Land Markets

1. Introduction: Land Ownership and Tenancy

- Table 12.1 shows how unequal the distributions of land are in the countries of Asia and Latin America.
  - A huge percentage of the rural population is either landless or owns very small plots of land, in contrast with a small fraction of the population who own very large quantities of land.
  - The Gini coefficients of land distribution are very high compared to the corresponding estimates of the inequality of income distribution.
- Although there is substantial inequality in Asia, land inequalities in Latin America are higher by an order of magnitude.
  - Figure 12.1 plots Lorenz curves for land inequality in two Asian countries (India and Thailand) and two Latin American countries (Honduras and Colombia).
  - The differences in the two sets of Lorenz curves are fairly evident.

Table 12.1. Ownership distribution of farms and farmland in Asia and Latin America in the early 1970s.

Country	Average operational farm size (hectares)	Percentage of farms and farmland				Gini coefficient of land concentration
		Below 5 hectares		Above 50 hectares		
		Farms	Area	Farms	Area	
Asia						
Bangladesh	1.6	90.6	67.6	n.a.	n.a.	0.42
India	2.3	88.7	46.7	0.1	3.7	0.62
Indonesia	1.1	97.9	68.7	0	13.6	0.56
Nepal	1.0	97.2	72.1	0	0.8	0.56
Philippines	3.6	84.4	47.8	0.2	13.9	
Thailand	3.7	72.3	39.4	0	0.9	0.45
Latin America						
Brazil	59.7	36.8	1.3	16.3	84.6	0.84
Costa Rica	38.1	48.9	1.9	14.5	79.7	0.82
Colombia	26.3	59.6	3.7	8.4	77.7	0.86
Peru	16.9	78.0	8.9	1.9	79.1	0.91
Uruguay	214.1	14.3	0.2	37.6	95.8	0.82
Venezuela	91.9	43.8	0.9	13.6	92.5	0.91

Source: Otsuka, Chuma, and Hayami [1992, Table 2].

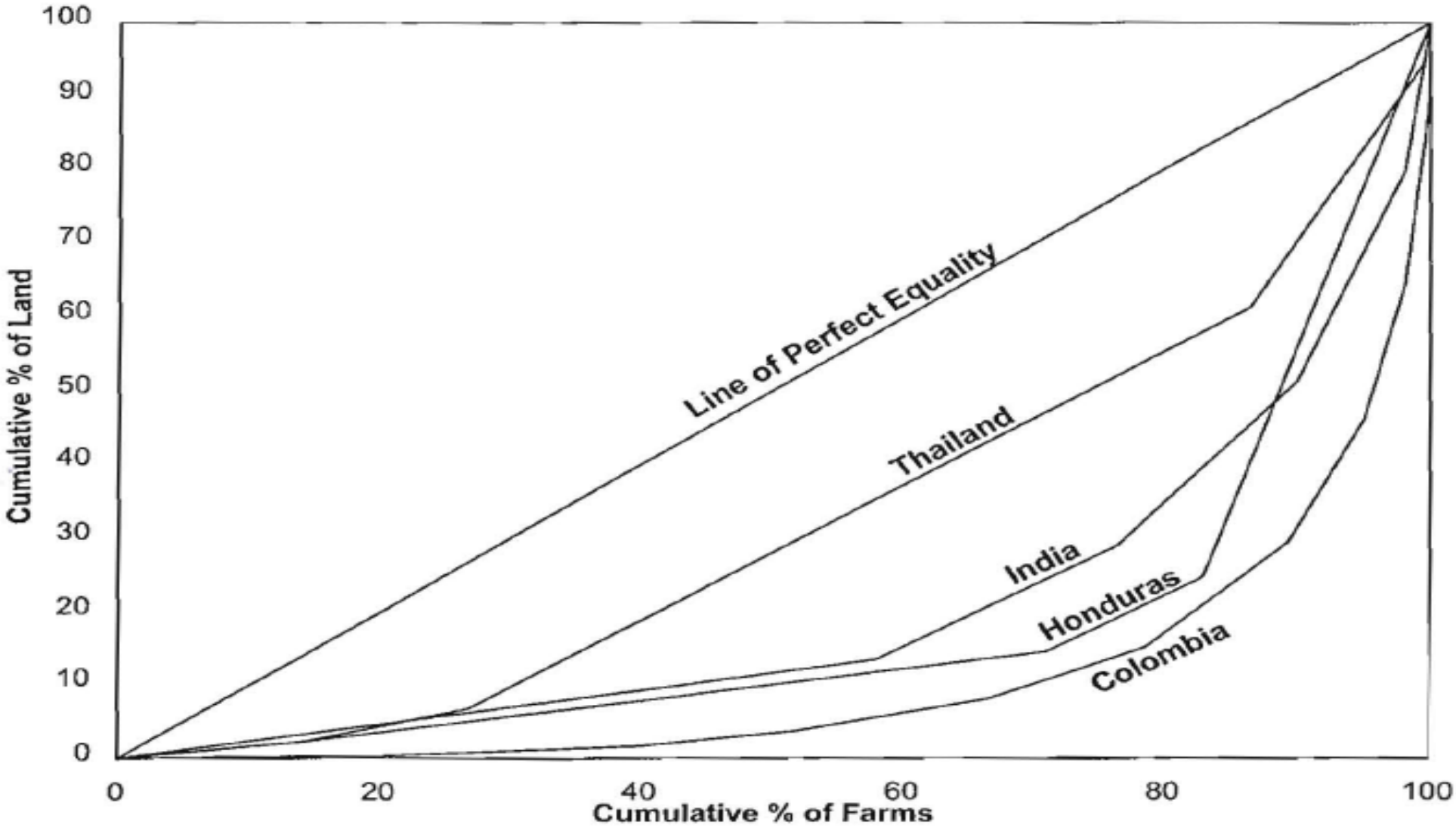

Figure 12.1. Lorenz curves for land holdings in two Asian and two Latin American countries. Source: Agricultural Censuses of Colombia [1988], Honduras [1993], India [1986], and Thailand [1988].

- Table 12.2 shows the distribution of farms and farmland by land tenure status in different parts of the world.
- The average farm size in Asia (2.3 hectares) is much lower than Latin America (46.5 hectares) and North America (161.2 hectares).
  - This reflects the population pressure in the Asian countries.
- The low per capita holdings of land in Asia and the high inequality of landholdings in Latin America have a similar effect: a significant fraction of the farms are owner operated and cultivated.
  - In Asia the fraction is particularly high, standing at around 86%.
  - The Latin American fraction is lower and also includes a significant fraction of very large farms that are cultivated with hired labor.
- The African countries are somewhat of an outlier in this respect.
  - Much of the land is held under forms of group or communal tenure, and individual claims on such plots are weak.

Table 12.2. Distribution of farms and farmland by land tenure status in the 1970 World Census of Agriculture.

	Asia	*Africa*	*Latin America*	*Europe*	*North America*	*World*
Countries	10	4	15	12	2	46
Farms (million)	93.3	3.5	8.6	11.9	3.1	120.4
Farm size (hectares)	2.3	0.5	46.5	7.6	161.2	10.0
Distribution of farms (%)						
Owner cultivation	85.8	5.2	60.3	67.6	63.2	79.2
Pure tenancy	5.9	1.6	17.1	9.3	12.0	7.1
Owner-cum-tenancy	8.2	6.9	6.6	23.0	24.8	10.0
Others	0.0	86.3	16.0	0.1	0.0	3.7
Distribution of farmland (%)						
Owner cultivation	84.0	9.2	80.4	58.9	36.6	61.1
Pure tenancy	5.9	3.0	6.2	12.5	11.9	9.0
Owner-cum-tenancy	10.1	29.1	5.6	28.5	51.5	27.2
Others	0.0	58.7	7.8	0.1	0.0	2.7
Percentage of share tenancy in tenanted land	84.5	0.0	16.1	12.5	31.5	36.1

Source: Otsuka, Chuma, and Hayami [1992, Table 1].

- Several countries provide for ownership or use rights to tenants who have worked the land for some prespecified number of years.
  - Several Asian countries and countries in Latin America, like Brazil or Mexico, uphold such a principle.
- Such legalization has not always had a potent effect in turning land over to the tiller.
  - Often, the reaction in Latin America has been in the direction of tenant eviction, followed by large-scale mechanized farming.
  - In the case of Asia such legal stipulation often results in a substantial amount of informal tenancy that goes unrecorded in the data.
- The significant presence of owner-cultivators in Asian countries such as Korea and Taiwan is not surprising.
  - These countries exhibit a relatively low degree of inequality in landholdings due to early land reforms.

- Whereas tenancy exists all over the world, there are variations in the forms of tenancy arrangement.
- Latin American tenancy is largely of the **fixed-rent** variety: the tenant pays a fixed sum of money to the landlord in return to the right to cultivate the land.
- Asian tenancy is characterized by a high incidence of **sharecropping**: the tenants pay the landlord an agreed-upon share of the crop.
- In Asia, on the whole, 84.5% of tenanted land is under share tenancy.
  - But the percentage range from around 30% (Thailand), through 50% (India) or 60% (Indonesia), all the way up to 90% in Bangladesh.
- In Latin America, on an average, 16.1% of tenanted land is under sharecropping; the corresponding percentages are much lower:
  - under 10% in countries such as Costa Rica or Uruguay and negligible in Peru, although relatively high at 50% in Colombia.

- Typically richer tenants engage in fixed-rent tenancy.
  - In fixed-rent tenancy the landlord is relieved of all risk: the rent is the same whether the crop does well or not.
    - In this sense, fixed-rent tenancy requires that the tenant be willing and able to bear the risks of agricultural production.
    - This is generally the case if the tenant has substantial wealth of his own.
  - This is indirect evidence that Latin American tenancies are held by large farmers.
- Contrast this with Asia where the bulk of tenancy is in the form of sharecropping.
  - Sharecropping has particular value when the tenant is small and averse to risk:
    - if a given fraction of output is paid as rent, then the tenant is, to some extent, insulated against output fluctuations, because he can share some of these fluctuations with his landlord.
  - This suggests that Asian tenancy probably reflects, on the whole, land leases from relatively large landowners to relatively small landowners.

2. Land Rental Contracts

- The land-lease market is usually more active than that of buying and selling land.
- There is a large literature on tenancy, particularly on *sharecropping*, which is an ancient and yet current institution in most parts of the world.
  - We will focus on two well accepted rationales of sharecropping:
    - trade-off between risk-sharing and incentive provision, and
    - limited liability.
- For a background and for discussion of other issues in the land market of developing countries refer to the following:

1. Ray, Debraj (1998), *Development Economics*, Princeton University Press, Ch. 12.
2. Bardhan, Pranab and Christopher Udry (1999), *Development Microeconomics*, Oxford University Press, Chapter 6.

- Tenancy involves two transactions: labour and land are exchanged with each other.
  - **Fixed rent tenancy contract:** a labourer rents in land in exchange for a *fixed* fee to the land-owner.
  - **Fixed wage contract:** the landlord hires in the labour in exchange for a fixed fee.
  - **Sharecropping tenancy contract:** a labourer rents in the land in exchange for paying the landlord a fee which is linear in output.
- Consider the production function $Q = F(L, T)$:
  - Q: output; L: labour; T: land.
- Tenant's income under these alternative contractual forms is: $y_T = s \cdot Q - R$.
- Correspondingly, landlord's income is: $y_L = Q - y_T = (1 - s) \cdot Q + R$.
- **Fixed rent tenancy contract:** $s = 1$ and $R > 0$.
- **Fixed wage contract:** $s = 0$ and $R < 0$.
- **Sharecropping tenancy contract:** $0 < s < 1$, and $R \gtreqless 0$.

- We discuss what determines the choice of land rental contracts in agriculture:
  - how the landlord chooses between a *fixed-rent* contract, a *sharecropping* contract, or a *wage* contract.

- **Sharecropping**, one of the ancient and yet current institutional arrangements in world agriculture,
  - provided the context of the application of one of the first principal-agent models in economics;
  - began the process of a whole group of development economists probing the micro-economic rationale of informal agrarian institutional arrangements
    - in poor countries in an environment of pervasive risks and information asymmetry.

- We discuss alternative theories of sharecropping with special emphasis on the roles of *risk-sharing*, *incentive provision, limited liability,* and *eviction* and *use rights*.

- The widespread prevalence of sharecropping tenancy in virtually all countries and all times has troubled economists since Adam Smith.
  - The fact that the tenant gets less than the marginal product of his inputs indicates that this agrarian institution is likely to be inefficient.

- Subsequent research based on the economics of information has shown that sharecropping tenancy is an optimal contractual response to *incomplete markets*.

- We present variants of a *principal-agent model* to capture the essence of different theories of tenancy.
  - We take as *given* the following aspects of the economic environment:
    - the production function; the preferences and endowments of landlords and tenants; market wages and rental rates.
  - Then we *derive* endogenously the *optimal contract*.

2.1 The Economic Environment

- **Production Function:**

$$Q = e + \theta. \tag{1}$$

  - Q: output;
  - e: effort put in by the cultivator;
  - θ: a random shock; distributed normally with zero mean and variance σ^2.

- The production function is linear in the tenant's effort, for simplicity.

- Output is stochastic reflecting uncertainties in agricultural production like weather fluctuations, pest attack, and so on.
  - Uncertain production is the reason for potential risk sharing and moral hazard.

- The tenant controls only the mean and not the variance of the production function.

- **Preferences:**

  All agents are *risk-averse*, and their utility as a function of income, y,takes the form:

$$u(y) = -e^{-\beta y},\ \beta > 0. \tag{2}$$

  – $\beta = -\dfrac{u''(y)}{u'(y)}$, the Arrow-Pratt measure of absolute risk aversion;

    ◦ so the utility function takes the constant absolute risk aversion (CARA) form.

- Since, under the tenancy contract, both the landlord and the tenant's incomes are linear in output, Q, consider, in general, $y = a + bQ = (a + be) + b\theta$.

- $\theta \sim N\left(0, \sigma^2\right), \Rightarrow y \sim N\left((a+be), b^2\sigma^2\right) \Rightarrow -\beta y \sim N\left(-\beta(a+be), b^2\beta^2\sigma^2\right)$.

- Recall that if $X \sim N\left(\mu, \sigma^2\right)$, then $Y = e^X$ is log-normally distributed with $E(Y) = e^{\mu+\frac{1}{2}\sigma^2}$.

  – It follows that $E\left(e^{-\beta y}\right) = e^{\left[-\beta(a+be)+\frac{1}{2}b^2\beta^2\sigma^2\right]}$.

$\Rightarrow$ Expected utility of an agent with an income y is

$$E\left(u\left(y\right)\right)=E\left(-e^{-\beta y}\right)=-e^{-\beta\left[\left(a+be\right)-\frac{1}{2}b^{2}\beta\sigma^{2}\right]}=-e^{-\beta\left[E(y)-\frac{\beta}{2}Var(y)\right]}.$$

since $E\left(y\right)=a+be$ and $Var\left(y\right)=b^{2}\sigma^{2}$.

- Since utility is ordinal (positive monotonic transformation of the utility function does not change the preference), let us abuse the notation a bit and consider the expected utility of an agent with an income y as

$$U\left(y\right)=E\left(y\right)-\frac{\beta(W)}{2}Var\left(y\right). \tag{3}$$

  - W: monetary wealth owned by the agent.
  - Assume that the coefficient of absolute risk-aversion, $\beta\left(W\right)$, is a *declining* function of W,
    - that is, the wealthier the agent the less risk-averse he is.

- **Endowments:**
  - The landlord owns a piece of land, monetary wealth W_L, and no labour.
  - The tenant owns no land, monetary wealth W_T, and 1 unit of labour.
- **Markets:**
  - The insurance markets are missing.
  - Land, labour and goods markets are perfectly competitive.

$\Rightarrow$ Landowner could buy the tenant's labour services at the market wage rate w, and the labour-owner could lease in the landlord's land at the market rental rate ρ.

$\Rightarrow$ The reservation (expected) utility of the landlord is ρ, that is, $U_L \geq \underline{U}_L = \rho$, and the reservation (expected) utility of the tenant is w, that is, $U_T \geq \underline{U}_T = w$.

- **Cost of Effort:**
  - Distinguish between labour and effort: the former is the potential to work, and the latter is the actual intensity of work.
  - It is costly to exert effort:

$$c(e) = \tfrac{1}{2}ce^2,\ c > 0. \tag{4}$$

- **Contracting:**
  - Effort, e, is neither observable nor monitorable.

  $\Rightarrow$ The tenant would need incentives to put in effort.

  - We restrict ourselves to *linear contracts*, that is, the tenant's income, y_T, is a linear function of output:

$$y_T = s \cdot Q - R, \text{ where } 0 \leq s \leq 1.$$

    - Let us summarize this contract as (s, R), where
      - s is referred to as the 'share' component and R as the 'fixed-rent' component.

2.2 The First Best

- Under the contract, (s, R), the expected utilities of the tenant and the landlord are:

$$U_T(e, s, R) = E(s \cdot Q - R) - \frac{\beta(W_T)}{2} Var(s \cdot Q - R) - \frac{1}{2} c e^2$$

$$= s \cdot e - R - \frac{\beta(W_T)}{2} s^2 \sigma^2 - \frac{1}{2} c e^2.$$

$$U_L(e, s, R) = E((1 - s) \cdot Q + R) - \frac{\beta(W_L)}{2} Var((1 - s) \cdot Q + R)$$

$$= (1 - s) \cdot e + R - \frac{\beta(W_L)}{2} (1 - s)^2 \sigma^2.$$

- Hence the **social surplus** is

$$S(e, s, R) = U_T(e, s, R) + U_L(e, s, R) = e - \frac{\beta(W_T)}{2} s^2 \sigma^2 - \frac{\beta(W_L)}{2} (1 - s)^2 \sigma^2 - \frac{1}{2} c e^2.$$

- The first best is defined by the optimal effort level, e^*, and contract structure, (s^*, R^*), that maximizes the social surplus.

- The optimal effort level and the share are the solutions of the F.O.C.'s:

$$\frac{\partial S}{\partial e} = 1 - ce = 0, \text{ and}$$

$$\frac{\partial S}{\partial s} = -\beta\left(W_T\right) s\sigma^2 + \beta\left(W_L\right)\left(1-s\right)\sigma^2 = 0,$$

which yields

$$\tilde{e} = \frac{1}{c}, \text{ and} \tag{5}$$

$$\tilde{s} = \frac{\beta\left(W_L\right)}{\beta\left(W_L\right) + \beta\left(W_T\right)}. \tag{6}$$

- The maximized value of social surplus is

$$\tilde{S} = \frac{1}{2c} - \left[\frac{\beta\left(W_T\right)\beta\left(W_L\right)}{\beta\left(W_L\right) + \beta\left(W_T\right)}\right]\frac{\sigma^2}{2}. \tag{7}$$

- As long as $\tilde{S} > w + \rho$, there are gains to be made from trade between the landowning and labour-owning agents.
  - Recall that the reservation (expected) utilities of the tenant and the landlord are w and ρ, respectively.

- The precise division of the gains would depend on the bargaining regime.
  - We adopt the bargaining protocol that is usually adopted in the contract theory literature:
    - the principal can make 'take it or leave it' offers to the agent subject to providing the agent with his reservation (expected) utility.
      - We adopt this bargaining protocol in the form of adding the **participation constraint** of the tenant: $U_T \geq w$.

2.3 Risk Sharing versus Incentive Provision

- Stiglitz (1974) was the first to formalize sharecropping as a compromise between risk-sharing and incentive provision.
  - Stiglitz introduced the first principal-agent model in economics literature to study the *moral hazard* problem with respect to *unobservable* (and therefore *non-contractible*) work effort.

- When effort is unobservable, the tenant would need incentives to put in effort.
  - Then fixed-rental contracts ($s = 1$) will be optimal from the point of view of *incentives*, but that would put too much *risk* on the tenant.
    - A *sharecropping* contract will achieve the right balance between risk-sharing and incentive provision.
      - This is essentially the story of Stiglitz (1974).

- **Incentive Compatibility Constraint:**
  - Since the landlord cannot observe e (and hence cannot specify e in the contract), he has to try to influence it through the choice of s and R.
  - This adds the *incentive compatibility constraint* into the contracting problem:

$$e = \arg\max_{\{e\}} U_T(e, s, R) = \arg\max_{\{e\}} \left[s \cdot e - R - \frac{\beta(W_T)}{2} s^2 \sigma^2 - \frac{1}{2} c e^2 \right] = \frac{s}{c}.$$

- **The Optimal Contracting Problem:**

$$\begin{cases} \max\limits_{\{s,R\}} U_L(e, s, R) \\ \text{subject to} \\ U_T(e, s, R) \geq w \text{: tenant's participation constraint (PC), and} \\ e = \arg\max\limits_{\{e\}} U_T(e, s, R) \text{: tenant's incentive compatibility constraint (ICC).} \end{cases}$$

- Substituting the expressions for expected utilities, the contracting problem becomes

$$\begin{cases} \max\limits_{\{s,R\}} \quad (1-s)\cdot e + R - \frac{\beta(W_L)}{2}(1-s)^2\sigma^2 \\ \text{subject to} \\ s\cdot e - R - \frac{\beta(W_T)}{2}s^2\sigma^2 - \frac{1}{2}ce^2 \geq w : \text{(PC), and} \\ e = \dfrac{s}{c} : \text{(ICC).} \end{cases}$$

- Since the objective function increases with R, (PC) must hold with equality.

$$\Rightarrow R = s\cdot e - \frac{\beta(W_T)}{2}s^2\sigma^2 - \frac{1}{2}ce^2 - w.$$

- Substituting this expression for R into the objective function the problem becomes

$$\begin{cases} \max\limits_{\{s\}} \quad e - \frac{\beta(W_T)}{2}s^2\sigma^2 - \frac{\beta(W_L)}{2}(1-s)^2\sigma^2 - \frac{1}{2}ce^2 - w \\ \text{subject to} \quad e = \dfrac{s}{c}. \end{cases}$$

– That is,

$$\max_{\{s\}} \quad \frac{s}{c} - \frac{\beta(W_T)}{2} s^2 \sigma^2 - \frac{\beta(W_L)}{2} (1-s)^2 \sigma^2 - \frac{s^2}{2c} - w.$$

– F.O.C.:

$$\frac{1}{c} - s\beta(W_T)\sigma^2 + (1-s)\beta(W_L)\sigma^2 - \frac{s}{c} = 0,$$

which yields

$$s^* = \frac{1 + c\beta(W_L)\sigma^2}{1 + c[\beta(W_L) + \beta(W_T)]\sigma^2}, \tag{8}$$

and consequently,

$$e^* = \frac{s^*}{c}, \tag{9}$$

$$R^* = \frac{(s^*)^2}{2c}\left[1 - c\beta(W_T)\sigma^2\right] - w. \tag{10}$$

- Observation 1:
  - As long as $\sigma^2 \neq 0$ (that is, there is some uncertainty and variation in production) and/or $\beta(W_T) \neq 0$ (that is, the tenant is not risk-neutral), $0 < s^* < 1$,
    - that is, *sharecropping* is the optimal form of contract.
  - Share contracts and fixed-rent contracts could coexist depending on the riskiness of production of different crops and on the attitudes towards risk of different tenants.
  - For fixed wage contracts to be seen the tenant has to be infinitely risk-averse.
  - The contractual form depends on
    - the attitudes towards risk of the parties ($\beta(W_L)$ and $\beta(W_T)$),
    - the variance of output (σ^2), and
    - the marginal cost of effort (c).
  - In contrast, in the first-best, the tenant's share depended only on the attitudes towards risk of the contracting parties.

- Observation 2:
  - Compare the effort level e^* (equation (9)) under this contract with the efficient (first-best) effort level $\tilde{e}$ (equation (5)):

$$e^* = \frac{s^*}{c} < \frac{1}{c} = \tilde{e}$$

    as long as $0 < s^* < 1$, that is, under sharecropping.

    - Thus sharecropping is an *inefficient* institutional arrangement compared to fixed-rent tenancy.

  - The difference in effort levels, $\tilde{e} - e^* = \frac{1 - s^*}{c}$, is called the 'agency costs' associated with sharecropping tenancy.

- Observation 3:
  - As uncertainty goes up ($\sigma^2 \uparrow$), the share of the tenant, the effort level and the fixed-rent component goes down.
    - Thus reduction in exogenous uncertainty would imply a movement towards fixed-rent tenancy.
- Observation 4:
  - An increase in the productivity of labour ($c \downarrow$) will increase the share of the tenant, the effort level and the fixed-rent component.
- Observation 5:
  - As the market wage rate (w) goes up, the fixed component of the rent goes down, but nothing else is affected.
    - This is a consequence of the fact that we take mean-variance utility function and effort does not affect the variance of output.

- Observation 6:
  - The more risk-averse a tenant is ($\beta(W_T) \uparrow$), $s^* \downarrow$, $e^* \downarrow$, and $R^* \downarrow$.
  - The more risk-averse a landlord is ($\beta(W_L) \uparrow$), $s^* \uparrow$, $e^* \uparrow$, and $R^* \uparrow$.
  - If we assume that the landlord is very rich so that he is risk-neutral ($\beta(W_L) = 0$), then the share of the tenant is

$$s^* = \frac{1}{1 + c\beta(W_T)\sigma^2} > 0 = \tilde{s}.$$

    That is, the optimal contract is sharecropping than the wage contract.
  - If instead the tenant is risk-neutral ($\beta(W_T) = 0$) while the landlord is risk-averse (($\beta(W_L) > 0$)), we get $s^* = 1$, and
    - only in this case we get full efficiency ($e^* = \frac{1}{c} = \tilde{e}$).

2.4 Tenancy Contracts under Limited Liability

- We now consider a somewhat modified version of the principal-agent model which emphasizes, along with moral hazard, a **limited liability constraint**:
  - *the tenant is liable upto his own wealth level* W_T.
    - This reflects a credit market imperfection.
- The first theoretical model with the limited liability constraint is that of Shetty (1988).
  - Main contribution is the recognition of the *ex post* limited liability constraint:
    - in bad states of nature, the rent cannot be paid completely.
- Laffont and Matoussi (1995) postulates an *ex ante* limited liability constraint:
  - the fixed component of the rent has to be paid in advance;
  - the amount of money that could be taken away (in advance) from the tenant as a fixed-rent is bounded above by his wealth W_T.

- We follow Laffont and Matoussi (1995) to illustrate how the *ex ante* limited liability constraint explains
  - the emergence of *sharecropping* contracts, and
  - the associated *tenancy ladder* where landlord prefers wealthier tenants.

- Consider the same economic environment developed in section 2.1 with the following two modifications:
  - both the landlord and the tenant are risk-neutral (in order to highlight the role of limited liability we downplay the role of risk sharing):

$$\beta\left(W_L\right) = 0 = \beta\left(W_T\right),$$

  - we add the ex ante limited liability constraint that the fixed component of the rent has to be paid in advance and this amount is bounded above by his wealth W_T:

$$R \leq W_T.$$

- **The Optimal Contracting Problem:**

$$\begin{cases} \max\limits_{\{s,R\}} U_L(e,s,R) \\ \text{subject to} \\ U_T(e,s,R) \geq w\text{: tenant's participation constraint (PC), and} \\ e = \arg\max\limits_{\{e\}} U_T(e,s,R)\text{: tenant's incentive compatibility constraint (ICC), and} \\ R \leq W_T\text{: tenant's limited liability constraint (LLC).} \end{cases}$$

- As before, the incentive compatibility constraint requires: $e = \dfrac{s}{c}$.
- Using $\beta(W_L) = 0 = \beta(W_T)$ and $e = \dfrac{s}{c}$, we have

$$U_L(e,s,R) = (1-s)\cdot e + R = \frac{s(1-s)}{c} + R,$$

$$U_T(e,s,R) = s\cdot e - R - \tfrac{1}{2}ce^2 = \frac{s^2}{2c} - R.$$

- Then the contracting problem becomes

$$\begin{cases} \max\limits_{\{s,R\}} \quad \dfrac{s\left(1-s\right)}{c}+R \\ \text{subject to} \\ \dfrac{s^2}{2c}-R\geq w : \text{(PC), and} \\ -R\geq -W_T : \text{(LLC).} \end{cases}$$

- Form the Lagrangian

$$\mathcal{L} = \frac{s\,(1-s)}{c} + R + \lambda\left[\frac{s^2}{2c} - R - w\right] + \mu\left[-R + W_T\right],$$

so that the first-order necessary and sufficient conditions are

$$s\text{:} \qquad \frac{1-2s}{c} + \lambda \cdot \frac{s}{c} = 0, \tag{i}$$

$$R\text{:} \qquad 1 - \lambda - \mu = 0, \tag{ii}$$

$$\lambda\text{:} \qquad \lambda\left[\frac{s^2}{2c} - R - w\right] = 0,\ \lambda \geq 0,\ \frac{s^2}{2c} - R - w \geq 0, \tag{iii}$$

$$\mu\text{:} \qquad \mu\left[-R + W_T\right] = 0,\ \mu \geq 0,\ -R + W_T \geq 0. \tag{iv}$$

- **Case I: Neither constraint binds:**
  - Then $\lambda = 0$, and $\mu = 0$; but this contradicts (ii).

  $\Rightarrow$ This case cannot arise in a solution to the contracting problem.

- **Case II: PC binds, LLC does not bind:**
  - Then $\mu = 0$, so that (ii) $\Rightarrow \lambda = 1$, and hence (i) $\Rightarrow s = 1$.
  - PC binds $\Rightarrow R = \frac{1}{2c} - w$.
  - LLC does not bind $\Rightarrow W_T > R$, $\Rightarrow W_T > \frac{1}{2c} - w$.
  - **Conclusion:** When $W_T > \frac{1}{2c} - w$, $\left(s^* = 1, \text{ and } R^* = \frac{1}{2c} - w \right)$ solves the contracting problem.

- **Case III: LLC binds, PC does not bind:**
  - Then $\lambda = 0$, so that (ii) $\Rightarrow \mu = 1$, and (i) $\Rightarrow s = \frac{1}{2}$.
  - LLC binds $\Rightarrow R = W_T$.
  - PC does not bind $\Rightarrow W_T < \frac{1}{8c} - w$.
  - **Conclusion:** When $W_T < \frac{1}{8c} - w$, $\left(s^* = \frac{1}{2}, \text{ and } R^* = W_T \right)$ solves the contracting problem.

- **Case IV: Both PC and LLC bind:**
  - LLC binds $\Rightarrow R = W_T$.
  - Then PC binds $\Rightarrow s = \sqrt{2c\,(w + W_T)}$.
  - (i) $\Rightarrow \lambda = 2 - \dfrac{1}{s}$.
    - Then $\lambda \geq 0 \Rightarrow s \geq \dfrac{1}{2}$

$$\Rightarrow \sqrt{2c\,(w + W_T)} \geq \frac{1}{2} \Rightarrow W_T \geq \frac{1}{8c} - w.$$

  - Since $\mu \geq 0$, (ii) $\Rightarrow \lambda \leq 1, \Rightarrow s \leq 1$

$$\Rightarrow \sqrt{2c\,(w + W_T)} \leq 1 \Rightarrow W_T \leq \frac{1}{2c} - w.$$

- **Conclusion:** When $\dfrac{1}{8c} - w \leq W_T \leq \dfrac{1}{2c} - w$, $\left(\dfrac{1}{2} \leq s^* = \sqrt{2c\,(w + W_T)} \leq 1, \text{ and } R^* = W_T\right)$ solves the contracting problem.

- When the tenant is wealthy enough ($W_T > \frac{1}{2c} - w$) that the LLC does not bind, then from the 'risk sharing versus incentive provision' model we know that
  - $s^* = 1$ and, from the binding PC, $R^* = \frac{1}{2c} - w$.

- When W_T is just below $\frac{1}{2c} - w$, then the landlord would want to maintain $s = 1$ and keep R equal to $\frac{1}{2c} - w$,
  - but this is not feasible any more, the LLC starts binding.
    - One option is to keep $s = 1$ (so that effort remains at the efficient level), and allow the PC not to bind.
    - The other option is to reduce s and secure some of the rents the tenant is earning (if PC does not bind, the tenant earns rents by definition) at the cost of reducing effort.
    - It turns out that the second option is more profitable to the landlord.

- Thus we see a *sharecropping* contract even when both parties are risk-neutral.
  - It arises from the fact that because of limited liability the maximum amount that the tenant will be able to pay to the landlord as a fixed fee is just W_T
    - which may be small so that it might not be possible for the principal to squeeze as much as possible out of the tenant.

- Can this process continue as W_T becomes smaller and smaller?
  - The answer is no.
    - If $W_T < \frac{1}{8c} - w$, then the landlord sets $s^* = \frac{1}{2}$ and would not bother reducing the tenant's payoff down to the reservation level as the cost in terms of incentives would be too much.

- We can summarize the solution to the contracting problem as follows:

W_T	s^*	R^*	U_L
$W_T < \frac{1}{8c} - w$	$\frac{1}{2}$	W_T	$U_L < \frac{3}{8c} - w$
$W_T = \frac{1}{8c} - w$	$\frac{1}{2}$	W_T	$\frac{3}{8c} - w$
$\frac{1}{8c} - w < W_T < \frac{1}{2c} - w$	$\frac{1}{2} \leq \sqrt{2c\left(w + W_T\right)} \leq 1$	W_T	$\frac{3}{8c} - w < U_L < \frac{1}{2c} - w$
$W_T \geq \frac{1}{2c} - w$	1	$\frac{1}{2c} - w$	$\frac{1}{2c} - w$

- As the tenant's wealth increases ($W_T \uparrow$),
  - tenant's cropshare increases ($s^* \uparrow$), & landlord's expected utility increases ($U_L \uparrow$).
- This implies a **tenancy ladder**: richer tenants are preferred by the landlord and are given higher crop shares.

- Observation 1:
  - Share contracts and fixed-rent contracts could coexist, but not pure wage contracts.
    - The contractual form would depend on the tenant's reservation payoff (w), his wealth level (W_T), and the marginal cost of effort (c).
- Observation 2:
  - The effort level e^* would, in general, be different from the surplus maximizing level, $\frac{1}{c}$.
    - The difference, which can be called 'agency costs' associated with sharecropping tenancy, is $(1 - s^*)\frac{1}{c}$.
  - Sharecropping is less efficient than fixed-rental tenancy which is the optimal contract only when the tenant's wealth exceeds $\frac{1}{2c} - w$.

- Observation 3:
  - As uncertainty goes up ($\sigma^2 \uparrow$), nothing changes as, by assumption, both parties are risk-neutral.
- Observation 4:
  - An increase in the productivity of labour ($c \downarrow$) will, in general, decrease the tenant's cropshare and increase his effort level.
    - The fixed-rent component would go up for the richest tenants for whom the LLC was not binding.
- Observation 5:
  - As the wage rate w goes up, the cropshare and effort goes up and the fixed-rent remains unchanged if the LLC is binding.
    - Otherwise it affects nothing.

3. Is Sharecropping Associated with Lower Yields?

- Shaban's (1987) study, using ICRISAT data, is one of the most careful contribution in this area.
  - It is not enough to simply check whether there are differences in yield per acre across sharecropped land and other forms of land use.
    - We must carefully control for several other factors that systematically vary with the form of tenancy (and not just the application of labour or other non-monitored inputs).
  - Shaban's study goes a long way toward handling these serious difficulties.
- The main idea (which handles quite a lot of otherwise uncontrollable variations) is to study the productivity of the *same household* that owns some land and sharecrops other land.
  - The ICRISAT data is full of such 'mixed' families.

- At one stroke, this insight permits the researcher to control for all sorts of family-related characteristics that vary systematically across owned and sharecropped land.
  - Families that own land may have better access to working capital than families that sharecrop, in which case the productivity on owned land may be higher.
    - However, this cannot be attributed to inefficiency of sharecropping.
  - A poor sharecropper may have few alternative uses for his labour and thus may farm the land more intensively despite the disincentive effect of sharecropping.
    - Then productivity will not be too different across owned or sharecropped land.
      - But this does not rule out the possibility that the inefficiency is still there.
  - Land quality may vary systematically across tenanted and untenanted land.
    - Shaban (1987) included plot values as well as dummy variables for irrigation and other measures of soil quality in the regression.
- After all these variables are controlled for, the only remaining differences are expected to stem from the form of the tenancy contract.

Results of Shaban (1987)

- Output and input intensities per acre are higher on the owned plots of a mixed sharecropper compared with the sharecropped plots.
  - Average differences: 32.6% for output; between 19 and 55% for the major inputs.
- Differences in irrigation across tenure status are important in explaining a large fraction of the input and output differences; but certainly not all.
  - Controlling for irrigation, plot value, and soil quality, the average differences between owned and sharecropped plots are higher by 16.3% for output, 20.8% for family male labour, 46.7% for family female labour, and 16.6% for bullock labour.
- Differences in input and output intensities between owned and sharecropped plots are also large and significant when attention is restricted to the plots of mixed sharecroppers on which only one crop (sorghum) is grown.
- When the variation in irrigation, plot value, and soil quality is controlled for, no systematic or significant difference between the plots that are owned and those rented on a fixed-rent basis can be detected.

4. Land Ownership

- The enormous inequalities in land holdings (refer to the Introduction) gives rise to four major questions:

1. Is such inequality compatible with **productive efficiency**?
2. If there is an efficiency loss, can it be repaired through the operation of **land rental markets**?
3. If land rental markets are not adequate to restore efficiency, would **land sales** from rich to poor spontaneously redress the balance?
4. If neither land rental markets nor land sales markets are sufficient, what is the role of **land reform**?

4.1 Farm Size and Productivity

- Stylized fact: Small farms are more productive than large farms.
- **Table 12.5** summarizes the findings of Sen (1981) from West Bengal.
  - A clear evidence of a negative relationship between productivity and farm size among owner-cultivated farms.
  - Among farms that have some tenanted land, there is no clear trend.
    - The very smallest farms have the lowest productivity, but among the remaining classes of farms, productivity continues to decline with size.
    - Note that in every size class, productivity per acre on sharecropped land is lower than the productivity of the same farms under owner cultivation.
- **Tables 12.6** and **12.7** present aggregated information for India (as a whole), north-east Brazil, the Punjab (Pakistan), and Muda river region (Malaysia).
  - The evidence supports the decreasing farm-size productivity relationship.

Table 12.5. Rupees of output per acre by size group and tenure: West Bengal.

Operated area (acres)	Pure owners (Rs/acre)	Farms with some crop sharing		
		Overall productivity (Rs/acre)	Productivity on owned land (Rs/acre)	Productivity on sharecropped land (Rs/acre)
0–3	1313	798	867	604
3–5	1044	909	1099	709
5–8	960	842	1130	676
8–12	691	843[a]	959[a]	604[a]
12+	624			
All	902	851	1047	658

Source: Sen [1981: Table 7].

[a]The last two size groups have been merged because of an insufficient number of observations.

Table 12.6. Farm size and land productivity: India.

Range of farm size (acres)	*Average farm size (acres)*	*Income per acre (rupees)*
0–5	3.0	737
5–15	9.3	607
15–25	19.5	482
25+	42.6	346

Source: Berry and Cline [1979, Table A-1].

Table 12.7. Farm size and land productivity: Selected regions.

Farm size	*Northeast Brazil*	*Punjab, Pakistan*	*Muda, Malaysia*
Small farm (hectares)	563 (10.0–49.9)	274 (5.1–10.1)	148 (0.7–1.0)
Largest farm (hectares)	100 (500+)	100 (20+)	100 (5.7–11.3)

Notes: Largest farm productivity is normalized to 100. "Small farm" refers to second smallest size range. Source: Berry and Cline [1979].

Is This Surprising? Arguments for Increasing Returns:

- Technology with fixed costs (tractors, harvesters, threshers, pump sets).
- Larger farmers have better access to credit.

Is This Surprising? Arguments for Decreasing Returns:

- Agency problems: large farms are cultivated by hired labour, which has fewer incentive to work hard.
  - Small farms are owner cultivated; does not suffer from these agency problems.
- Imperfect labour markets with unemployment reinforces the last point by reducing the opportunity cost for family labour relative to that of hired labour.
- **Conclusion:** Available evidence suggests that the productivity gains arising from incentives (in the background of imperfect markets) do outweigh the technological returns to scale from larger plots.

4.2 Land Sales

- The empirical evidence in the last section shows that there are clear productivity advantages of small farms over large farms.
  - This brings us to the issue of land sales: if small landowners can buy land from rich landowners, then productivity gains can be realized.
- The question is: Do land markets work adequately?
  - The available empirical evidence suggests that they do not.
  - Land sales from relatively rich to relatively poor, while not entirely absent, are not very common either.
  - There is some evidence for land sales by the relatively rich, perhaps to finance weddings or large investments.
  - But most land sales appears to be in the form of distress sales that occur from poor to rich: land transfers in lieu of debt repayment.

Why are land sales markets so thin?

- When credit markets are imperfect, the value of land consists of two components.
  - The first component is the discounted sum of income streams that will emanate from working the land.
  - The second component comes from imperfect credit markets:
    - land can be used as collateral, and this ability has value measured by the profitability of the additional loans that can be obtained by mortgaging the land.
- A seller will therefore want to sell the land for a price that is no less than the sum of these two values.
- Now consider what a buyer is willing to pay.
  - If the buyer must obtain a loan to buy the land and must mortgage that very piece of land for the loan, then he can't reap the collateral value until the loan is paid off.
  - Hence the buyer's present valuation of the land must be *less* than that of the seller.
- Buyer's valuation being less than the seller's valuation, no sale of land will occur.

4.3 Land Reform

- Put together all that we have discussed so far.
  - Productivity is higher on smaller plots than on larger plots.
  - These productivity gains cannot be realized by tenancy, because tenancy contract itself erodes the productivity gain.
  - Land sales markets cannot adequately substitute for land tenancy markets.
- To realize the productivity gains, we are then left with the only option of land transfers from rich to poor by the measures that is collectively known as land reform.
- It takes tremendous political will (resistance from powerful landed lobbies, in particular) to push a land reform program through.
- Major land reforms in the world have been the product of political upheavals in society where large landowners are viewed as enemies, and so there is immense popular support for land reform.

5. References

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