Agricultural Organization and Productivity:

Agrarian Organization

1. Introduction

- Eswaran and Kotwal (1986) discuss the implications of imperfections in credit and labour markets for the nature of agrarian organization.

- Principal focus on emergence of different “classes” within a given agrarian economy,
  - as conventionally defined by sociologists or Marxist scholars in terms of ownership of assets such as land.

- This paper
  - highlights the importance of class structure for the performance of the economy;
  - explains some empirical regularities such as
    - the inverse farm size – productivity relationship,
    - why the poor may be restricted in their productive choices,
    - how inequality in landholding affects class structure and agricultural productivity.

- Two universal problems that entrepreneurs must contend with.
  - Credit Market Imperfection: An agent generally has access only to a limited amount of working capital.
  - Labour Market Imperfection: Hired workers are subject moral hazard, necessitating their supervision.
- Eswaran and Kotwal (1986) model, for an agrarian economy,
  - the constraints imposed on entrepreneurs' activities by these two problems,
  - determine endogenously the various organizational forms of production, and the resulting allocation of resources.

- Agricultural production typically involves several months lag between the time inputs are purchased and the time output is marketed.

$\Rightarrow$ Access to working capital and hence to credit market plays an important role in a farmer's production decisions.

- In poor agrarian economies credit is invariably rationed according to the ability to offer collateral.

$\Rightarrow$ The amount of working capital a farmer can mobilize depends on the amount of land he owns,

  ◦ a good proxy for his overall wealth , and his ability to offer collateral.

- Hired hands have a propensity to shirk.

⇒ They need to be supervised;

⇒ the labour time that can be hired from the market is only an imperfect substitute for one's own time.

- Time endowment of a farmer becomes a crucial constraint on his decisions.

⇒ How he allocates his time becomes an important determinant of the production organization.

- The theoretical framework focuses on the effects of these two constraints on the behaviour of utility-maximizing agents.

- In the partial equilibrium form of the model it is shown that agents, through their optimal time allocation, determine the organization of production they adopt.
  - This explains the emergence of different “classes” within an agrarian economy.
  - It also provides an explanation of the inverse relationship between farm size and the labour input per acre.
- The authors have used the general equilibrium form of the model to examine the effects of land and credit reform on
  - social welfare,
  - income distribution,
  - the number of people below poverty,
  - the proletarianization of marginal cultivators,
  - the welfare of the landless class.

2. The Partial Equilibrium

- We assume that the factor prices are exogenously given.
  - Consider the optimization problem facing an agent constrained by
    - the credit available to him and by his time endowment.

- The production function:

$$q = \epsilon\, f\,(h, n) \tag{1}$$

  - q: output; h: land; n: labour;
  - ϵ is a positive random variable with expected value unity,
    - embodies the effect of stochastic factor such as the weather;
  - both inputs are essential for production;
  - $f\,(h, n)$ is assumed to be linearly homogeneous, increasing, strictly quasi-concave and twice-continuously differentiable in its arguments.

- Land and labour can be hired in competitive markets at exogenously given prices:
  - v: rental rate for land;
  - w: wage rate for labour.
- Price of output, P, is also exogenously given.
- Production entails the incurrence of *fixed set-up costs*, K.
  - It is introduced as a proxy to represent the fixed component of costs associated with other inputs.
    - Example: sinking of tube-wells for irrigation.
  - These costs will render unprofitable the cultivation of extremely small plot sizes.
  - These costs will be partly responsible for the existence of a class of pure agricultural workers in the economy.

- $\bar{B}$: the amount of working capital to which a farmer has access.
  - It is determined by the assets he possesses,
    - mainly the amount of land he owns.
- Notations:
  - $\bar{h}$: the amount of land the farmer owns.
    - Since land can be leased in or out, h can be greater or less than $\bar{h}$.
  - l: the amount of labour time he himself supplies on his farm
  - t: the amount of labour time he sells on the labour market.
  - r: the (exogenously fixed) interest rate per crop season.
- The scale of operation of a farmer is bounded by the **working capital constraint**:

$$vh + w(n - l) \leq \bar{B} - K + v\bar{h} + wt. \tag{2}$$

- The potential for moral hazard on the part of hired workers makes their supervision imperative.
  - The presence of ϵ in the production process renders it impossible to infer from the knowledge of any two of q, h and n, the value of the third.
  - Even a supervisor will have incentives to shirk; needs to be monitored.

$\Rightarrow$ The entrepreneur must himself undertake the task of supervision.

- Each agent is endowed with 1 unit of time that he allocates across
  - the amount of leisure, R
  - the amount of labour time he sells on the labour market, t
  - the amount of labour time he himself supplies on his farm, l
  - supervising hired labour on his farm, S.

- The amount of labour time required to supervise L hired workers is

$$S = s(L), \tag{3}$$

  - $s'(L) > 0$, $s''(L) > 0$, and $s(0) = 0$;
    - also $s'(0) < 1$, supervision is not prohibitively costly;
  - strict convexity is rationalized on the grounds that it renders finite the size of the enterprise despite linear homogeneity of the production function.

- The **time endowment constraint** facing an entrepreneur is:

$$l \equiv 1 - R - t - s(L) \geq 0. \tag{4}$$

- All agents have identical preferences:

$$U\left(Y,R\right)=Y+u\left(R\right); \tag{5}$$

  - Y: the present value earnings of the period;
  - $u'\left(R\right)>0$, $u''\left(R\right)<0$;
  - $\lim_{R\to 0} u'\left(R\right)=\infty$;
  - Linearity of the utility function in income implies that the agents are risk-neutral.

- We now turn to the optimization problem facing an agent.
  - For the moment we examine his choices assuming that he opts to cultivate.
  - We subsequently analyze his choice between being a cultivator and an agricultural worker.

- Notations:
  $\beta \equiv \dfrac{1}{1+r}$ is the discount factor per crop period;
  define $B \equiv \bar{B} - K + v\bar{h}$.

- An entrepreneur seeking to maximize his expected utility by cultivation will solve:

$$\underset{\{R,h,t,L\}}{\text{Maximize}}\ P\beta f\left(h, l+L\right) + wt - v\left(h - \bar{h}\right) - wL - K + u\left(R\right), \tag{6}$$

subject to

$$B + wt \geq vh + wL, \tag{7}$$

$$l \equiv 1 - R - t - s\left(L\right) \geq 0,\ L \geq 0,\ t \geq 0. \tag{8}$$

- Given our assumptions on $u\left(R\right)$ and $f\left(h, n\right)$, this problem has the classic Kuhn-Tucker form.
  - For given v, w and B, there exists a unique solution.

- The following proposition demonstrates that there are four potential modes of cultivation that can arise.

- **Proposition 1.** *The solution to the optimization problem admits four distinct modes of cultivation*, *separated by three critical values of* B – B_1, B_2, B_3 (*with* $0 < B_1 < B_2 < B_3$) – *such that the entrepreneur is a*

(I) **Labourer-cultivator** ($t > 0, l > 0, L = 0$) *for* $0 \leq B < B_1$,

(II) **Self-cultivator** ($t = 0, l > 0, L = 0$) *for* $B_1 \leq B < B_2$,

(III) **Small capitalist** ($t = 0, l > 0, L > 0$) *for* $B_2 \leq B < B_3$,

(IV) **Large capitalist** ($t = 0, l = 0, L > 0$) *for* $B_3 \leq B$.

- In what follows we first discuss the proof of Proposition 1 and then try to understand the intuition for the result.

- Form the Lagrangian

$$\mathcal{L} = P\beta f\left(h, l + L\right) + wt - v\left(h - \bar{h}\right) - wL - K + u\left(1 - l - t - s\left(L\right)\right)$$

$$+\mu\left[B + wt - vh - wL\right] + \lambda_l \cdot l + \lambda_t \cdot t + \lambda_L \cdot L,$$

so that the first-order necessary and sufficient conditions are

$$h: \quad P\beta f_h - v\left(1 + \mu\right) = 0, \tag{i}$$

$$l: \quad P\beta f_n - u'\left(R\right) + \lambda_l = 0, \tag{ii}$$

$$t: \quad w\left(1 + \mu\right) - u'\left(R\right) + \lambda_t = 0, \tag{iii}$$

$$L: \quad P\beta f_n - w\left(1 + \mu\right) - u'\left(R\right) s'\left(L\right) + \lambda_L = 0, \tag{iv}$$

with $\lambda_l \cdot l = 0$, $\lambda_l \geq 0$, $l \geq 0$; $\lambda_t \cdot t = 0$, $\lambda_t \geq 0$, $t \geq 0$; and $\lambda_L \cdot L = 0$, $\lambda_L \geq 0$, $L \geq 0$.

– It is easy to argue that the working capital constraint (7) binds, that is, $\mu \geq 0$ and

$$B + wt = vh + wL. \tag{v}$$

- **Case (I): $t > 0$, $l > 0$, $L = 0$.**
  - Since $f(h,n)$ is linear homogeneous, $f_n(\cdot)$, $f_h(\cdot)$ and $MRTS_{h,n}(\cdot)$ are all functions of the land-to-labour ratio, $\frac{h}{n}$.
  - The F.O.C.'s (i), (ii) and (iii) imply $MRTS_{h,n}\left(\frac{h}{n}\right) = \frac{f_n}{f_h} = \frac{w}{v}$.
    - This equation determines $\frac{h}{n}$ as a constant, say $\left(\frac{h}{n}\right)_1$.
  - Then (ii), $u'(R) = P\beta f_n\left(\left(\frac{h}{n}\right)_1\right)$, determines R so that $1-R$ is distributed between l and t, $1-R = l+t$.
  - This, the constant $\left(\frac{h}{n}\right)_1$, and equation (v), $B + wt = vh$, determine l, t and h.
  - Note that the optimal t decreases with B. Since $t > 0$, this case arises when $B < B_1 \equiv vh_1$, where h_1 is consistent with constant $\left(\frac{h}{n}\right)_1$ and $t = 0$.

- **Case (II): $t = 0$, $l > 0$, $L = 0$.**
  - The F.O.C.'s (i), (ii) and (iii) imply $MRTS_{h,n}\left(\frac{h}{n}\right) = \frac{f_n}{f_h} = \frac{w}{v} + \frac{\lambda_t}{v(1+\mu)}$.
    - Since $\lambda_t \geq 0$, $B \geq B_1$ for the same logic as applied to case (I).
  - Since $t = 0$ and $L = 0$, (v) gives $B = vh$, that is, as $B \uparrow$, $h \uparrow$, implying
    - $f_h \downarrow$ and hence $\mu \downarrow$ (from (i)) as $B \uparrow$;
    - $f_n \uparrow$ and hence $u'(R) \uparrow$ (from (ii)) as $B \uparrow$
  - Combining with (ii) and (iii), condition (iv) gives $\lambda_L = w(1+\mu) + u'(R) \cdot s'(0) - u'(R)$.
    - Then $\lambda_L \geq 0$ implies $w(1+\mu) + u'(R) \cdot s'(0) \geq u'(R)$.
    - Since $\mu \downarrow$ and $u'(R) \uparrow$ as $B \uparrow$, and since $s'(0) < 1$, it follows that the gap between $w(1+\mu) + u'(R) \cdot s'(0)$ and $u'(R)$ decreases as as $B \uparrow$.

$\Rightarrow$ Case (II) arises when $B < B_2$, where B_2 corresponds to that value of B for which $w(1+\mu) + u'(R) \cdot s'(0) + u'(R)$.

- Note that in Proposition 1 B_3 separates the two cases (III) and (IV).
  - So B_3 can be identified by considering cases (III) and (IV) jointly.
  - Cases (III) and (IV) can be combined as $\boldsymbol{t = 0, l \geq 0, L > 0.}$
- **Homework!**

- Now let us try to understand the intuition for Proposition 1.

- One with very little access to capital can lease in only a small amount of land;
  - marginal revenue product of labour on this piece of land, $P\beta f_n$, would be small.
  - He finds it optimal to sell his services on the labour market for part of the time,
    - thereby augmenting his working capital.
    - He then earns a return on this capital by expanding his operation.
  - Such agents are the *labourer-cultivators*: wage-earners cum entrepreneurs.

- The amount of leisure they consume is determined by $u'(R) = P\beta f_n$,
  - the utility derived from the marginal unit of leisure equals the income from cultivation that is foregone as a result.
    - Since f_n is a function of $\frac{h}{n}$, and $\frac{h}{n}$ is constant in this case, it follows that all labourer-cultivators consume the same amount of leisure.

- The greater the working capital a labourer-cultivator has access to, the greater the amount of land he can rent,
  - therefore, the larger is the marginal product of his own labour.
  - As all labour-cultivators consume the same amount of labour, $\rightarrow$ those with larger budget will sell less of their labour services and devote more time to cultivation.
- The agent with $B = B_1$ altogether ceases to transact in the labour market;
  - he devotes all of his non-leisure time to cultivation;
    - ◦ emerges the class of *self-cultivators*.

- If hired and own labour had the same price,
  - an agent with a budget marginally greater than B_1 would hire outside labour.
- This, however, is not so.
  - While the wage rate earned by the agent in the labour market is w,
  - the cost to him of hiring the first worker on his own farm is $w + s'(0)\,u'(R)$,
    - ∘ strictly greater than w since $s'(0) > 0$.

$\Rightarrow$ This agent will not hire outside labour;

  - he will expend his entire budget on hiring land and opt to be a self-cultivator.
  - Agents with greater access to working capital will self-cultivate larger farms by consuming less leisure.

- Since each agent has a limited amount of time endowment, the price of own labour (i.e., the marginal utility of leisure foregone) becomes increasingly higher at higher levels of working capital.

⇒ the ratio of effective price of hired to own labour, $\dfrac{w + s'(0)\,u'(R)}{u'(R)}$, declines.

⇒ An agent with some sufficiently high budget, $B \geq B_2$, will thus find it optimal to hire and supervise outside labour,

  ◦ apart from applying some of his own labour on the farm.

- This agent marks the transition from the class of self-cultivators to the class of *small capitalists*.

- We thus see that the capitalist mode of cultivation emerges as a natural response to the need of entrepreneurs to circumvent their time endowment constraints.

- Agents with budgets greater than B_2 will hire greater amounts of labour and spend more time in supervision.

- At some level of working capital B_3 it pays the agent to specialize in supervision:
  - all labour is hired labour, and
  - the agent maximizes the returns to his access to working capital by only supervising hired hands.

- Agents with $B \geq B_3$ comprise the class of *large capitalists*.

- Denote the solution to the optimization problem by the quartet

$$\left[R^{*}\left(B,v,w\right),\ h^{*}\left(B,v,w\right),\ t^{*}\left(B,v,w\right),\ L^{*}\left(B,v,w\right)\right],$$

and the associated expected utility by

$$U^{*}\left(B,v,w,K\right).$$

- Note that since the constant term $v\bar{h}$ appears additively in the maximand (6), we can write

$$U^{*}\left(B,v,w,K\right)=U^{+}\left(B,v,w,K\right)+v\bar{h}.$$

where $U^{+}\left(\cdot\right)$ is non-decreasing in B.

- In Proposition 1 we presumed that the agent opts to cultivate.
  - Whether or not he will do so will depend on whether or not $U^*(B, v, w, K)$ exceeds his next best alternative:
    - being a pure agricultural worker.
- As an agricultural worker, the maximized utility of an agent who owns (and leases out) an amount of land $\bar{h}$ is given by

$$U_0^*\left(v, w, \bar{h}\right) = \max_R w(1 - R) + u(R) + v\bar{h}. \tag{9}$$

- The agent will opt to cultivate if and only if

$$U^*(B, v, w, K) > U_0^*\left(v, w, \bar{h}\right). \tag{10}$$

- If set-up costs, K, were zero, all agents (including those with $B = 0$) will opt to cultivate if the technology is viable at prices (P, v, w).

- However, if set-up costs are positive and sufficiently large,
  - agents with meagre working capital would find it more attractive to join the labour force on a full-time basis than to cultivate on a scale so small as to be unprofitable.
- Those agents for whom (10) is violated will form the class of **pure agricultural workers**.
  - Thus, there emerges a five-fold class structure in this model of an agrarian economy.
- We shall assume that all the modes of cultivation we have discussed are manifest.

- Next we turn our attention to the **land-to-labour ratio** of farms as a function of the entrepreneurs' access to working capital, B.
  - The following proposition records the results comparing the land-to-labour ratio and average productivity per acre across farms spanning the four modes of cultivation.

- **Proposition 2.** *As a function of* B,

(a) *the land-to-labour ratio is constant over the labourer-cultivator class and strictly increasing over all other classes*,

(b) *the* (*expected*) *output per acre of farms is constant over the labourer-cultivator class and strictly decreasing over all other classes*.

- We have already proved that $\left(\frac{h}{n}\right)$ is constant under case (I).

- For all the other cases note that as $B\uparrow, h\uparrow$.

$\Rightarrow f_n \uparrow$ and $f_h \downarrow, \Rightarrow MRTS_{h,n}\left(\frac{h}{n}\right) = \frac{f_n}{f_h} \uparrow$.

  - Since $MRTS_{h,n}$ is an increasing function of $\left(\frac{h}{n}\right)$, it follows that $\left(\frac{h}{n}\right)$ increases as B increases for cases (II) - (IV).

- Part (b) of Proposition 2 follows directly from part (a) and the linear homogeneity of the production function.

- Let us now discuss the intuition for Proposition 2.

- The agents are effectively setting the marginal products of land and labour equal to the ratio of their *perceived prices*.

- The perceived price of land is the same for all agents, and equals its market price.

- All labourer-cultivators consume the same amount of leisure,

$\Rightarrow$ the perceived price of own labour is constant for all $B \leq B_1$.

  - Since the price ratio of the factors (land and own labour) is constant for $B \leq B_1$,

    - production from a linearly homogeneous technology will use the factors in a fixed ratio.

- Beyond B_1, increases in B induce the entrepreneurs to consume less leisure,

  - resulting in a rising perceived price of own labour.

- Since the price of land is constant, we observe a bias towards land in the use of factors under self-cultivation:
  - the land-to-labour ratio increases with B.
- In the capitalistic mode of production, this effect is further reinforced by the fact that
  - the cost of supervising hired labour increases at an increasing rate with the amount of labour hired.

3. The General Equilibrium

- We set up the general equilibrium framework where
  - the factor prices, wage rate (w) and rental rate (r), are determined endogenously as those which clear the labour and land-rental markets,
  - the class structures emerge endogenously.
- The general equilibrium framework enables us to evaluate the *income distribution* and *welfare effects* of policy actions such as
  - *land reform* and *credit reform*.

- The present value of the output price, $P\beta$, is normalized to unity.

- Since analytic results are difficult to obtain in general equilibrium, we take resort to specific functional forms and numerical methods.

$$f(h,n) = Ah^{\frac{1}{2}}n^{\frac{1}{2}},\ (A>0), \tag{11}$$

$$u(R) = DR^{\frac{1}{2}},\ (D>0), \tag{12}$$

$$\bar{B}\left(\bar{h}\right) = \theta\bar{h} + \phi,\ (\theta \geq 0,\ \phi \geq 0), \tag{13}$$

(If $\phi > 0$, even landless agents have access to some credit.)

$$s(L) = bL + cL^2,\ (0 < b < 1,\ c \geq 0). \tag{16}$$

- The total amount of land (exogenously given), H, is distributed across N_0+N_1 agents,
  - N_1 agents own strictly positive amount of land; N_0 agents are landless.
- Distribution of ownership across the landed agents is not necessarily egalitarian.
  - Index a landed agent by the proportion, p, of the landed agents who own smaller holdings than he does.
  - Proportion of land held by all landed agents $p' < p$, $F(p)$, is given by Pareto distribution:

$$F(p) = 1 - (1-p)^{\delta}, \; (0 < \delta \leq 1). \tag{14}$$

  - Larger $\delta \rightarrow$ more egalitarian ownership distribution across the N_1 landed agents.
- (14) $\rightarrow$ the amount of land agent p owns, $\bar{h}(p)$, is given by:

$$\bar{h}(p) = H \cdot \delta (1-p)^{\delta-1}. \tag{15}$$

  - Together, (13) and (15) determine the amount of credit available to every agent.

3.1 General Equilibrium: Class Structure

- Figures 1 and 2 show the percentage of total land operated in equilibrium under different modes of production as a function of δ which characterizes land distribution.
  - There is no landless people in Figure 1 ($N_0 = 0$);
  - there are landless agents in Figure 2.
- If the ownership distribution is extremely unequal ($\delta \approx 0$), the dominant mode of production is large capitalist farming whether or not there exists a landless class.
  - The 'latifundia' agriculture of north-east Brazil would correspond to this case.
- When there is relatively uniform distribution of land ownership ($\delta \approx 1$) and an absence of landless rural workers, the dominant mode of production is self-cultivation (Figure 1).
  - Example: Agrarian areas of present-day Taiwan and Japan.

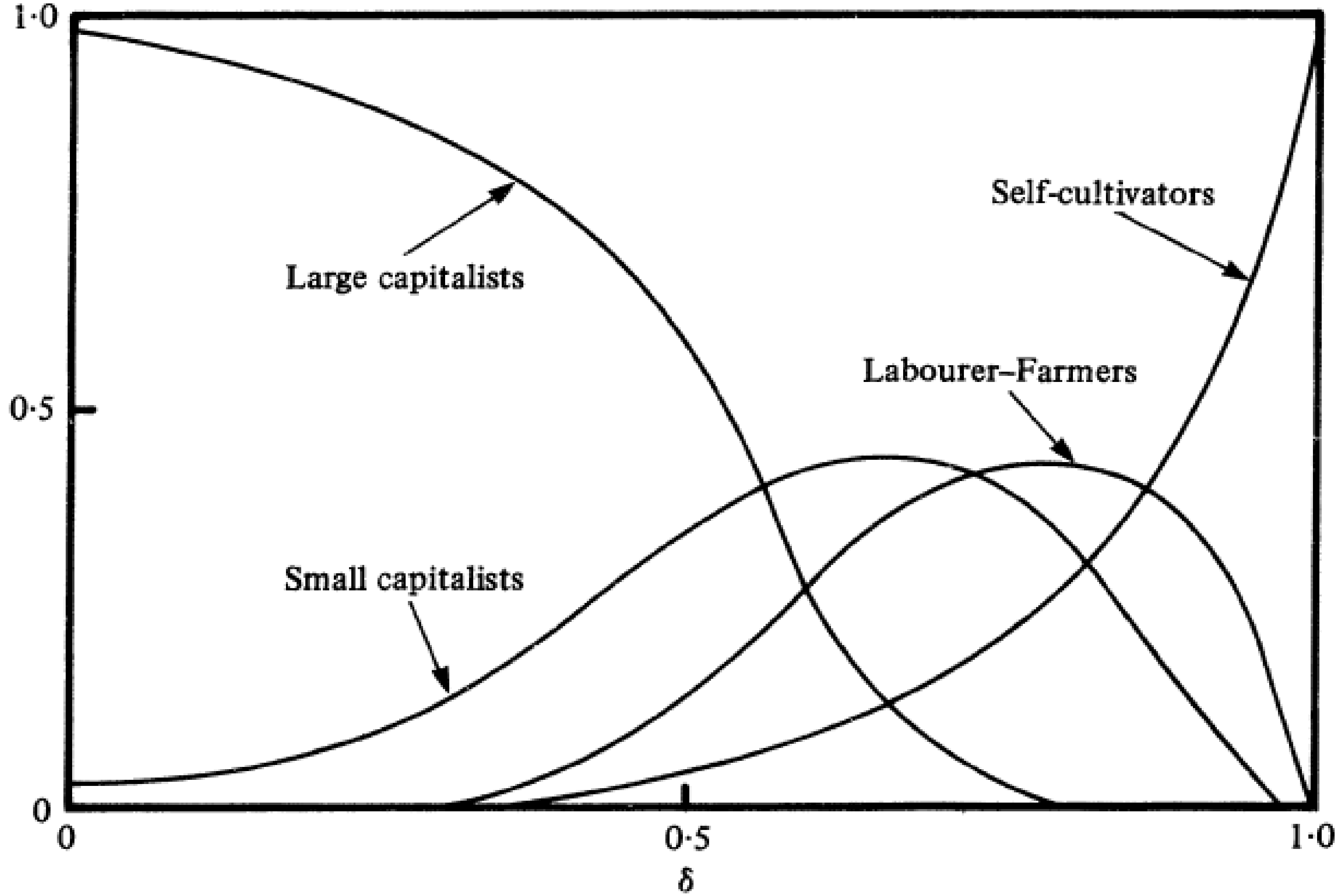

Fig. 1. Proportion of land operated under various modes of cultivation as a function of δ. Parameter values: $A = 5$, $b = 0{\cdot}1$, $D = 0{\cdot}1$, $K = 0{\cdot}5$, $\theta = 1$, $\phi = 0$, $H = 0{\cdot}5$, $N_0 = 0$, $N_1 = 1$.

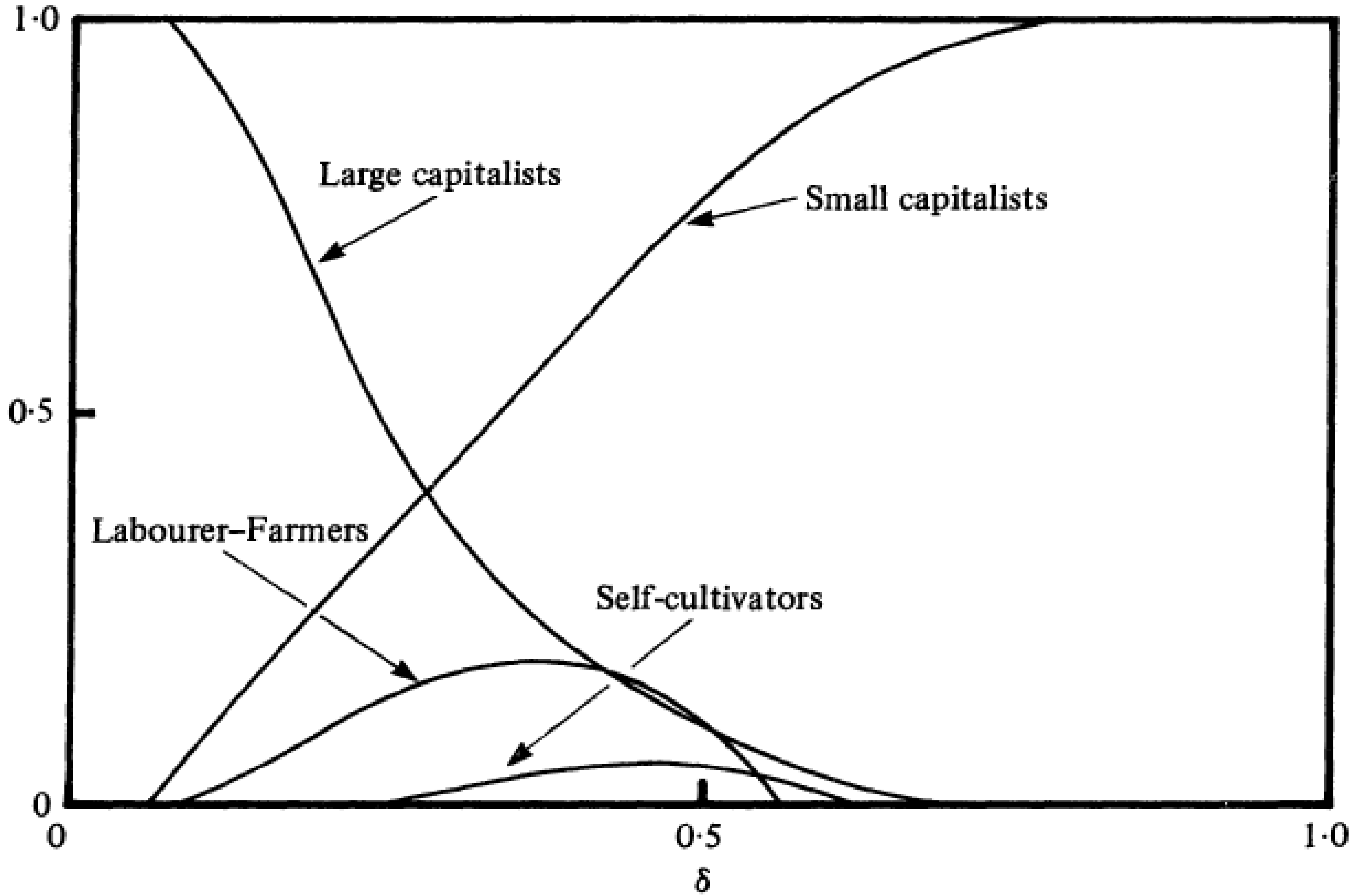

Fig. 2. Proportion of land operated under various modes of cultivation as a function of δ. Parameter values: $A = 5$, $b = 0{\cdot}3$, $c = 0{\cdot}01$, $D = 0{\cdot}1$, $K = 0{\cdot}5$, $\theta = 1$, $\phi = 0$, $H = 1$, $N_0 = 0{\cdot}5$, $N_1 = 1$.

- In the limit when the distribution is perfectly uniform, $\delta = 1$, the credit available will be identical for all cultivators.
  - This will yield an equilibrium involving only self-cultivators, owning and operating identical amounts of land.
  - Consistent with Rosenzweig's (1978) empirical findings in Indian agriculture that
    - participation in labour market declines with decreases in landholding inequality.
- If there exists a class of landless workers, the egalitarian landed class will be able to hire these workers to supplement their own labour,
  - the landed agents will all be small capitalists (Figure 2, $\delta \to 1$).
- Large capitalism $\to$ there must exist a sizeable class of agricultural labourers.
  - Consistent with Bardhan's (1982) findings in West Bengal:
  - the proportion of wage labourers in rural labour force is positively and very significantly associated with the inequality of distribution of cultivated land.

3.2 General Equilibrium: Land Reform

- Land reform is defined to be an increase in the land distribution parameter δ.
- Figure 3 allows us to evaluate the impact of land reform on
  - social welfare,
  - relative income distribution (measured by the Gini index, G_i),
  - absolute poverty (measured as the proportion of total population below an arbitrarily selected poverty line income, Y_p).
- Figure 3 also presents the land-ownership Gini coefficient, $G_h = \dfrac{1-\delta}{1+\delta}$.
- An increase in the distribution parameter δ (i.e., greater equality)
  - reduces the income inequality ($G_i \downarrow$),
  - reduces the proportion of the rural population below the poverty line,
  - simultaneously results in an increase in social welfare.

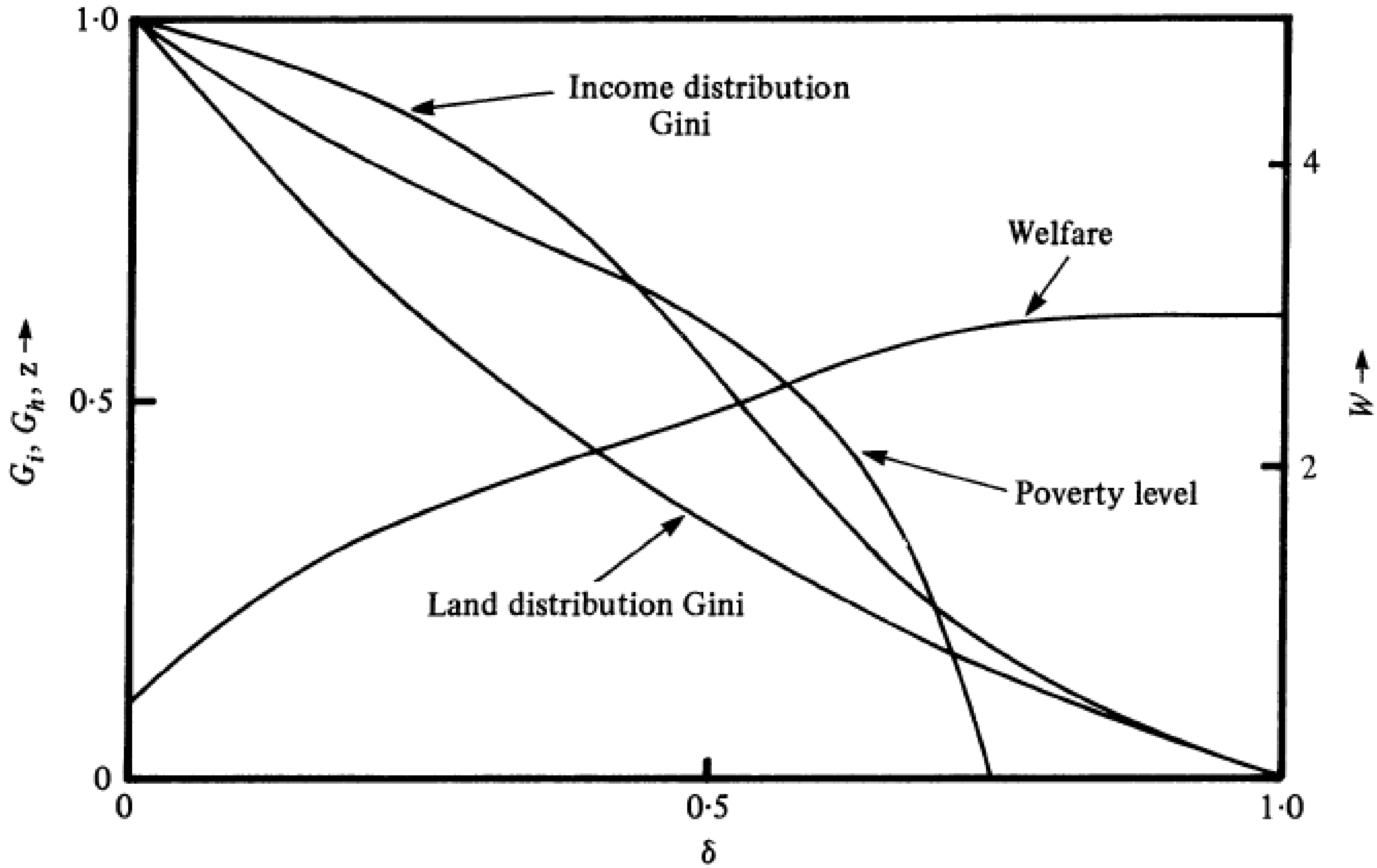

Fig. 3. Impact of land reform on the poverty level, income distribution and social welfare. Parameter values are same as those in Fig. 1. The poverty line is set at $Y_p = 1{\cdot}3$.

- The increase in social welfare is a direct consequence of the inverse relationship between farm size and land productivity;
  - a move towards a more egalitarian land-ownership distribution increases aggregate output.
- This result is significant in the light of the debate on land reform.
  - The records of successful land reforms carried out in Japan and Taiwan and its impact on agricultural output are quite consistent with this result.
- Figure 4 depicts the impact of land reform amongst only the landed agents on the utility level of a landless agent.
  - The utility of a landless worker increases continuously as the distribution of land ownership is made more uniform among the landed agents.

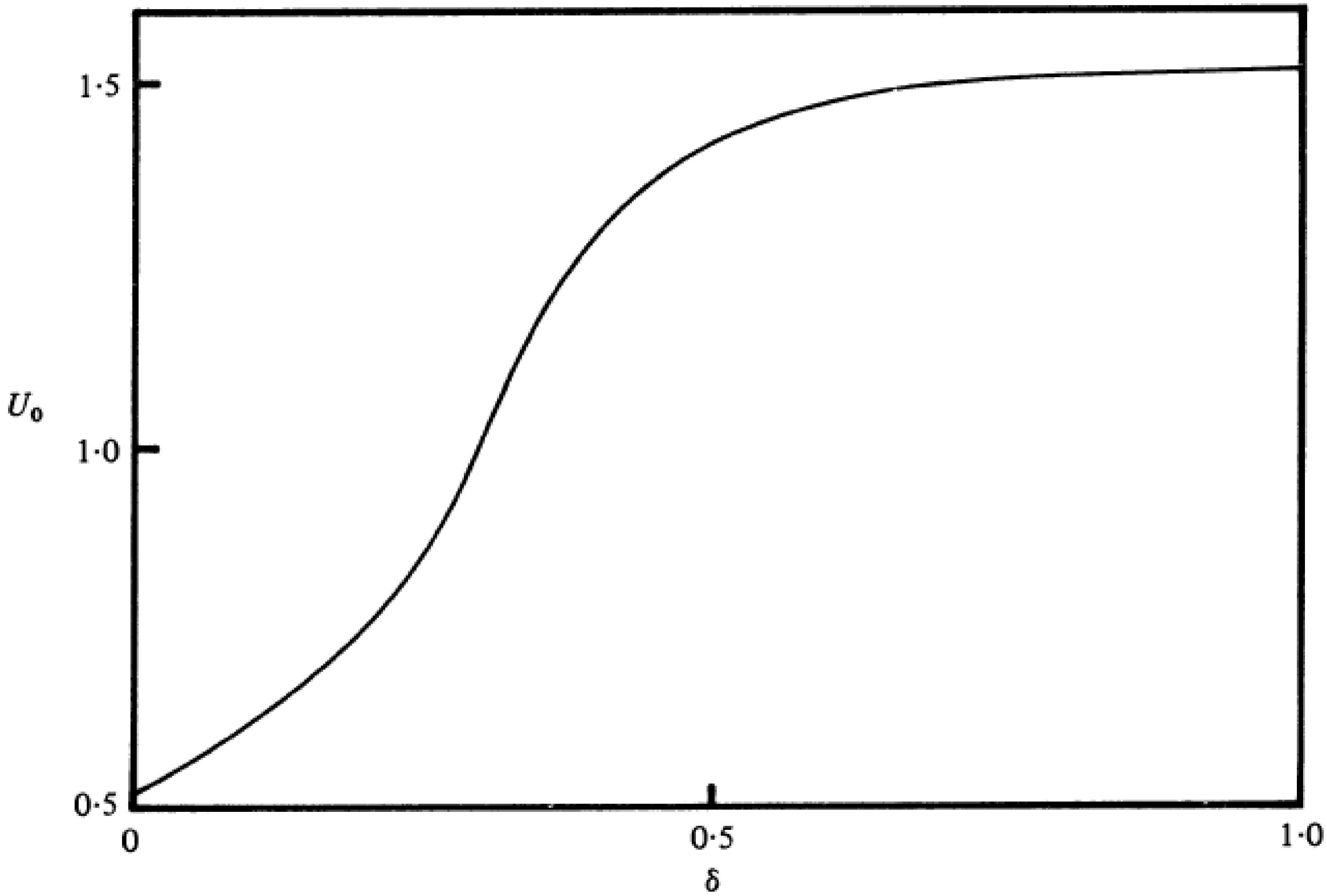

Fig. 4. Impact of land reform amongst only the landed agents on the utility level of a landless agent. Parameter values are same as those in Fig. 2.

- This result follows from the increase in demand for labour and thus in wages that results from the land reform since
  - smaller farms demand greater amounts of labour per acre.
  - This is supported by the empirical results of Rosenzweig (1978) on Indian agriculture:
    - rural wages decrease with inequality in land-ownership.
- For extremely unequal distributions (low values of δ), Figure 4 shows that any increase in δ brings about substantial increases in the welfare of landless workers.
  - The relationship becomes concave as the distribution gets more uniform.
  - Clearly, the benefits of land reform for the landless are quite marked when the ownership distribution among the landed is highly skewed.

3.3 General Equilibrium: Credit Reform

- Figure 5 illustrates the results of a credit reform in which
  - the total volume of the credit is held constant,
  - θ, the parameter which determines the extent to which access to credit is dependent on land ownership, is varied between 0 and 1.
    - $\theta = 0 \Rightarrow$ access to credit is completely independent of land ownership;
    - when θ is large, credit access is very sensitive to land ownership.
- We find that with an increase in θ
  - social welfare monotonically decreases, and
  - the proportion of rural population below the poverty line monotonically increases.
- This provides the rationale for the argument that creation of institutions capable of accepting as collateral future crops rather than owned land-holdings.

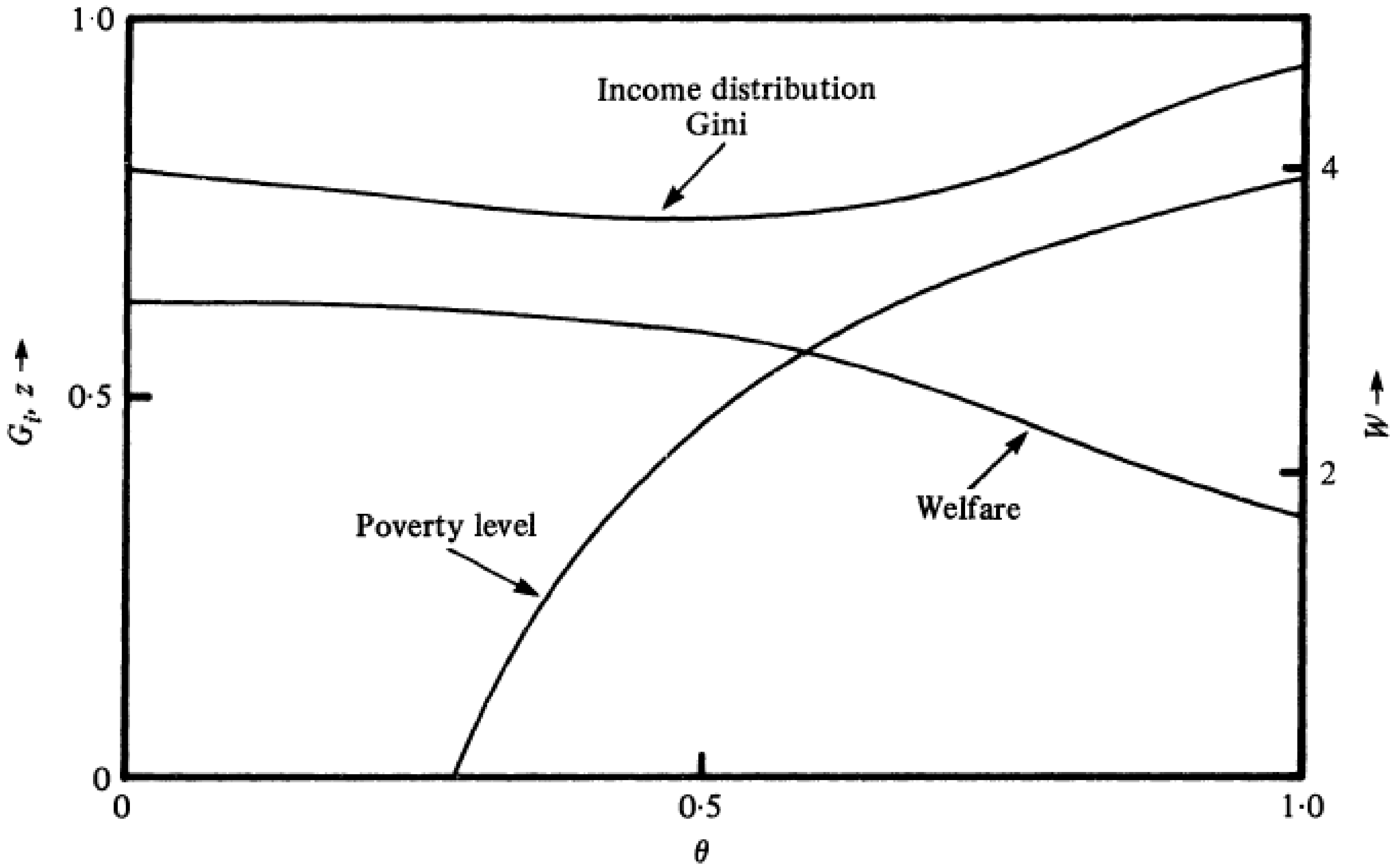

Fig. 5. Impact of credit reform on poverty, income distribution and social welfare. Total credit is fixed at $B_T = 0{\cdot}5$. Other parameter values: $A = 5$, $b = 0{\cdot}3$, $c = 0{\cdot}1$, $D = 0{\cdot}1$, $K = 0{\cdot}2$ $\delta = 0{\cdot}1$, $N_0 = 0$, $N_1 = 1$, $Y_p = 1{\cdot}0$.

References

- This note is based on

1. Eswaran, Mukesh and Ashok Kotwal (1986), "Access to Capital and Agrarian Production Organization", *Economic Journal*, 96, 482-498,

   and

2. Mookherjee, Dilip and Debraj Ray (2001), Section 3 of Introduction to *Readings in the Theory of Economic Development*, London: Blackwell.