: Data

- Focus on long rainy season in each year and on temporarily crops
- Match households that split off based on the plots cultivated
- $Y_{it}$  - real agricultural output aggregated at the hh level (median prices in wave2 of each crop used as weights)
- $L_{it}$  - the size of the land that was actually cultivated in acres
- $N_{it}$  - total number of person-days (includes domestic and hired)
- $K_{it}$  - capital inputs aggregated at the hh level (include owned and used capital, rented in capital, and chemicals such as fertilizers)

# Production Function Estimates

	(OLS)	(OLS FE)	(DP)
log(Land)	0.343 (0.015)	0.264 (0.026)	0.299 (0.071)
log(Labor)	0.404 (0.017)	0.366 (0.025)	0.368 (0.161)
log(Capital)	0.111 (0.006)	0.051 (0.009)	0.035 (0.025)
$\beta_I$			0.294
$\beta_n$			0.412
$\beta_k$			0.050
$\rho$			0.533
Return to scale	0.85	0.68	0.76
Test on common factor restrictions			0.835
# obs.	8,949	6,073	3,641
Unexpected shocks	✓	✓	✓

St. errors two-way clustered at district & HH levels. Regressions include Year FE, OLS - also district-year FE

back

## Conceptual Framework

$n$  heterogeneous farmers producing single homogeneous good:

$$Y_i = e_i A L_i^{\alpha_L} \prod_k X_{k,i}^{\alpha_{X_k}}$$

where  $L_i$  is land input and  $e_i$  – farmer's individual productivity,  $X_{k,i}$  - other inputs

Efficient static allocation with no market frictions:

$$\log(L_i^*) \propto \log(e_i)$$

and  $\frac{L_i^*}{X_{k,i}^*} = \frac{L_i^*}{X_{k,-i}^*}, \forall k, -i$

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# Land Property Rights and Allocation of Land

	ln(land)		
HH productivity	0.050 (0.013)	0.047 (0.008)	0.044 (0.008)
HH productivity × land_rights		0.023 (0.005)	0.023 (0.005)
HH productivity × credit			0.051 (0.010)
# obs.	8,939	8,939	8,939
# households	5,095	5,095	5,095
Wave#District FE	Y	Y	Y
R <sup>2</sup>	0.290	0.292	0.295

Standard errors are in parentheses two-way clustered at district & household levels.  
*land\_rights* is the share of land under "strong" property rights at hh level; *credit* is a dummy indicating whether hh obtained a credit in a given year from any source

# Robustness and Other Findings

- Relax assumption of Cobb-Douglas production function

Factor Ratios

CES

- Production function and misallocation exercise without shocks

Results

- Selection issues

HH Fixed Effects

Other Measures of Property Rights

- HH characteristics: HH with titled land also have higher probability of

Results

- ▶ getting a loan/larger loan
- ▶ rent out their land
- ▶ operate non-agricultural enterprise
- ▶ lower probability of agriculture being the main employment

back

## Factor ratios

	ln(land)			
	labor		capital	
ln(Input)	0.586 (0.013)	0.576 (0.013)	0.177 (0.007)	0.173 (0.007)
ln(Input) × land_rights		0.042 (0.008)		0.022 (0.004)
ln(Input) × credit		0.050 (0.014)		0.033 (0.007)
# obs.	10,054	10,054	10,047	10,047
# households	5,515	5,515	5,515	5,515
Wave#District FE	Y	Y	Y	Y

Standard errors are in parentheses two-way clustered at district & household levels

back

## Marginal product of land and market frictions (CES)

	ln(MPL)			
	leave fallow	right sell	title	obtain free
land_rights	-0.196 (0.035)	-0.184 (0.029)	-0.034 (0.045)	0.216 (0.042)
credit	0.403 (0.093)	0.414 (0.092)	0.404 (0.093)	0.410 (0.092)
# obs.	8,925	8,925	8,925	8,925
Wave#District FE	✓	✓	✓	✓

Standard errors are in parentheses two-way clustered at district & household levels.

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# Land Misallocation (No shocks)

	ln(land)									
	leave fallow		right sell		title		obtain free			
HH productivity	0.119 (0.013)	0.085 (0.013)	0.079 (0.013)	0.081 (0.013)	0.076 (0.013)	0.114 (0.013)	0.109 (0.013)	0.126 (0.013)	0.121 (0.013)	
HH productivity × land_rights		0.043 (0.004)	0.043 (0.004)	0.055 (0.003)	0.055 (0.003)	0.023 (0.005)	0.023 (0.005)	-0.059 (0.005)	-0.059 (0.005)	
HH productivity × credit			0.045 (0.009)		0.042 (0.009)		0.044 (0.009)		0.043 (0.009)	
# obs.	8,939	8,939	8,939	8,939	8,939	8,939	8,939	8,939	8,939	
# households	5,095	5,095	5,095	5,095	5,095	5,095	5,095	5,095	5,095	
Wave#	FE	Y	Y	Y	Y	Y	Y	Y	Y	
R <sup>2</sup>		0.296	0.307	0.310	0.326	0.328	0.298	0.300	0.312	0.313

Standard errors are in parentheses two-way clustered at district & household levels.

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# Land Misallocation: Across Time Variation

	ln(land)			
	leave fallow	right sell	title	obtain free
HH productivity	-0.014 (0.014)	-0.018 (0.014)	-0.013 (0.014)	-0.009 (0.014)
HH productivity × land_rights	0.001 (0.004)	0.008 (0.003)	0.009 (0.004)	-0.023 (0.006)
HH productivity × credit	0.021 (0.009)	0.021 (0.009)	0.021 (0.009)	0.022 (0.009)
# obs.	6,043	6,043	6,043	6,043
# households	2,218	2,218	2,218	2,218
Wave#District FE	Y	Y	Y	Y
HH FE	Y	Y	Y	Y
R <sup>2</sup>	0.833	0.833	0.833	0.833

Standard errors are in parentheses two-way clustered at district & household levels [back](#)

# Land Misallocation (Different Measures)

	ln(land)									
	leave fallow		right sell		title		obtain free			
HH productivity	0.050 (0.013)	0.014 (0.009)	0.011 (0.009)	0.014 (0.008)	0.011 (0.008)	0.047 (0.008)	0.044 (0.008)	0.057 (0.008)	0.056 (0.008)	
HH productivity × land_rights		0.044 (0.004)	0.044 (0.004)	0.056 (0.003)	0.056 (0.003)	0.023 (0.005)	0.023 (0.005)	-0.060 (0.005)	-0.059 (0.005)	
HH productivity × credit			0.052 (0.009)		0.050 (0.009)		0.051 (0.010)		0.050 (0.010)	
# obs.	8,939	8,939	8,939	8,939	8,939	8,939	8,939	8,939	8,939	
# households	5,095	5,095	5,095	5,095	5,095	5,095	5,095	5,095	5,095	
Wave#	FE	Y	Y	Y	Y	Y	Y	Y	Y	
R <sup>2</sup>		0.290	0.301	0.304	0.319	0.322	0.292	0.295	0.305	0.307

Standard errors are in parentheses two-way clustered at district & household levels [back](#)

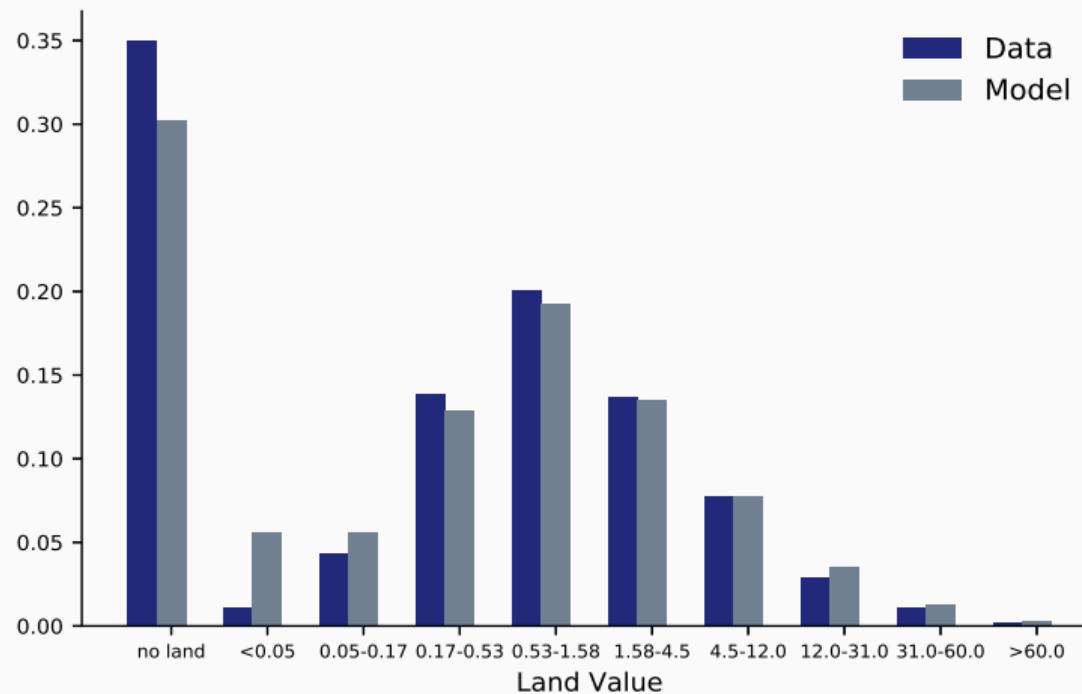
## Land property rights and other household characteristics

Dependent variable

	rent out land	head of HH in agriculture	obtained credit	size of a loan	operate a business
land_rights	0.015 (0.006)	-0.037 (0.014)	0.028 (0.013)	0.574 (0.199)	0.023 (0.015)
# obs.	7,874	11,752	11,752	448	11,752
Household FE	✓	✓	✓	✓	✓

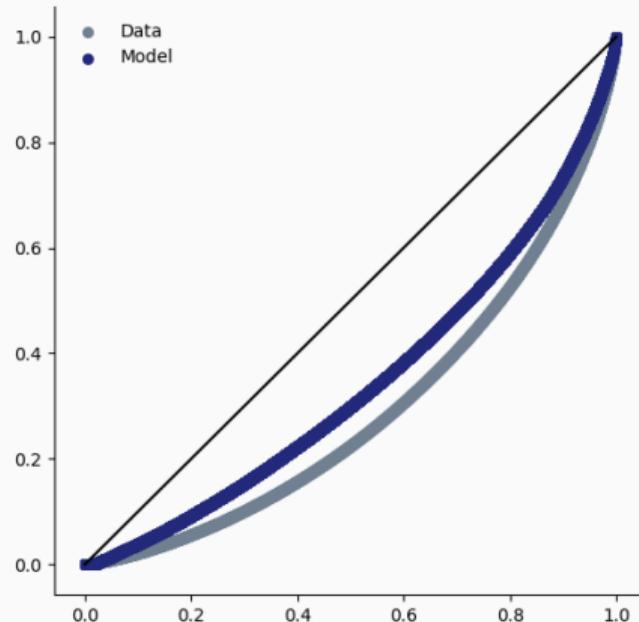
Standard errors are in parentheses two-way clustered at district & household levels.

## Distribution of Land: Model vs Data



*Note: the distribution is based on price of land in mln TZS such that it is equispaced on a log scale* [back](#)

## Non-targeted Moments: Lorenz Curve for Consumption



Land utilization in the model is 92% (data – 88%) [back](#)

## Model: Additional Assumptions

- Logarithm of productivity for each sector  $s$  follows a first-order autoregressive process

$$z_{s,t} = \rho z_{s,t-1} + \varepsilon_{s,t}$$

where  $|\rho| < 1$  and  $\varepsilon_t$  is a white noise process with variance  $\sigma_\varepsilon^2$

- Production function of entrepreneurs is Cobb-Douglas

$$y^e = \exp(z^e)(k^{\alpha_e} n^{1-\alpha_e})^{1-\nu}$$

where  $(1 - \nu)$  is the span-of-control parameters, representing the share of output accruing to variable factors. Fraction  $\alpha$  goes to capital and  $(1 - \alpha)$  – to labor.

- $\pi_R$  and  $\pi_E$  are independent of household characteristics

# Model Mechanism: Land

## Proposition 1

Denote optimal choices of land used by farmers who owns land under communal and private property right regimes as  $I_c^*$  and  $I_p^*$ , respectively. Then, if optimal land usage is larger than household land holding,  $I_p^* > I_p$ , and farmers' initial conditions in private and communal part of the economy are the same (i.e. same amount of land, skills and assets):

$$I_c^* \leq I_p^*$$

and for assets holdings  $a_{small} < a_{large}$ , given everything else the same:

$$I_p^*(a_{small}) - I_c^*(a_{small}) \geq I_p^*(a_{large}) - I_c^*(a_{large}),$$

and for the levels of agricultural productivity  $z_{small} < z_{large}$ :

$$I_p^*(z_{small}) - I_c^*(z_{small}) \leq I_p^*(z_{large}) - I_c^*(z_{large}),$$

and for the levels of land holdings  $l_{small} < l_{large}$ , given everything else the same:

$$I_p^*(l_{small}) - I_c^*(l_{small}) \leq I_p^*(l_{large}) - I_c^*(l_{large}).$$

# Model Mechanism: Land

## Proposition 2

Denote optimal choices of land used by farmers who owns land under communal and private property right regimes as  $I_c^*$  and  $I_p^*$ , respectively. Then, if optimal land usage is lower than household land holding,  $I_p^* < I_p$ , and farmers' initial conditions in private and communal part of the economy are the same (i.e. same amount of land, skills and assets):

$$I_c^* \geq I_p^*$$

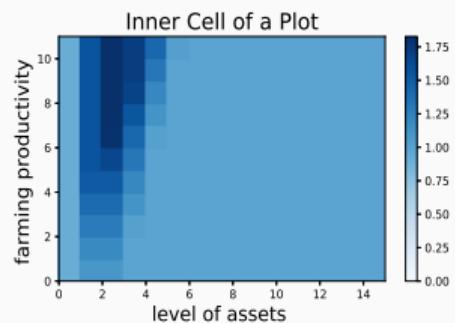
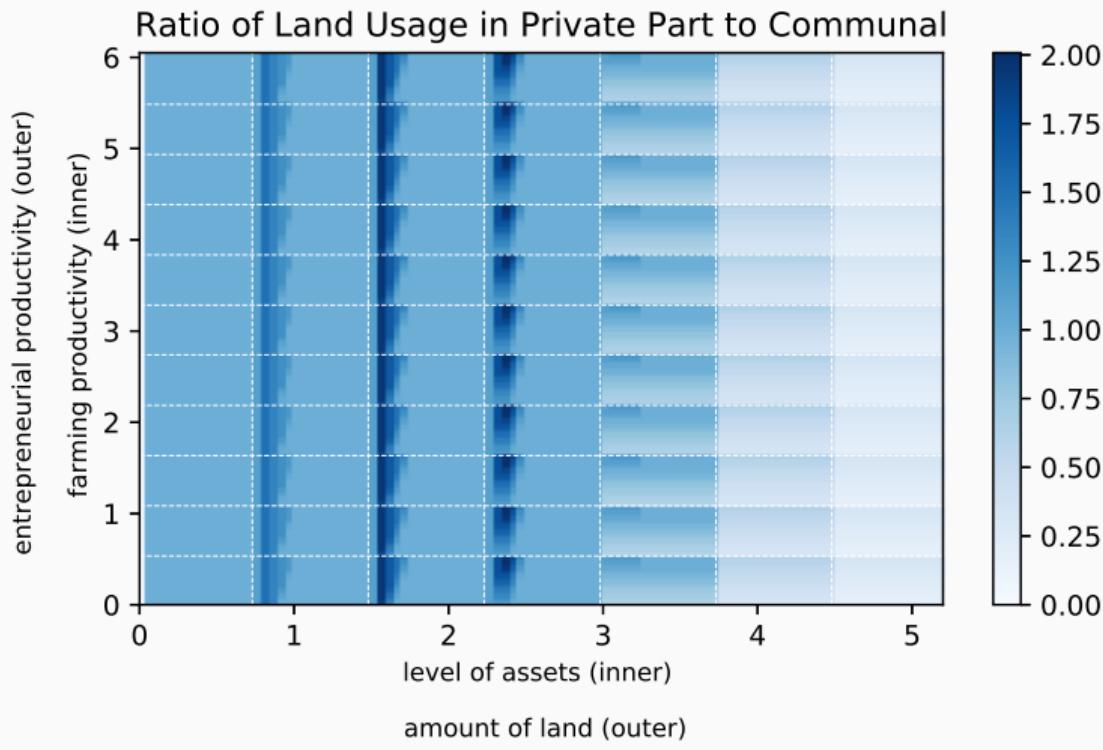
and for the levels of agricultural productivity  $z_{small} < z_{large}$ , given everything else the same

$$I_c^*(z_{small}) - I_p^*(z_{small}) \geq I_c^*(z_{large}) - I_p^*(z_{large})$$

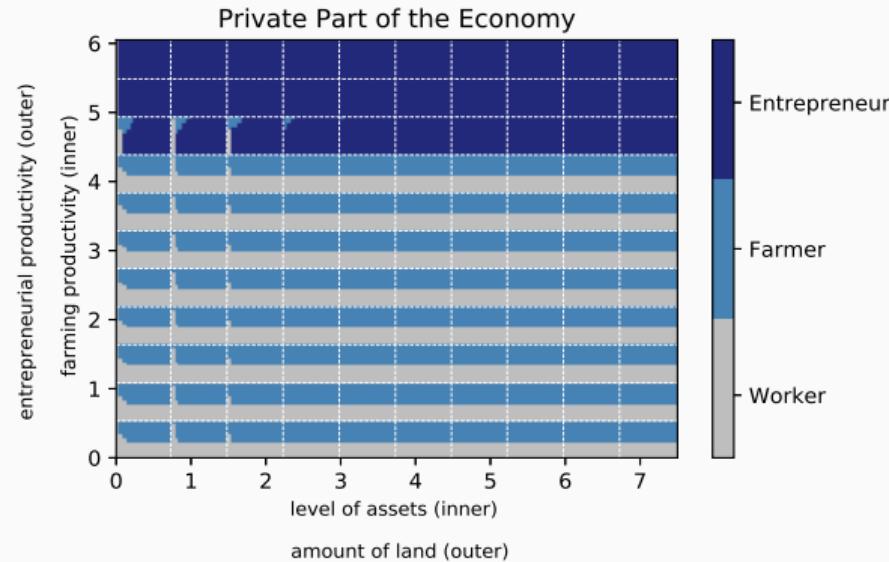
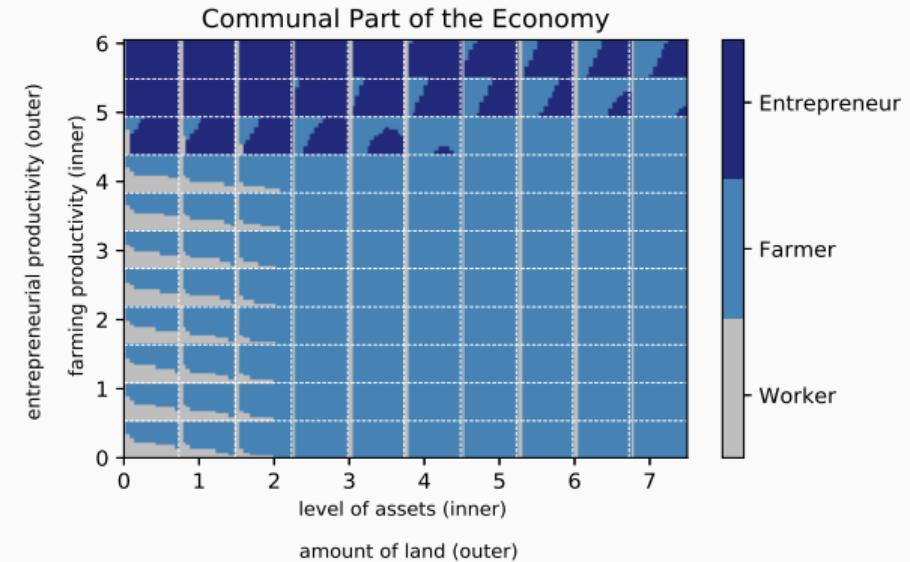
and for the levels of land holdings  $I_{small} < I_{large}$ , given everything else the same, we get

$$I_c^*(I_{small}) - I_p^*(I_{small}) \leq I_c^*(I_{large}) - I_p^*(I_{large})$$

# Mechanism: Land Misallocation

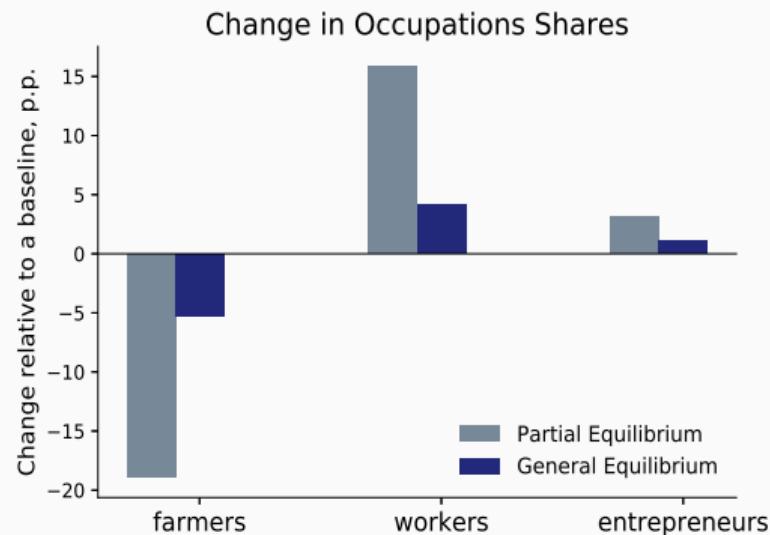
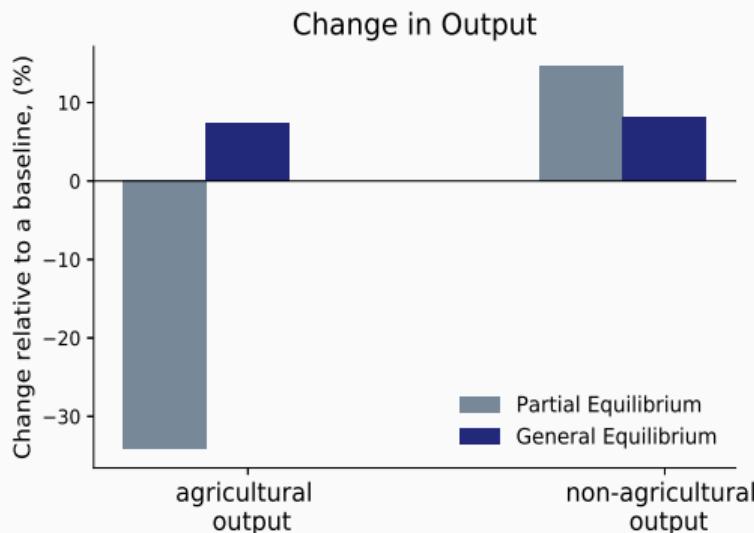


# Mechanism: Labor Misallocation



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# Land Reform: Partial vs General Equilibrium



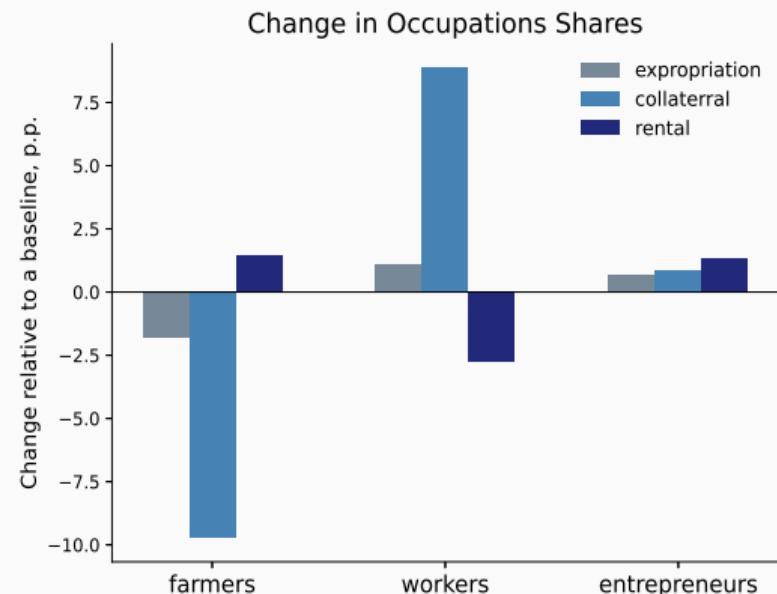
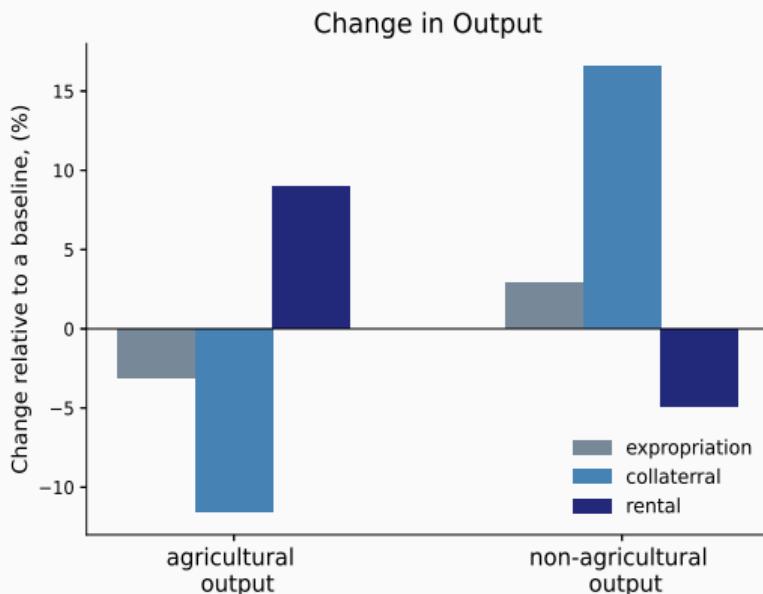
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## Main Channels

Exploit different mechanisms of land reform by removing one friction at a time:

- No expropriation risk
- Ability to use land as collateral
- Ability to rent out land

# Main Channels: Output and Occupations

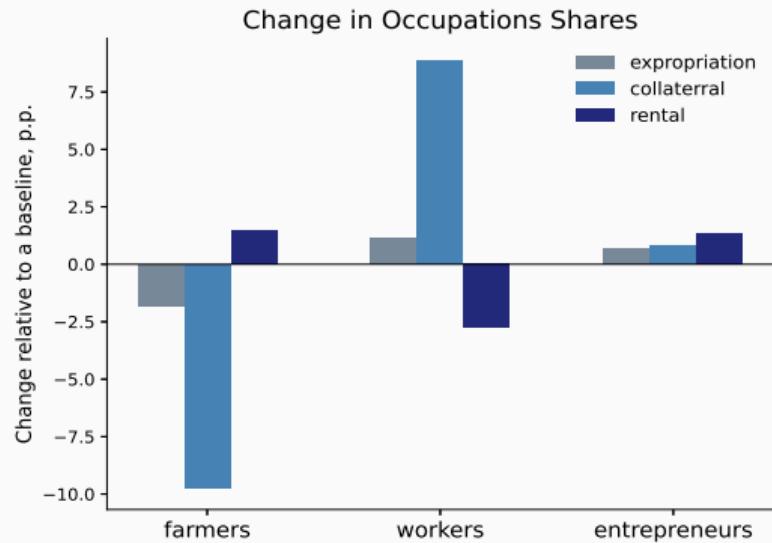
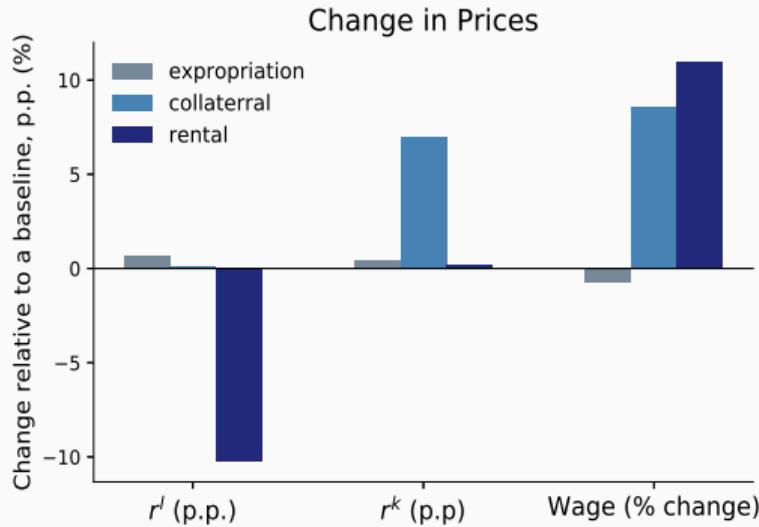


prices

Land Reform With No Financial Frictions

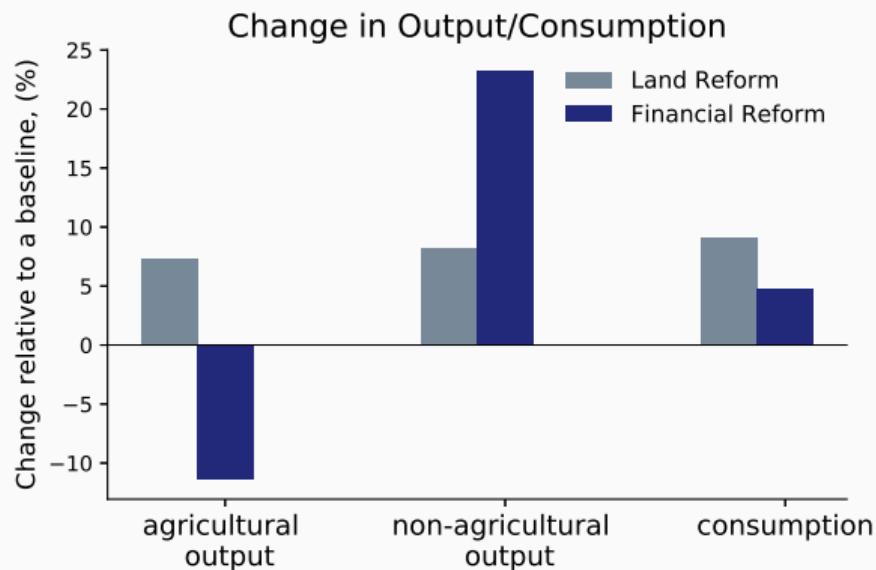
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# Main Channels: Prices and Occupations



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# Land vs Financial Reform

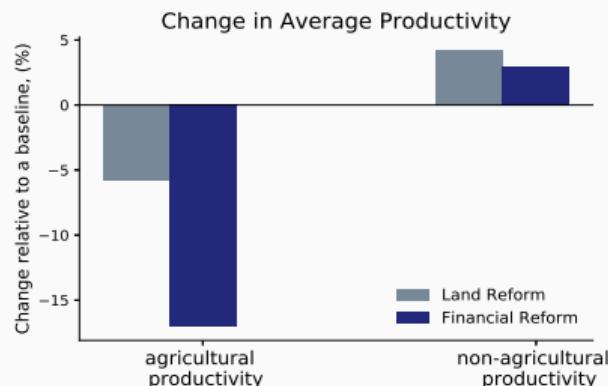
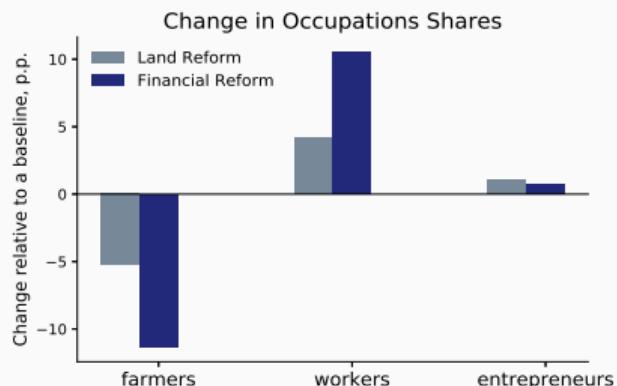
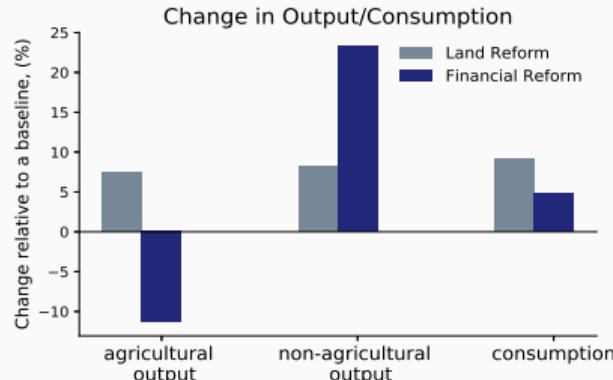
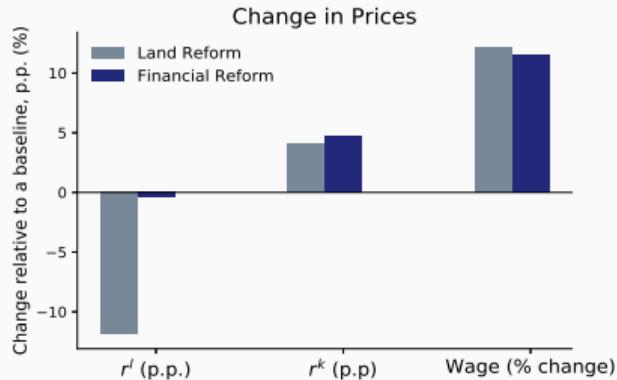


*Note: financial constraint relaxed so that loan to collateral same as in Sweden (83.9%)*

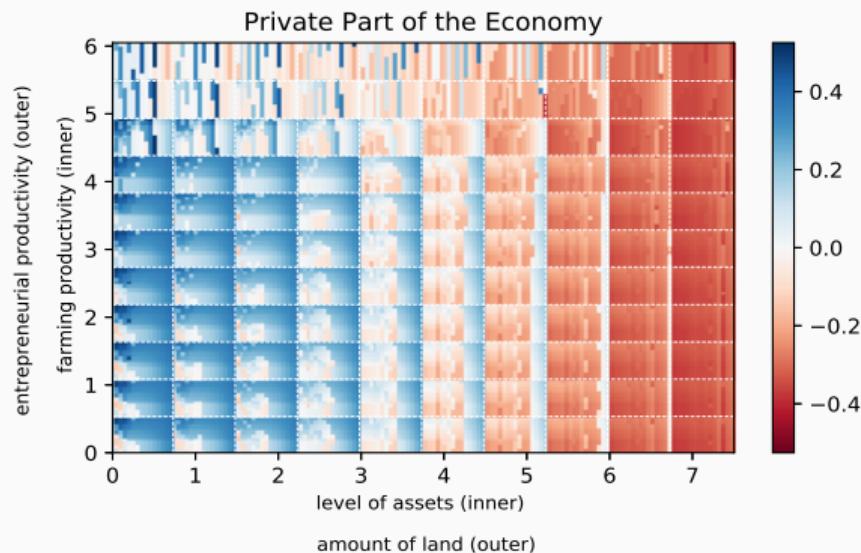
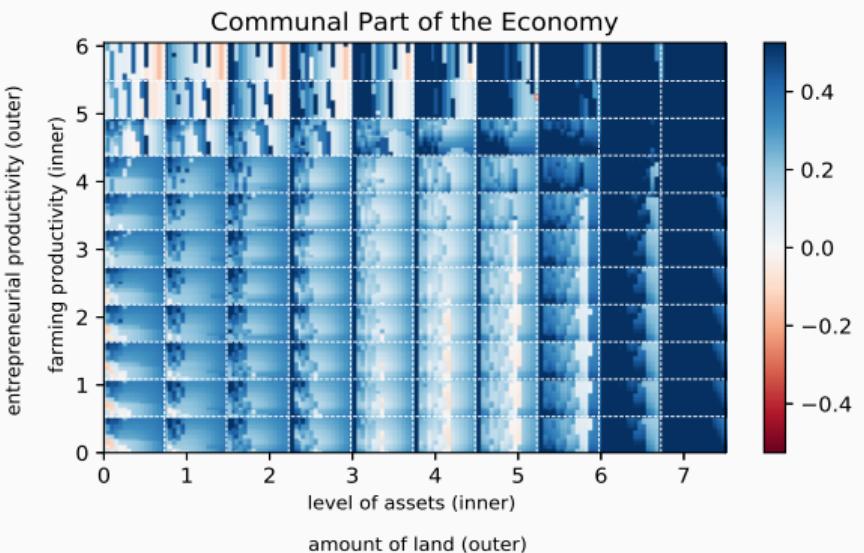
[all outcomes](#)

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# Land vs Financial Reform



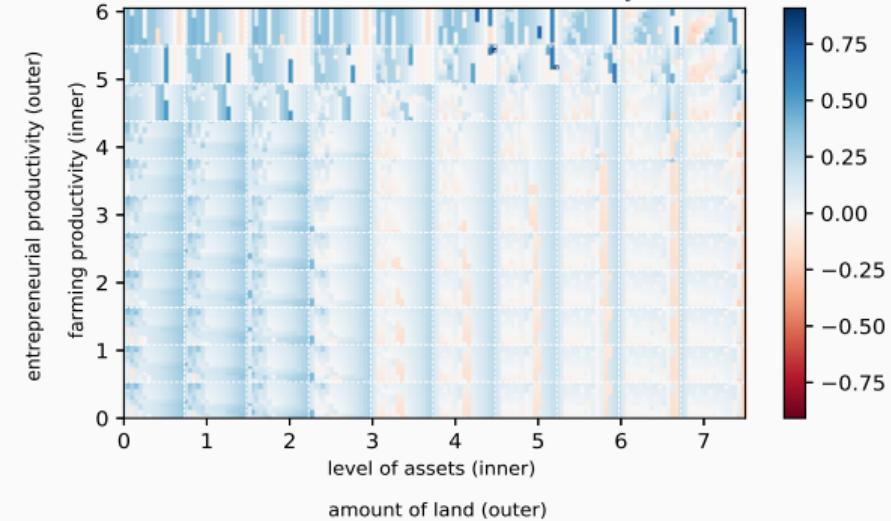
# Welfare: Winners and Losers Land Reform



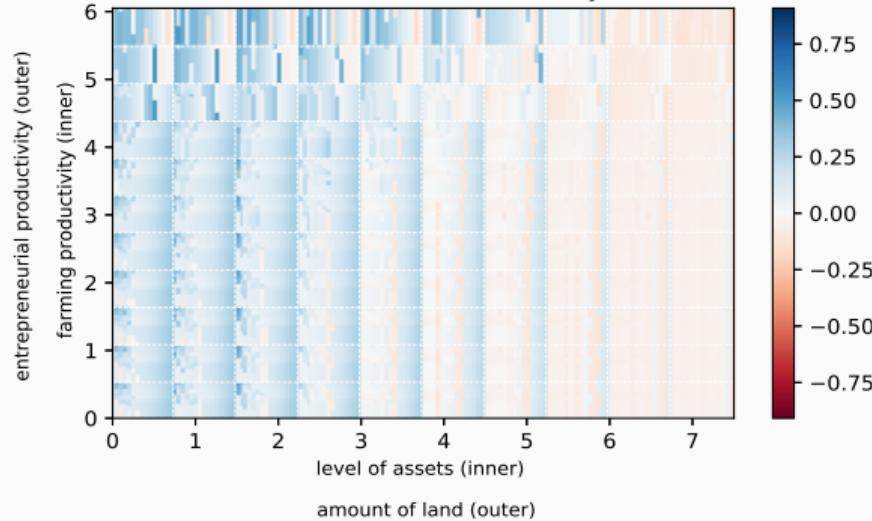
Overall consumption increases, while consumption inequality slightly decreases (Gini  $30.9 \Rightarrow 29.6$ )

# Welfare: Winners and Losers Financial Reform

Communal Part of the Economy



Private Part of the Economy

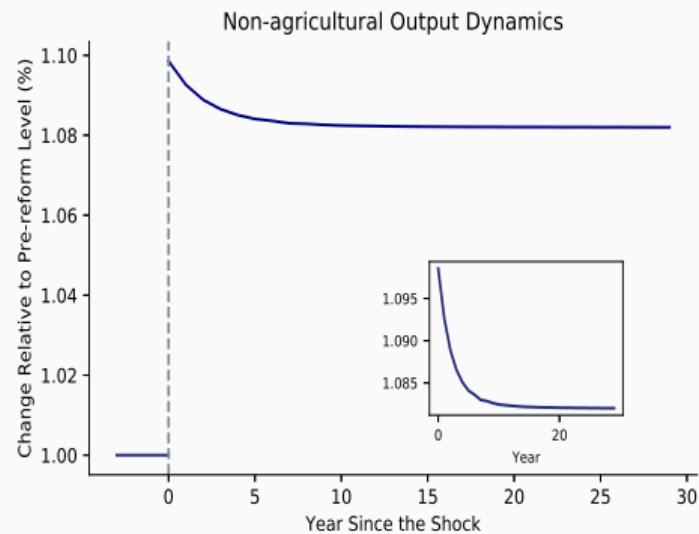
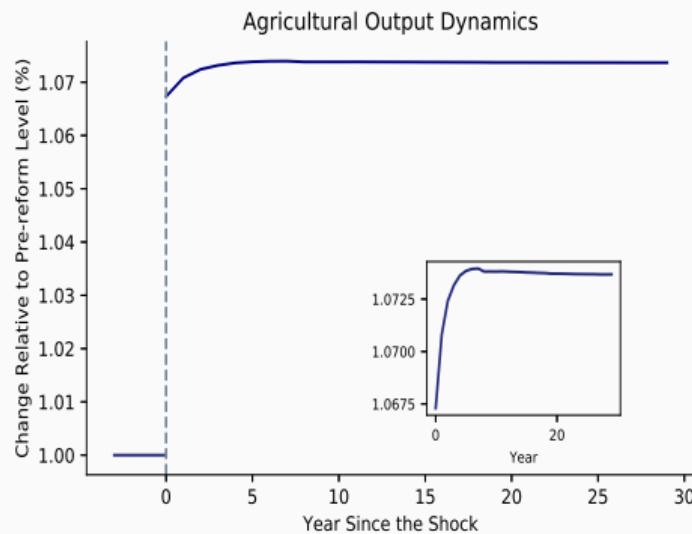


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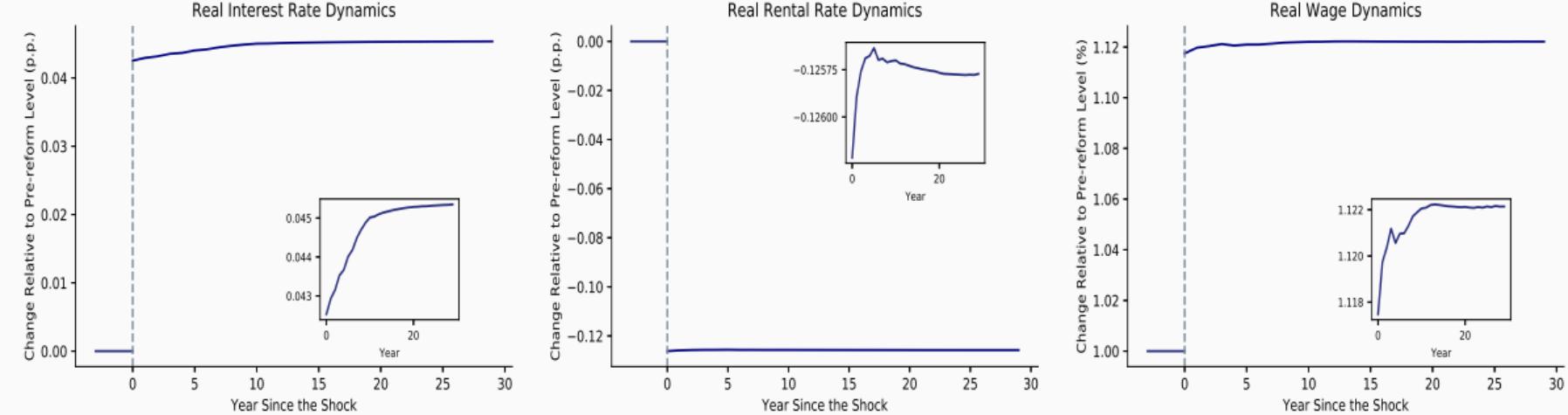
## Postreform Transition Dynamics

- Study the transition dynamics triggered by a sudden unexpected reform that eliminates communal property rights
- Once reform is implemented, everyone understands that it is permanent change
- Assume that financial frictions remain the same throughout transition period
- Simplifies actual reform episodes, which tended to be more gradual
- The dynamics following the reform are wholly endogenous

# Postreform Transition Dynamics: Output



# Postreform Transition Dynamics: Prices



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## Model Extensions/Future Work

- Communal land as insurance
- Role of collateral for agriculture  $\Rightarrow$  mechanization/ $\uparrow$  hired labor/pre-paid rent
- Endogenous financial reform?
- Default + limited insurance market

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