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14.771 Development Economics: Microeconomic Issues and Policy Models  
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# 1 **Agriculture: The efficiency of land use**

- Share of agriculture in employment is close to 50% for the world as a whole (50% in China, 57% in India).
- Is land used efficiently?

## 1.0.1 **Farm size and productivity: observed relationship**

- Farm size productivity differences: see table.
- Profit-Wealth ratios and weather variability (monsoon onset is a measure of the risk faced by the farmer): see figure

- The Profit-Wealth ratio is always greater for small farmers
- Small farmers' profits are hurt much more by uncertainty than large farmers'

## 1.0.2 Why is this surprising?

- Arguments for increasing returns (the opposite relationship)
  - Technology with fixed costs (tractors, etc..)
  - Larger farmers have better access to capital
  - Larger farmers have better access to politically allocated inputs (evidence from Africa in a book by Bates “Market and states in tropical Africa” ).
  - The best farmer will have more land...
- Mitigating factors:
  - Rental markets in farm machinery
  - Technological change in not very rapid. Savings not that important.

### 1.0.3 What could be going on: Arguments for decreasing returns

- – Agency problems: large farms are cultivated by hired labor, which has fewer incentive to work hard. Small farms are owner cultivated.  
⇒ Redistributing land will create more owner cultivated land which will be more productive.
- But why cannot the owner of the land not give the right incentive to the farmers?

#### **1.0.4 Different potential explanations for the observed inverse productivity relationship:**

- Differences in land quality
- Differences in farmer characteristics
- Incentive Problems

Problem with the observed relationship: all of this could be going on... How can we separate these different effects.

### 1.0.5 Evidence: Study by Biswanger and Rosenzweig

- Using ICRISAT data: very detailed panel (repeated observation for every household) data from India.
- Some individuals cultivate both an owner-operated plot and a rented plot.
- Biswanger and Rosenzweig compare the inputs they apply on their own plot and the rented plots, and the overall productivity of both plots.

$$\Pi_{ij} = \alpha + \beta R_{ij} + \eta_i + v_{ij},$$

- where  $\Pi_{ij}$  is farmer's  $i$  outcome (profit, investment) on plot  $j$ , and  $R_{ij}$  indicate whether the plot is rented.  $\eta_i$  is the unobserved (but fixed)

characteristics of the farmers (risk aversion, quality, etc...). We think that  $\eta_i$  and  $R_{ij}$  may be correlated, but, for a minute, not  $v_{ij}$  and  $R_{ij}$ . What can we do?

- Control for the individual fixed effect to compare plots within individual's. So for example, for all the farmers that cultivate two plots of land, we can run the regression:

$$\Pi_{i2} - \Pi_{i1} = \beta(R_{i2} - R_{i1}) + v_{i2} - v_{i1},$$

- The individual fixed effect is gone!

Biswanger and Rosenzweig find a strong negative  $\beta$ . What does this suggest? What could be the remaining problem?



### **1.0.6 More evidence: Shaban (1987)**

- Uses the same data, but controls in addition for plot quality.
- He finds that individual work 40% more on their own land (controlling for land size) and that the productivity is 15% to 30% higher on own land than on rented land (with or without controlling for land quality).
- On balance, the evidence suggests that the inefficiency comes from incentive problems.

## 1.1 Incentive problems: A simple model of sharecropping

- There is a landlord who own two plots of land but can only cultivate 1
- He hires a tenant to farm the other plot
- Cultivation effort is denoted by  $e$ .
- The landlord cannot observe  $e$ .
- Effort is costly to the tenant:  $\frac{1}{2}ce^2$
- Two things can happen:
  - with probability  $e$ : Output is  $H$

- with probability  $e$ : Output is 0
- The tenant has outside option  $w$
- The tenant and landlord write a contract which specifies a payment to the tenant
  - a payment  $h$  if output is  $H$
  - a payment  $l$  if the output is 0

### 1.1.1 What does the landlord choose for $e$ ?

- Maximize  $eH + (1 - e)0 - \frac{1}{2}ce^2$ 
  - What is the solution?
  - Why?

## 1.1.2 No Limited Liability

- Work sequentially: given  $h$  and  $l$ , what is the tenant's effort? Tenants want to maximize income minus the cost of effort:  $eh + (1 - e)l - \frac{1}{2}ce^2$
- What is the solution for  $e$  given  $h$  and  $l$ ?
- How do we need to fix  $h$  and  $l$  to incite the tenant to choose the optimal effort  $\frac{H}{c}$ ?
- $l =$
- $h =$
- This contract is a *fixed rent contract*.
- How is the rent,  $R$ , chosen?

- Tenant has to agree to work with landlord: he has to receive at least  $\underline{w}$ .  $\rightarrow$  exercise: calculate  $R$

### 1.1.3 Limited Liability

- Imagine that the tenant cannot receive negative payment: *limited liability*.
- What will  $l$  be?
- What will  $e$  be?
- What will the output be?
- How does it move with  $h$ ?

- Maximization problem of the landlord: Maximize his income.

$$\max e_{tenant}[H - h]$$

$$\max \frac{h}{c}[H - h]$$

- What is the optimal  $h$  now?
- What is the output?
- How does the output compare to the optimal output?
- What is the difference  $h - l$ ?
- How does it compare to the case without limited liability?
- Why is the effort smaller than the optimal effort?

### 1.1.4 Outside Option

Remember that the tenant can choose to work somewhere else and will receive a utility  $\underline{w}$ . How does it modify the contract chosen above?

- Tenant's utility under the contract:

$$\frac{h}{2}h - \frac{1}{2}c\left(\frac{h}{c}\right)^2 = \frac{1}{2}h^2 = \frac{1}{8}H^2$$

if  $\frac{1}{8}\frac{H^2}{c} \geq \underline{w}$ , they can choose this contract: Is there anything strange about this contract?

if  $\frac{1}{8}\frac{H^2}{c} < \underline{w}$ , they have to pick a contract which will give at least  $\underline{w}$  to the tenant Pick  $h$  such that:

$$\frac{1}{2}h^2 = \underline{w}$$

$h =$

$e =$

- $e$  is always an increasing function of  $\underline{w}$
- output is always an increasing function of  $\underline{w}$

→ increasing the tenant outside option increases productivity

### 1.1.5 Implications

What does that imply for

- The effort chosen by the tenant versus the landlord?

The relation between land-size and productivity assuming that some people own 1 unit of and some 2?

The effect of redistributing land on productivity?



## 1.2 Risk, insurance and tenancy

- We continue in the world of the previous lecture:

Success is 1, failure is 0

The probability of success is  $e$ .

However we now add risk-aversion

- First assume that output is publicly verifiable.
- In that case insurance is provided by the "world market" which is assumed to be risk neutral
  - Landlord's do not need to insure their tenants or vice versa.
  - Therefore we can assume that the tenancy contract is always a fixed rent contract at rent  $R$ .

- Then the landlord and the tenant gets insurance on the market
- Suppose there are people who own 0, 1 or 2 pieces of land.
- However people can cultivate only one.
- Then someone who has 2 plots will need to get at least one tenant.
- If he gets one tenant, his earnings are  $R + \omega + 1$  when its a success and  $R + \omega$  when it is failure, where  $R$  is the rent and  $\omega$  is his non-labor income.
- Then he gets insurance:

The insurer is also concerned about moral hazard since she does not observe effort. Suppose the insurance contract gives him  $y_H$  when he succeeds and  $y_L$  when he fails

The landlord chooses effort based on the implied incentives

- The insurance contract maximizes

$$eV(y_H, e) + (1 - e)V(y_L, e)$$

$$st\ e\ maximizes\ eV(y_H, e) + (1 - e)V(y_L, e)$$

$$R + \omega + e = ey_H + (1 - e)y_L$$

- For the tenant it is the same problem, except that he has to pay  $R$  and has an outside income  $\omega'$ . His insurance contract maximizes

$$eV(y_H, e) + (1 - e)V(y_L, e)$$

$$st\ e\ maximizes\ eV(y_H, e) + (1 - e)V(y_L, e)$$

$$-R + \omega' + e = ey_H + (1 - e)y_L$$

**1.2.1 A convenient example:**  $V(\cdot) = -\exp[-\lambda(y - \frac{1}{2}ce^2)]$

- Writing  $r = y_H - y_L$  we can rewrite the maximand

$$\max -\exp[-\lambda(y_L)] \left\{ -e \exp[-\lambda(r - \frac{1}{2}ce^2)] - (1 - e) \exp[-\lambda(-\frac{1}{2}ce^2)] \right\}$$

- Notice that the choice of  $e$  does not depend on  $y_L$ .
- You can raise  $e$  by raising  $r$ .
- The marginal cost of raising  $r$  also does not depend on  $y_L$ .
- Therefore we can separate the instruments: use  $r$  to give incentives and use  $y_L$  to set the levels.

What does that imply for

- The effort chosen by the tenant versus the landlord?

Will the landlord get a tenant on the last plot?

what is the role of the outside option?

The relation between land-size and productivity?

The effect of redistributing land?

**1.2.2 Does that mean that with diminishing absolute risk aversion landlords who have one plot will necessarily be more productive on average than landlord's who have two plots as long as tenants poorer than either one as long as those with one or more plot do not have too good an outside option?**

- Not necessarily

- The richer landlord might take more risk on plot 1 even if the tenant takes less risk on plot 2
- More subtle effect: the income effect on the willingness to take risks makes tenants less willing to bear risk, but the insurance company also knows that a smaller amount of risk is enough to motivate a tenant. The net effect on effort is ambiguous.

### An example

- Assume two choices for  $e = 0, e'$ .
- The cost of  $e' : \frac{1}{2}ce'^2 = E$
- Optimal insurance contract  $(y_H, y_L)$  such that

$$e'V(y_H) + (1 - e')V(y_L) - E = V(y_L)$$

1. which implies  $e'[V(y_H) - V(y_L)] = E$

2. and  $\omega' + e' = e'y_H + (1 - e')y_L$

- $V'(y_H)\frac{dy_H}{d\omega'} = V'(y_L)\frac{dy_L}{d\omega'}$  from 1.

- $e'\frac{dy_H}{d\omega'} + (1 - e')\frac{dy_L}{d\omega'} = 1$  from 2.

- Solving these two we get

$$\frac{dy_H}{d\omega'} = \frac{V'(y_L)}{e'V'(y_L) + (1 - e')V'(y_H)}$$

$$\frac{dy_L}{d\omega'} = \frac{V'(y_H)}{e'V'(y_L) + (1 - e')V'(y_H)}$$

- The utility of a farmer

$$V_F(\omega') = e'V(y_H) + (1 - e')V(y_L) - E$$

- From which  $\frac{dV_F(\omega')}{d\omega'} = \frac{V'(y_L)V'(y_H)}{e'V'(y_H) + (1 - e')V'(y_L)}\omega p$
- For a pure rentier:  $V_R(\omega') = \omega' + R$  (bad notation)
- $\frac{dV_R(\omega')}{d\omega'} = V'(\omega + R)$



- Which of these slopes is greater when  $V_F(\omega') = V_R(\omega')$  will determine which curve cuts the other from below and therefore who farms.

- Since  $\omega' + R < \bar{y} = e'y_H + (1 - e')y_L$  (risk aversion+cost of effort),  $\frac{1}{V'(\omega'+2R)} < \frac{1}{V'(\bar{y})}$

- Let  $1/V'$  be a convex function. When is this true?

- Then  $\frac{e'}{V'(y_H)} + \frac{1-e'}{V'(y_L)} \geq \frac{1}{V'(\bar{y})}$

$$> \frac{1}{V'(\omega'+R)}.$$

- Which implies  $\frac{dV_R(\omega')}{d\omega'} > \frac{dV_F(\omega')}{d\omega'}$

- In other words, the landless may be more willing to farm the plot owners, which will bid up the rent till all land is with tenants, even though the plot owners do not have better outside options.

## 1.3 Costly verification of output

- Suppose output is costly to verify. Specifically one unit of labor can verify the output of  $N$  plots of land.
- Assume everyone has one unit of labor and that this unit is indivisible.
- This unit can either cultivate 1 unit of land or verify output on  $N$  plots of land.
- Finally assume that the total output of the  $N$  plots that the verifier verifies is unobservable to others and as a result, no one insures the person who verifies output.
- Therefore there are three possible occupations

Tenant: someone who farms 1 unit of land whose output is verified by the landlord and therefore can get insurance

Landlord: someone who verifies output and insures others

Yeoman farmer: someone who gets no insurance but farms 1 unit of land.

- Suppose first risk-aversion is fixed: Everyone is CARA with potentially differing coefficients.
- Who, in terms of risk-aversion will become
  - a tenant
  - a yeoman farmer
  - a landlord

think of the case where one group is quite risk averse and the other is risk-neutral

and there are too few risk-neutral people to cultivate all the land.

- What are the implications for

Farm size and productivity?

And the effect of land redistribution?

- Now let risk-aversion vary with wealth and let people have identical utility functions but differing wealth

who becomes a tenant?

Farm size productivity?

The effect of land redistribution?

## 1.4 Two-sided moral hazard

- A fourth model: two sided moral hazard.

who becomes a tenant

Farm size and productivity

The effect of land redistribution

## 2 The case for redistributing land

Why redistribute land rather than money? As economists, we tend to think that money is better, since with money, the poor could buy land if they wanted to. So why land reform?

- The giving end: Getting land from the rural rich.

- Common argument (1): land cannot flee to Switzerland, and cannot be hidden: easy to seize

Yet: Land titles are very sketchy. Formal titles can be quite different from effective control, especially if people have an incentive to do so. Land may not be so easy to take away after all.

- Common argument (2): redistributing land does not create distortions, since it is a fixed asset (income taxation would reduce labor supply, but land does not).

Yet: Redistributing land is difficult: it is opposed by landowners who often control important political resources. There are very few instances of large scale land redistribution that did not take place in the midst of massive social upheaval. Land reform may be politically very costly.

- Perhaps we want to tax the rural rich, and not the urban elite (entrepreneurs, etc...), for example because we want to foster industrialization. This does not seem to be important now, since recent examples have favored *market assisted* land reforms, whereby landlords are compensated out of general tax revenues.
- We may feel that landlords hold onto land because it gives them prestige/political power.
- The receiving end: giving land to the rural poor.
  - Makes them more likely to migrate to the cities. But are cities really too large?
  - Land is an asset: can be used as collateral and therefore may generate extra value (Hernando de Soto). But why would illiquidity help.

- Intrahousehold allocation issues. Perhaps money would be spent by the household head in alcohol etc... whether land will remain in the household. We should make it hard to sell the land then! This may be the most compelling argument in favor of land reform. ●



## 2.1 Does land reform work? Besley-Burgess (2000)

- Few studies of the efficiency consequences of large-scale reforms of property rights: Most reforms have been accompanied by major upheaval and social unrest → difficult to separate the effects of the two.
- Besley-Burgess (QJE, 2000): Uses the fact that India has carried out a large number of land reforms under conditions of reasonable social peace.
- The number of reforms is large because reform is a state subject and there are many states. Moreover while every state has some reform, some have had more reforms than others.

- Besley-Burgess create an index of the number of land reforms (actually they classify reforms into four categories: tenancy reforms, abolition of intermediaries, land ceilings, land consolidation). They then count the number of reforms of each type in or before a given year. This gives them an index of "tenancy reforms" for that state for that year, say. They add up all the four indices to get a single land reform index for that state for that year.

- They then run a regression of the form

$$x_{st} = \alpha_s + \beta_t + \gamma y_{st} + \xi I_{st-4} + \varepsilon_{st}$$

where  $x_{st}$ , is the poverty rate in state  $s$  at time  $t$ ,  $y_{st}$  is a set of time and state varying controls and  $I_{st-4}$  is the index of the number of reforms till up to 4 years before the current date.

- The results show [SEE TABLE III]
  - land reforms are associated with a decline in poverty.
  - There is no effect on urban poverty.
  - Only tenancy reforms and the abolition of intermediaries had an effect on poverty.
- The results survive when you control for: population growth, agricultural yield lagged four years, health and education expenditures per capita, state taxes/SDP, proressivity of taxes.

- Both progressivity of taxes and State taxes/SDP reduce poverty but the land tenure effect remains intact.
- Concern: Endogeneity of land reforms: Instrument for land reforms using the vote share of "hard left" parties as against the centrist parties. Is this a good instrument?
- Concern: Serial correlation of errors.

## 2.2 Does land reform work? Banerjee-Gertler-Ghatak (2002)

- Banerjee, Gertler, Ghatak study a *tenancy reform* = improvement in the rights of tenants. It differs from a traditional land reform (redistribution of land). Land is not redistributed. The tenant is offered the *security of tenure* = if he registers, he cannot be evicted by the landlord, as long as he pays 25% of the output to the landlord

Consequences of the reform on the tenant

### 1 Bargaining power effect

- Tenant and landlord negotiate on the share
- Before, what would happen to the tenant if he disagreed with the landlord?

- After, what can happen to him?
- What are the consequences of this on the share of the tenant?
  - is it good or bad for productivity?
  - why?

## 2 Security of tenure effect

- What positive effect does it have on productivity?
- 
- What negative effect does it have on productivity?
-

## **2.3 Empirical analysis of the reform**

- Left front government came to power in 1977
  - Started registration camps in villages (officials came to help tenants register)
  - Faced some difficulties = flood, landlords' opposition
- registration progressed more slowly than expected and was still continuing in early 1990s.

## 2.4 The expected effects of the reform

1. Reform → bargaining power → improvement in share → improvement in productivity

2. Reform → security of tenure → improvement in productivity (?)

Questions asked in the study=

- a) Did reform increase share of output for the tenants?
- b) Did reform increase security of tenure?
- c) Did reform increase productivity?



## **2.5 Empirical analysis**

### **2.5.1 Security and share of output**

- From a retrospective survey: 80% said that landlord used eviction threats in the pre-reform period and 30% claimed that they (or their fathers) were actually threatened. 96% said it was difficult or impossible to evict now.
- share of tenants getting more than 50% of output went up from 17% to 39%.

### **2.5.2 Productivity 1**

- Bangladesh
  - Neighboring country but no reform

- Difference in difference

	BEFORE	AFTER	DIFFERENCE
WEST BENGAL	1308.2	1649.52	
BANGLADESH	1296.76	1561.64	
DIFFERENCE	11	88	77

### 2.5.3 Productivity 2

- Within West Bengal

Districts had different registration rates at different times. At any given point, was productivity higher in the districts which had more registered tenants?

## 2.6 Regression

$$y_{dt} = \alpha_d + \lambda_t + \beta b_{dt} + \gamma X_{dt} + \epsilon_{dt}$$

$\alpha_d$  = district specific effect

$\lambda$  = year effect

$b_{dt}$  = number of registered tenants

$X_{dt}$  = other district-time varying variables

$\gamma$  = effect of other district-firm varying variables on productivity

Results: [SEE TABLES 5 and 6] Show that higher registration is associated with faster growth in yield.

- Concern: Other identification issues.