Misallocation Implications of Security and Collateral Value of Land

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Introduction

- **Land Misallocation:** possible source of variation in agriculture productivity across rich and poor countries
- Important to understand sources of land misallocation (market versus policy distortions) to draw policy implications, e.g.:
    - Should distorting policies that induce misallocation be removed?
    - Or, is misallocation caused by market frictions that may have motivated these policies, or may justify other regulations?

Introduction, contd.

- Existing macro-development literature has mostly explored role of land market restrictions in Africa and China, related to communal (rather than private) property rights (Adamopoulos et al 2022, Chen et al 2022, 2023)
- Credit market frictions (Buera et al 2011, Buera Shin 2013, Moll 2014) may also be a possible source, but only limited evidence so far in the land context (Shenoy 2017, Manysheva 2022, Silver 2023)

Alternative Sources of Land Misallocation?

- Poor countries with private land rights and land markets may conceivably be subject to other distortions
- E.g., inadequate (market or public) insurance against weather shocks may induce low ability poor farmers to place higher value on owning land as a source of food security, and thus be reluctant to sell land to more able and wealthier farmers
- In contrast to standard credit market frictions, resulting heterogeneity in land valuations might exhibit negative wealth (and ability) effects
- Suggestive evidence from household surveys in India (Ghatak et al 2013)

Suggestive 'Evidence' of Security Value of Land from Singur, West Bengal

- West Bengal government tried to acquire land from farmers in Singur for a proposed car factory during 2007-08 using eminent domain
- Offered compensation at 30% above prevailing market price
- 40% of affected households refused, leading to widespread protests
- We surveyed representative sample of households in this area, to understand sources of variation in refusal rates
- Found households with lower non-agricultural wealth/earnings were more likely to refuse, controlling for plot/household characteristics and selling rights
- Explanation given in interviews by those who refused: would be exposed to fluctuations in subsistence costs owing to food price volatility

Other Evidence of Insurance Frictions

- Lack of rainfall insurance in India (Cole et al 2013, Mobarak and Rosenzweig 2013)
- Privatization of common lands may expose poor farmers to more risk (Baland and Francois 2005)
- Following 1993 legalization of land sales in Vietnam, those with more stable incomes were more likely to sell land (Promsopha 2015)
- Myanmar households owning agricultural land were less prone to food insecurity (Rammanohar and Pritchard 2014)
- Insurance (rather than credit) frictions limit fertilizer application in Ghana (Karlan et al 2014)

Purpose of this Paper

- Insurance frictions have not received as much attention as credit frictions from theoretical development economists
- What are their implications for wealth effects or land misallocation, and how do these differ from effects of credit frictions?
- Welfare properties: are market equilibria constrained Pareto efficient? If not, what kinds of policies might generate welfare improvements? Is misallocation a reliable indicator of welfare effects in this second-best setting?
- Study heterogenous agent GE models of land markets and agricultural production with missing insurance markets

Collateral Value of Land: Alternative Channel?

- In the second part of the paper (which I will not have the time to cover in this talk), we explore a variation on a credit friction channel that might conceivably generate negative wealth effects: collateral value of land (de Soto 2000, Manysheva 2022)
- *Idea:* Poor agents subject to greater credit constraints value collateral role of land, which enhances their ability to borrow to finance *other* non-farm needs (business, children education etc.)
- We examine whether this intuition is correct

Main Findings

- **Security value:** decreasing in ability, also in wealth for low ability agents; generates land misallocation with too many small low productivity farms (under weak restrictions on ability-wealth heterogeneity patterns)
- **Collateral value:** increasing in both ability and wealth; may or may not generate land misallocation (depending on ability-wealth correlation, and collateralizability of land)
- In either model, market land allocations are constrained Pareto-inefficient (a la Geanakoplos-Polemarchakis 1986, Stiglitz 1982)
- Demonstrate Pareto improving policies which lower (raise) misallocation in security (collateral) model

2. Security Model: Technology

- Two goods: food (F), non-food (M)
- F produced using own land (l) and own labor in fixed (1:1) proportions (no tenancy/hired labor)
- F production depends additionally on farmer ability a and weather shock $A_w, w = d, n$ with probability f_w:

$$q_F(l; a, A_w) = aA_w l^{1-\alpha}, \alpha \in (0,1), A_n > A_d$$

- M produced using only labor; CRS; unaffected by weather

Security Model: Heterogeneity

- Continuum (or finite number of price-taking) agents
- Agent heterogeneity: given cdf over type $t = (a, l_0, m_0)$, where a:ability, l_0: land endowment and m_0 : wealth/M-stock
- Every agent has:
  - unit labor endowment, divided between farm and non-farm production
  - Preferences over *ex post* consumption: Stone Geary utility with food subsistence requirement $s > 0$:

$$u \equiv (c_F - s)^{\gamma} c_M^{1-\gamma}, \gamma \in (0, 1)$$

  - *Ex ante* risk attitude: VNM utility $V(u_w), V' > 0, V" < 0$, over u_w (state-w utility)

Timing and Market Structure

- Stages:
  - Date 0: land market opens, agent of type t ends up owning land $l(t)$
  - Each agent works on farm ($l \leq \min\{l(t), 1\}$) and non-farm activity ($1 - l$)
  - Weather shock w realized, farm and non-farm outputs produced
  - Date 1: spot commodity markets open
- **Friction:** no weather insurance

Spot Market Demand/Utility

- Agent of type t cultivating land $l \in [0,1]$ ends up with state w 'nominal' income (where $p_w \equiv$ state w food price, $P \equiv$ date 0 land price, M-good is numeraire):

$$Y_w(l|t,P,p_w) \equiv ap_w A_w l^{1-\alpha} + (1-l) + m_0 - P(l-l_0)$$

- Commodity demands (assuming $Y_w > p_w s$):

$$c_F = s + \gamma[Y_w - p_w s], c_M = (1-\gamma)[Y_w - p_w s]$$

- Resulting state w utility ('real' income):

$$u_w(l|t,P,p_w) = \frac{Y_w(l|t,P,p_w) - p_w s}{p_w^{\gamma}}$$

Radner Equilibrium: Definition

- Date 0 land price P, date 1 spot prices (p_d, p_n) and land allocation $\{l(t)\}$ such that:
  - Given land allocation $\{l(t)\}$, spot markets clear at food price p_w in state $w = d, n$
  - Date 0 land market clears:

$$\int l(t)dF(t) = \int l_0(t)dF(t)$$

    where land demand $l(t) \in [0, 1]$ maximizes $\sum_w f_w V(u_w(l|t, P, p_w))$ s.t. $m_0 + P(l - l_0) \geq 0$.

Parameter Restrictions

- **Ability heterogeneity; interior land demands:**

$$0 < \underline{a} < \bar{a} < \frac{A_d \lambda^{1-\alpha} \underline{a} - s}{k A_d}$$

where $k \equiv \frac{\gamma}{1-\gamma}(1 - \lambda + \mu)$, $\lambda \equiv E[l_0(t)], \mu \equiv E[m_0(t)]$

- **Land scarcity:** $\lambda \in (0, 1)$

- **Non-binding wealth constraint at date 0:** $m_0(t) \geq 1$ for all t

- **Affordability of subsistence:**

$$\frac{s}{\lambda^{1-\alpha} A_d \underline{a}} < \min\{\gamma, \frac{1-\gamma}{1+\gamma(\mu-\lambda)}\}$$

Spot Market Equilibrium

- Given land allocation $l(t)$, spot market clearing price in state w:

$$p_w = \frac{k}{A_w E[al(t)^{1-\alpha}] - s}$$

where $k \equiv \frac{\gamma}{1-\gamma}(1 - \lambda + \mu)$

- Hence food price is higher in drought state: $p_d > p_s$

- Demand for food is price-inelastic, so farm income is higher in drought: $p_d A_d > p_n A_n$ (land is a hedge against higher food prices in droughts)

Spot Market Equilibrium, contd.

- Parameter restrictions imply affordability of subsistence for all t, P:

$$Y_w(l(t)|t, P, p_w) > p_w s$$

- spot utility ('real income') is lower during drought for all t, P:

$$u_d(l(t)|P, p_d) < u_n(l(t)|P, p_n)$$

as higher cost of living outweighs higher 'nominal' farm incomes (recall:)

$$u_w(l|t, P, p_w) = \frac{a p_w A_w l^{1-\alpha} - p_w s + (1-l) + m_0 + P(l - l_0)}{p_w^{\gamma}}$$

Date 0 Land Market

- Parameter restrictions ensure labor allocation is interior:

$$\log l(t) = \frac{1}{\alpha}[\log(1-\alpha) + \log a(t) + \log(\sum_w \phi_w(t) p_w A_w) - \log(1+P)]$$

where

$$\log \phi_w(t) \equiv \log[\frac{f_w V'(u_w(t))}{p_w^\gamma}] - \log[\sum_{w'} \frac{f_{w'} V'(u_{w'}(t))}{p_{w'}^\gamma}]$$

is the state w weight adjusting nominal land return for cost-of-living (COL) and risk

- In first best contexts state w weight $\phi_w^{FB} \equiv \psi_w$ adjusts only for COL, **does not vary with t:**

$$\log \psi_w = \log[\frac{f_w}{p_w^\gamma}] - \log[\sum_{w'} \frac{f_{w'}}{p_{w'}^\gamma}]$$

Security Value of Land

- Since $\phi_d(t) + \phi_n(t) = 1$:

$$\log l(t) = \frac{1}{\alpha}[\log(1-\alpha)+\log a(t)+\log\{\phi_d(t)(p_dA_d-p_nA_n)+p_nA_n\}-\log(1+P)]$$

  which implies (since $p_dA_d > p_nA_n$):

- $\frac{l(t)}{l(t')} > \frac{l^{FB}(t)}{l^{FB}(t')}$ if and only if $\phi_d(t) > \phi_d(t')$

- Hence $\phi_d(t)$ is a measure of the distortion in land allocation arising due to insecurity

Non-decreasing Absolute Risk-Aversion (NDARA)

Proposition

NDARA implies $\phi_d(t)$ is increasing in ability and wealth.

- Misallocation is qualitatively similar to standard credit friction
- **Reason:** $\phi_d(t)$ is monotone increasing in $\frac{V'(u_d)}{V'(u_n)}$, which in turn is increasing in m_0 iff

$$ARA_n \frac{1}{p_n^\gamma} \frac{\partial Y_n}{\partial m_0} - ARA_d \frac{1}{p_d^\gamma} \frac{\partial Y_d}{\partial m_0} > 0$$

  and $u_n > u_d$ implies $ARA_n \geq ARA_d$, while rise in wealth raises real income more in state n: $p_n < p_d$, $\frac{\partial Y_n}{\partial m_0} = \frac{\partial Y_d}{\partial m_0} = 1$
- $\phi_d(t)$ is increasing in a, because it also has a larger effect on real income in state n ($\frac{\partial Y_w}{\partial a} = p_w A_w \frac{[\partial a l(t)^{1-\alpha}]}{\partial a}$ and $\frac{p_n A_n}{p_n^\gamma} > \frac{p_d A_d}{p_d^\gamma}$)

Misallocation with DARA

- Under DARA, ARA is lower in state n thus providing an effect in the opposite direction
- For the risk effect to dominate the real income effects of rising ability/wealth, ARA has to be falling fast enough
- Does it fall fast enough with CRRA?

Main Result: Misallocation with CRRA

Proposition

CRRA implies $\phi_d(t)$ is (a) decreasing in ability, and (b) decreasing (increasing) in wealth if ability is below (above) some intermediate level $a_m \in (\underline{a}, \bar{a})$.

- With CRRA, $\phi_d(t)$ is monotone increasing in ratio of disposable nominal incomes: $\frac{Y_n - p_n s}{Y_d - p_d s}$, as COL adjustment does not vary with t
- Increase in ability raises nominal income in both states, but by less in state n both absolutely ($p_n A_n < p_d A_d$) and proportionally:

$$\frac{p_n A_n}{Y_n - p_n s} < \frac{p_d A_d}{Y_d - p_d s}$$

Wealth Effects with CRRA: Intuition

- Raising wealth raises nominal income by the same amount in both states
- Reduces insecurity ($\phi_d(t)$) iff disposable income ($Y_w(t) - p_w s$) is lower in drought ($\frac{u_d}{u_n}$ rises)
- True (false) for low (high) ability agents, because:
- in any state w, variations in disposable income across types are driven by differences in food output $A_w q(t)$ (where $q(t) \equiv a(t) l(t)^{1-\alpha}$) and in non-farm wealth $W(t)$:

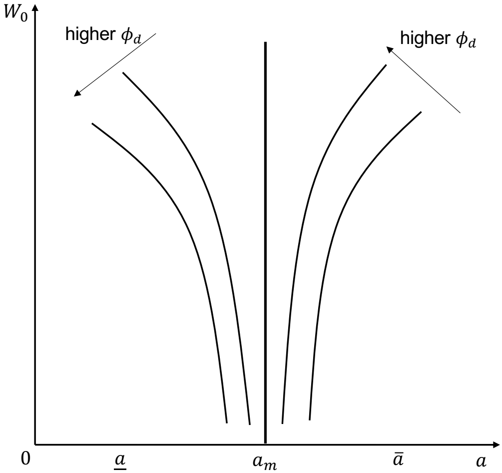
$$Y_w(t) - p_w s = p_w[A_w q(t) - s] + W(t) = k \frac{A_w q(t) - s}{A_w E_{\tilde{t}}[q(\tilde{t})] - s} + W(t)$$

Wealth Effects with CRRA: Intuition (contd.)

$$Y_w(t) - p_w s = p_w[A_w q(t) - s] + W(t) = k \frac{A_w q(t) - s}{A_w E_{\tilde{t}}[q(\tilde{t})] - s} + W(t)$$

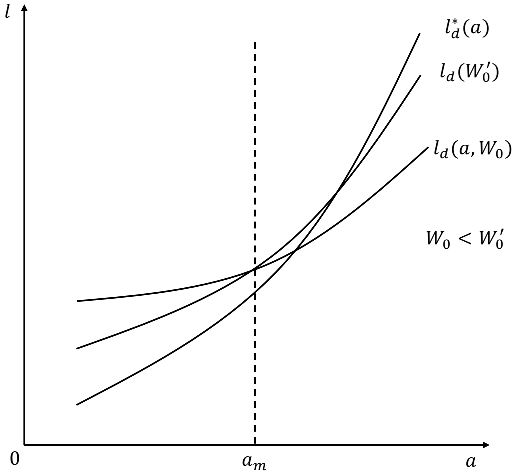
- For a 'representative' type t^* producing per capita food output ($q(t^*) = E[q(\tilde{t})]$), disposable income $= k + W(t^*)$, state independent
- Hence wealth effects are locally zero for t^*
- Changes in wealth holding ability fixed at $a(t^*)$ leaves land allocation and hence $q(t)$ fixed, so wealth effects are zero for all types with ability $a(t^*)$
- For agents with ability smaller (larger) than $a(t^*)$, disposable income is smaller during drought, hence wealth effects are negative (positive)

CRRA: Variation in ϕ_d, wrt ability and wealth $W_0 \equiv m_0 + Pl_0$



ISO - ϕ_d curves

CRRA: Land Misallocation



Security Model with CRRA: Macro Implications

- Land allocation most biased in favor of low-ability low-wealth agents, followed by low ability high-wealth, then high ability high wealth, and least for high ability high wealth group
- Bias in favor of low ability agents:
  - lowers Eq, aggregate farm productivity and food output
  - raises food price in every state
  - raises food price volatility $\frac{p_d}{p_n} = \frac{A_n Eq - s}{A_d Eq - s}$
- Misallocation likely to be greater in poorer countries (i.e., with lower average wealth)

Security Model with CRRA: Welfare Implications

- Missing insurance markets, hence standard Welfare Theorems do not apply
- Equilibria are generically constrained Pareto inefficient (Geanakoplos Polemarchakis 1986, Stiglitz 1982)
- Reallocation of land from low to high ability agents lower food prices that generate first order Pareto improvements
- Public drought relief/creating insurance markets would induce land market transactions that reduce misallocation

Variation: Collateral Value Model

- Rest of the paper studies an alternative model where land is valued as a form of collateral by poor agents that helps them finance some other income/utility raising activity (non-farm business, child education)
- Where lenders can appropriate (returns from) land but not financial wealth of defaulters
- No risk, but wealth constraints bite
- Land misallocation implications depend on how collateralizable/pledgeable land is

Contrast with Security Model

- There is no land misallocation if (and only if) land returns are 100% pledgeable
- Marginal WTP for land is nondecreasing in ability and wealth (less misallocation if ability-wealth correlation is higher)
- Policies that increase land misallocation generate constrained Pareto improvements (by reducing interest rate, internalizing negative pecuniary externalities among borrowers)