Labour Market Imperfections

1. Introduction

- Following distinctive institutional characteristics of the labour market of informal economy of the developing countries are well documented.
  - Fragmented labor markets: Large variations in wages within a narrow geographic region, despite the presence of competition.
  - Involuntary unemployment: Persistent lack of market clearing despite absence of any regulations that prevent wages from adjusting flexibly.
  - Pervasiveness of long-term contracts between employers and employees.
  - Unequal treatment of observationally similar workers.
    - *Dual labor markets* where some workers enter into long-term contracts while others carry out similar tasks on a casual basis at substantially lower wages.
  - Importance of asset ownership: Limited access of the poor to employment owing to malnutrition and absence of human capital.

- We will focus on imperfections in the labour market such as *involuntary unemployment* and *dual labour markets*.

- For a background and for discussion of other issues in the labour market of developing countries refer to the following:

1. Ray, Debraj (1998), *Development Economics*, Princeton University Press, Chapter 13.

2. Bardhan, Pranab and Christopher Udry (1999), *Development Microeconomics*, Oxford University Press, Chapter 4.

3. Basu, Kaushik (1997), *Analytical Development Economics*: *The Less Developed Economy Revisited*, MIT Press, Chapters 9 and 10.

2. Malnutrition and Efficiency Wages

- Following Dasgupta and Ray (1986, 1987) we consider the phenomenon of *nutrition-based efficiency wages*, and its resulting implications for the labour market.
  - This topic goes back to earlier works by Leibenstein (1957), Prasad (1970), Mirrless (1976), Stiglitz (1976) and Bliss and Stern (1978).

- The phenomenon of involuntary unemployment poses a challenge for conventional economic theory.
  - If wages are flexible in the downward direction, any excess supply ought to be eliminated by corresponding wage cuts.
    - Unemployed workers could undercut the going wage by offering to do the same work for less pay,

      - an offer that should be accepted by profit-maximizing employers.

- What prevents such arbitrage?
- The *efficiency wage theory* provides one answer to this conundrum:
  - if the productive efficiency of the worker depends on the wage, a wage cut will be accompanied by a drop in the worker's efficiency,
    - thus rendering the arbitrage worthless to the employer.
- Dasgupta and Ray (1986, 1987) embed this story into a general equilibrium setting,
  - permitting analysis of the effects of land endowment patterns on unemployment and productivity.
  - The theory provides a link between persistent involuntary unemployment and the incidence of undernourishment,
    - relates them in turn to the production and distribution of income and thus ultimately to the distribution of assets.

2.1 Dasgupta and Ray (1986)

- The theory is founded on the much-discussed observation that
  - at low levels of nutrition-intake there is a positive relation between a person's nutrition status and his ability to function;
    - a person's consumption-intake affects his productivity.
- The central idea is that unless an economy in the aggregate is richly endowed with physical assets, it is the assetless who are vulnerable in the *labour market*.
  - Potential employers find attractive those who enjoy non-wage income, for in effect they are cheaper workers.
  - Those who enjoy non-wage income can undercut those who do not, and
    - if the distribution of assets is highly unequal even competitive markets are incapable of absorbing the entire labour force:
      - the assetless are too expensive to employ in their entirety, as there are too many of them.

- A simple example:
  - Suppose each person requires precisely 2000 calories per day to be able to function;
    - anything less and his productivity is nil; anything more and his productivity is unaffected.
  - Consider two persons; one has no non-wage income while the other enjoys 1500 calories per day of such income.

⇒ The first person needs a full 2000 calories of wages per day in order to be employable; the latter only 500 calories per day.

  - It is for this reason the assetless is disadvantaged in the labour market.

2.1.1 The Model

- Consider a timeless construct and abstain from uncertainty.

- Distinguish labour-*time* from labour-*power*;

  – it is the latter which is an input in production.

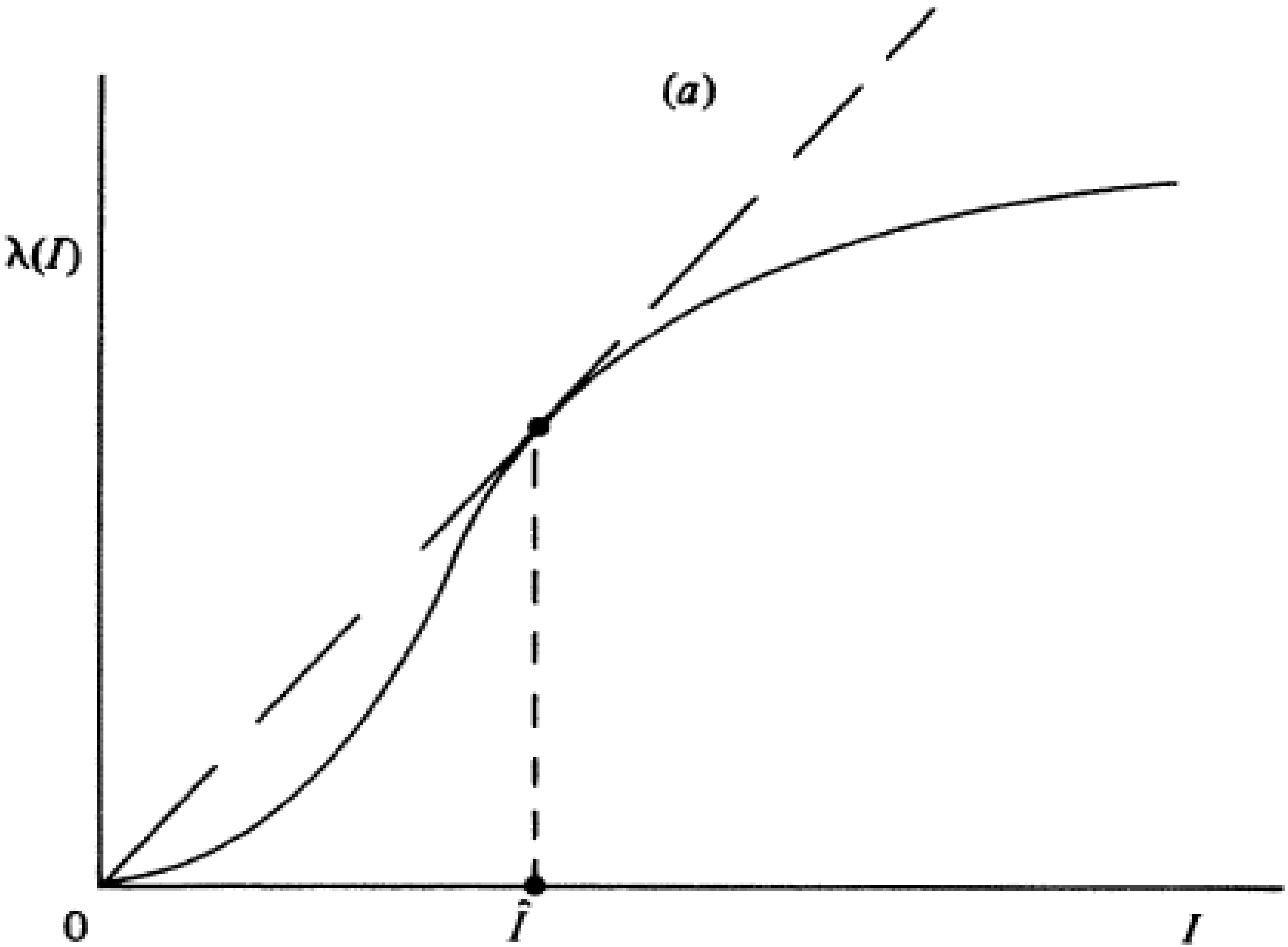
- Denote by λ the labour-*power* a worker supplies over a fixed number of ‘hours’.

  – Assume that λ is functionally related to the worker’s consumption, I, as shown in Figure 1(a).

- The key features of the functional relationship are:

  – it is increasing in the region of interest;

  – at low consumption levels it increases at an *increasing* rate, followed eventually by diminishing returns to further consumption.


(a)
λ(I)
0
Î
I

- The reason for this work capacity - consumption relationship can be explained as follows.
  - Initially, most of the nutrition (consumption) goes to maintaining *resting metabolism*, and so sustaining the basic frame of the body.
    - In this stretch very little extra energy is left over for productive work.
    - Work capacity in this region is very low, and does not increase too quickly as nutrition levels change.
  - Once resting metabolism is taken care of, there is a marked increase in work capacity,
    - the lion's share of additional nutrition input can now be funneled to work.
  - This phase is followed by a phase of diminishing returns,
    - the natural limits imposed by the body's frame restrict the conversion of increasing nutrition into ever-increasing work capacity.

- An alternative specification of the work capacity - consumption relationship (used, for example, by Bliss and Stern (1978)) is drawn in Figure 1(b).
  - Work capacity or labour power, $\lambda,$ is nil until a threshold level of consumption, $I^*,$ the *resting metabolic rate* (RMR).
  - $\lambda\left(I\right)$ is an increasing function beyond $I^*;$
    - but it increases at a diminishing rate.

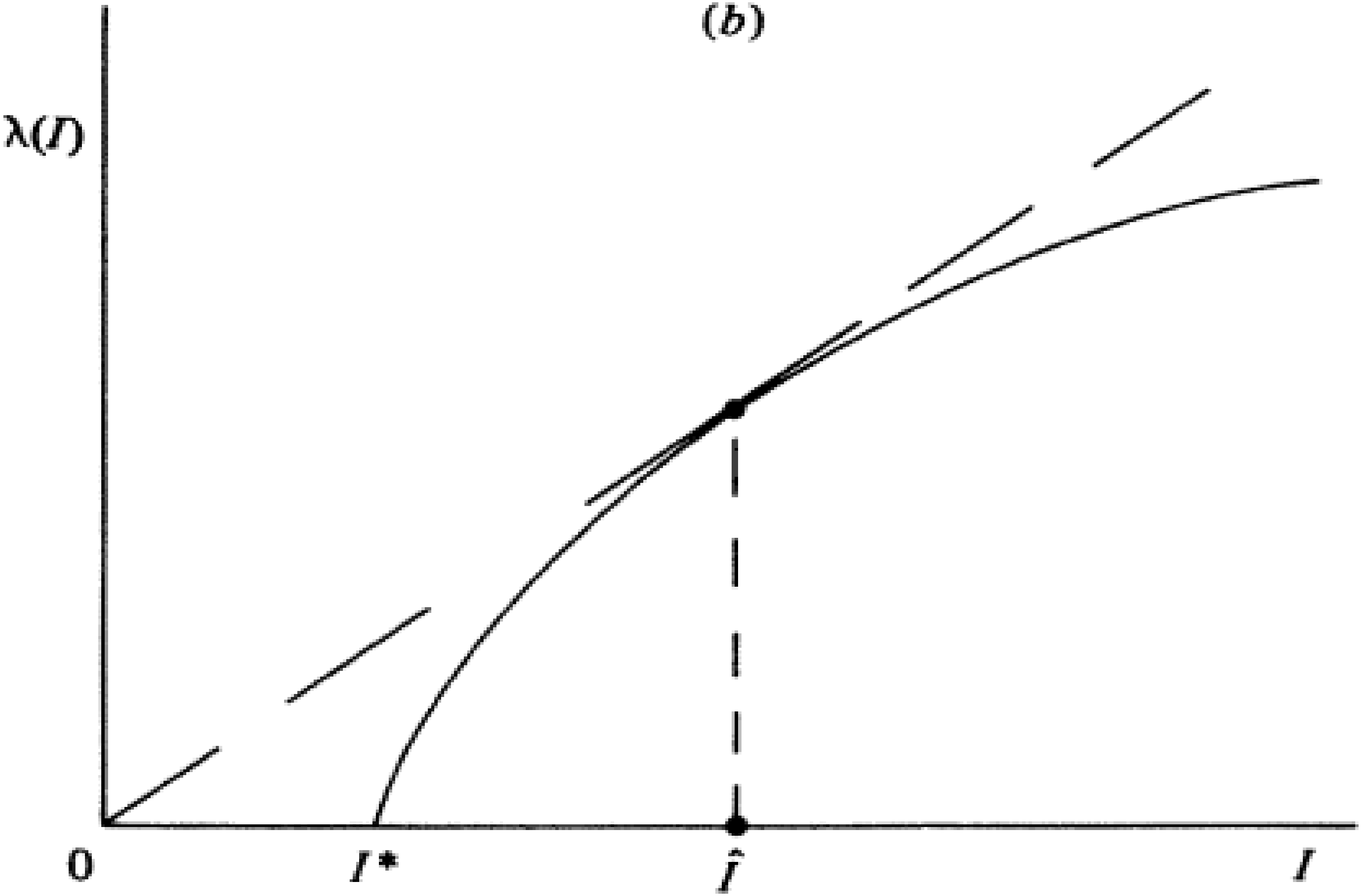


Fig. 1

- The aggregate production function is $F(E,T)$.
  - E denotes the aggregate labour-power employed in production;
    - It is the sum of individual labour powers employed.
  - T denotes the quantity of land.
  - Land is homogeneous; workers are not.
- $F(E,T)$ is assumed to be concave, twice differentiable, constant returns to scale, increasing in E and T, and displaying diminishing marginal products.
- Total land in the economy is fixed at $\hat{T}$.
- Aggregate labour power in the economy is endogenous.
- Total population, assumed to be equal to the potential labour force, is N; N is large.
  - Approximate and suppose that people can be numbered along the interval $[0,1]$.

- Each person has a label, n, where n is a real number between 0 and 1.
- Population density is constant and equal to N.
  - Normalize $N = 1$, so as not to have to refer to the population size.
- The proportion of land an n-person owns is $t(n)$;

$\Rightarrow$ total amount of land he owns is $\hat{T}t(n)$.

  - We label people such that $t(n)$ is non-decreasing in n.
    - So $t(n)$ is the land distribution and is assumed to be continuous.
- In Figure 2 a typical land distribution is drawn.
  - All persons labelled 0 to $\underline{n}$ are landless.
  - From $\underline{n}$ the $t(n)$ function is increasing.

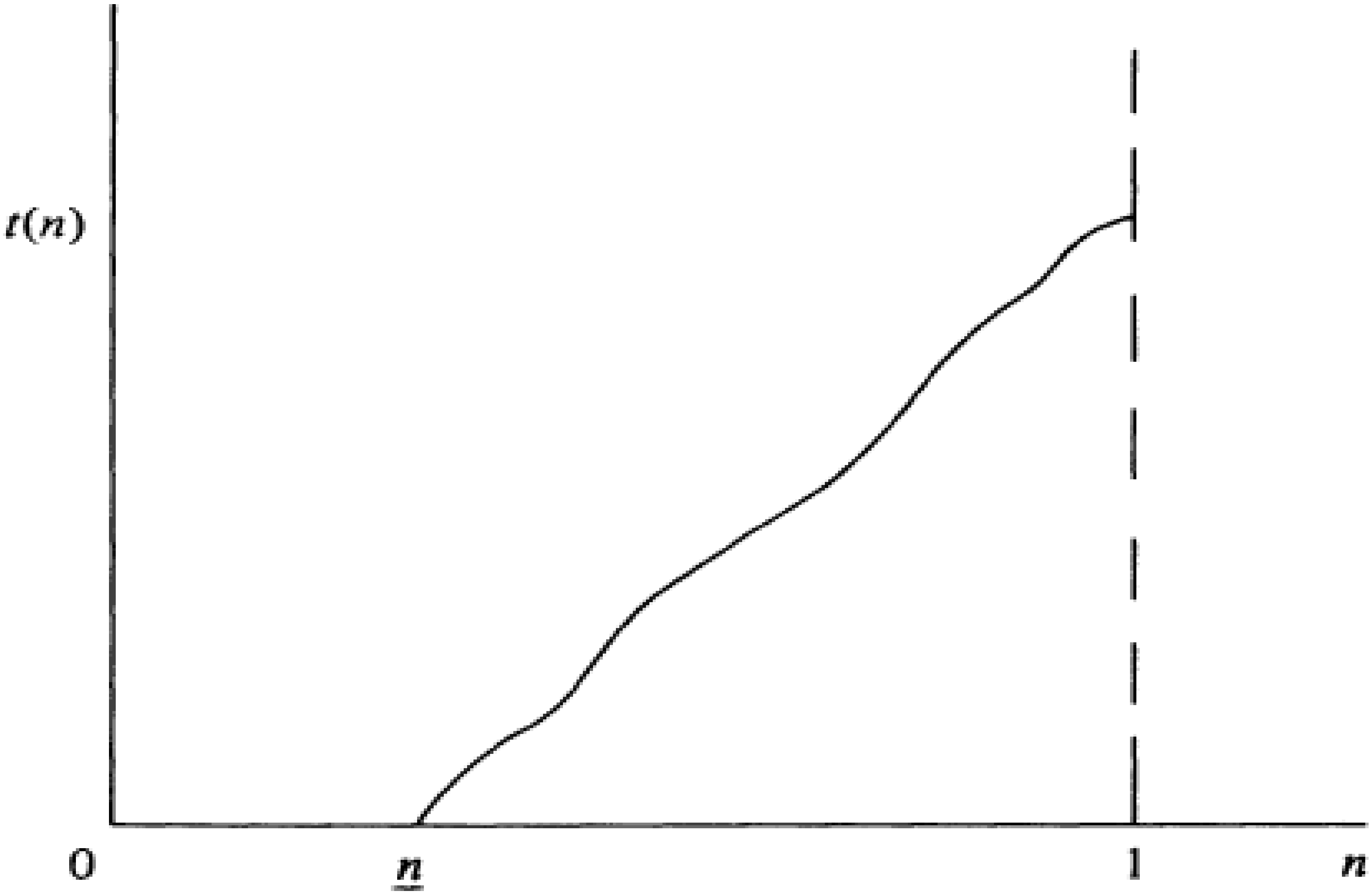


Fig. 2

- Assume one either does not work in production sector or works for one unit of time.

- There are competitive markets for both land and labour power; let r denote the competitive land rental rate. $\Rightarrow$ The n-person's non-wage income is $r\hat{T}t\left(n\right)$.

- Each person has a *reservation wage* which must as a minimum be offered if he is to accept a job in the competitive labour market.

- For high n-persons this reservation wage is high as they receive a high rental income.

  – Their utility from leisure is high.

- For low n-persons (say the landless), reservation wage is low, but possibly not nil.

  – We are concerned with malnutrition, not starvation.

    ◦ The landless do not starve if they fail to find jobs in the labour market.

      - They beg, do odd jobs outside the economy under review, which keep them undernourished; but they do not die.

- Thus the reservation wage of even the landless exceeds their RMR.
  - All we assume is that at this reservation wage a person is malnourished.

- Denote by $\bar{w}(R)$ the reservation wage function; R denotes non-wage income.

- Assume the $\bar{w}(R)$ *function* is exogenously given (continuous and non-decreasing).
  - Of course, non-wage income is endogenous to the model.

- This reservation wage function is depicted in Figure 3.
  - For a given $r > 0$, $\bar{w}\left(r\hat{T}t(n)\right)$ is constant for all $n \in [0, \underline{n}]$ since all these n-persons are identical.
  - After that $\bar{w}\left(r\hat{T}t(n)\right)$ increases in n.

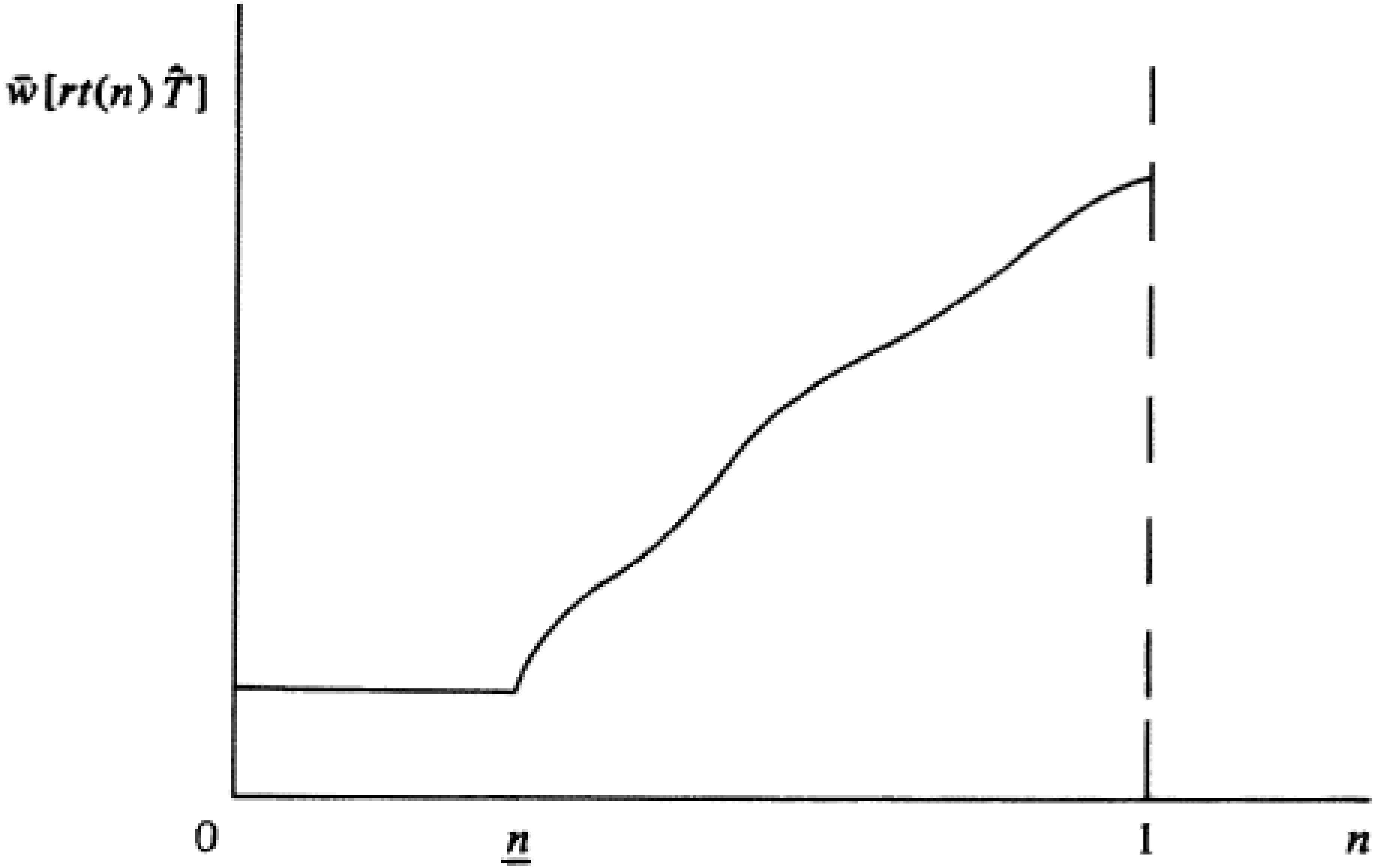


Fig. 3

- Malnutrition:

  For concreteness choose the consumption level $\hat{I}$ in Figure 1 as the cut-off consumption level below which a person is said to be undernourished.

  - At $\hat{I}$ marginal labour power equals average labour power.
  - $\hat{I}$ is then the food-adequacy standard.
  - Nothing of analytical consequence depends on this choice.
    - All that is needed is the assumption that the reservation wage of a landless person is one at which he is undernourished, and thus less than $\hat{I}$.

- Involuntary Unemployment:

  A person is involuntarily unemployed if he cannot find employment in a market which does employ a person very similar to him and if the latter person, *by virtue of his employment in this market*, *is distinctly better off than him*.

  - Involuntary unemployment has to do with differential treatment meted out to similar people.

2.1.2 Efficiency Wage

- To keep the exposition simple rest of the paper specializes somewhat and assume that $\lambda\left(I\right)$ is of the form given in Figure 1(b).

- The *efficiency-wage*, $w^*\left(n, r\right)$, of n-person is defined as

$$w^*\left(n, r\right) \equiv \arg \min_{w \geq \bar{w}\left(r\hat{T}t(n)\right)} \frac{w}{\lambda\left(w + r\hat{T}t\left(n\right)\right)}. \tag{1}$$

  – $w^*\left(n, r\right)$ is the wage per unit of labour-*time* which, at the rental rate r, minimizes the wage per unit of labour *power* of n-person, conditional on his being willing to work at this wage rate.

    ◦ Since the n-person's reservation wage $\bar{w}\left(r\hat{T}t\left(n\right)\right)$ depends on the rental rate, his efficiency-wage depends, in general, on r.

- The minimization problem in (1) is equivalent to:

$$\underset{w \geq \bar{w}\left(r\hat{T}t(n)\right)}{\text{Maximize}} \; \frac{\lambda\left(w + r\hat{T}t\left(n\right)\right)}{w}.$$

Form the Lagrangian $\mathcal{L} = \dfrac{\lambda\left(w + r\hat{T}t\left(n\right)\right)}{w} + \xi \cdot \left[w - \bar{w}\left(r\hat{T}t\left(n\right)\right)\right]$, so that the F.O.C. are given by

$$\frac{w \cdot \lambda'\left(w + r\hat{T}t\left(n\right)\right) - \lambda\left(w + r\hat{T}t\left(n\right)\right)}{w^2} + \xi = 0, \tag{a}$$

and

$$\xi \cdot \left[w - \bar{w}\left(r\hat{T}t\left(n\right)\right)\right] = 0,\ \xi \geq 0, \text{ and } w \geq \bar{w}\left(r\hat{T}t\left(n\right)\right). \tag{b}$$

- When the reservation wage constraint is not binding ($w^*(n,r) > \bar{w}\left(r\hat{T}t(n)\right)$),
  - Then $\xi = 0$, so that (a) implies

$$\lambda'\left(w^*(n,r) + r\hat{T}t(n)\right) = \frac{\lambda\left(w^*(n,r) + r\hat{T}t(n)\right)}{w^*(n,r)} \tag{c}$$

- For the landless, that is, for $n \in [0, \underline{n}]$, $t(n) = 0$, implying $I = w^*(n,r) + r\hat{T}t(n) = w^*(n,r)$, so that (c) implies

$$\lambda'(I) = \frac{\lambda(I)}{I} \Rightarrow I = \hat{I} \Rightarrow w^*(n,r) = \hat{I}.$$

  - Recall that, by hypothesis, $\hat{I}$ exceeds the reservation wage of the landless.
    - This confirms that for the landless we are under the case when the reservation wage constraint is not binding.

- For one who owns a tiny amount of land, that is, n is just above $\underline{n}$ and $t(n)$ is positive but small enough so that the reservation wage constraint continues not to bind, (c) implies

$$\lambda'(I) = \frac{\lambda\left(w^*(n,r) + r\hat{T}t(n)\right)}{w^*(n,r)} > \frac{\lambda(I)}{I} \text{ since } I = w^*(n,r) + r\hat{T}t(n) > w^*(n,r),$$

$$\Rightarrow I < \hat{I},$$

$$\Rightarrow \bar{w}\left(r\hat{T}t(n)\right) < w^*(n,r) < \hat{I}.$$

  – That is, for one who owns a tiny amount of land, $w^*(n,r) < \hat{I}$, and, at the same time, $I < \hat{I}$.

- What happens to $w^*(n,r)$ and I as n increases further, that is, for those who owns larger amounts of landholding?

- Note that as long as the reservation wage constraint is not binding, (c) continues to hold.

- Total differentiating (c) we derive the following:

$$\frac{dw^*}{dn} = r\hat{T}t'(n)\left[\frac{\lambda'(I)}{\lambda''(I)} - 1\right] < 0, \text{ and } \frac{dI}{dn} = \frac{dw^*}{dn} + r\hat{T}t'(n) = r\hat{T}t'(n)\left[\frac{\lambda'(I)}{\lambda''(I)}\right] < 0.$$

  – That is, the efficiency wage decreases with increase in landholding and, as a result, income of these small landowners decline.

  $\Rightarrow$ For these small landowners also we continue to have

$$I < \hat{I}, \text{ and } \bar{w}\left(r\hat{T}t(n)\right) < w^*(n,r) < \hat{I}.$$

- But how long will it continue?

  – Note we started with the landless for whom $w^*(n,r) = \hat{I} >$ their reservation wage.

    ◦ Then as $n \uparrow$, $\bar{w}\left(r\hat{T}t(n)\right) \uparrow$, but $w^*(n,r) \downarrow$.

  $\Rightarrow$ Continuing this way we can identify an n_0 such that $w^*(n_0,r) = \bar{w}\left(r\hat{T}t(n_0)\right)$.

- So we conclude one with considerable amount of land, $n > n_0$,

$$w^*(n,r) = \bar{w}\left(r\hat{T}t(n)\right).$$

- Finally, for one who owns a great deal of land we would expect,

$$w^*(n,r) = \bar{w}\left(r\hat{T}t(n)\right) > \hat{I}.$$

- Define $\mu^*(n,r)$ as

$$\mu^*(n,r) \equiv \frac{w^*(n,r)}{\lambda\left(w^*(n,r) + r\hat{T}t(n)\right)}. \tag{2}$$

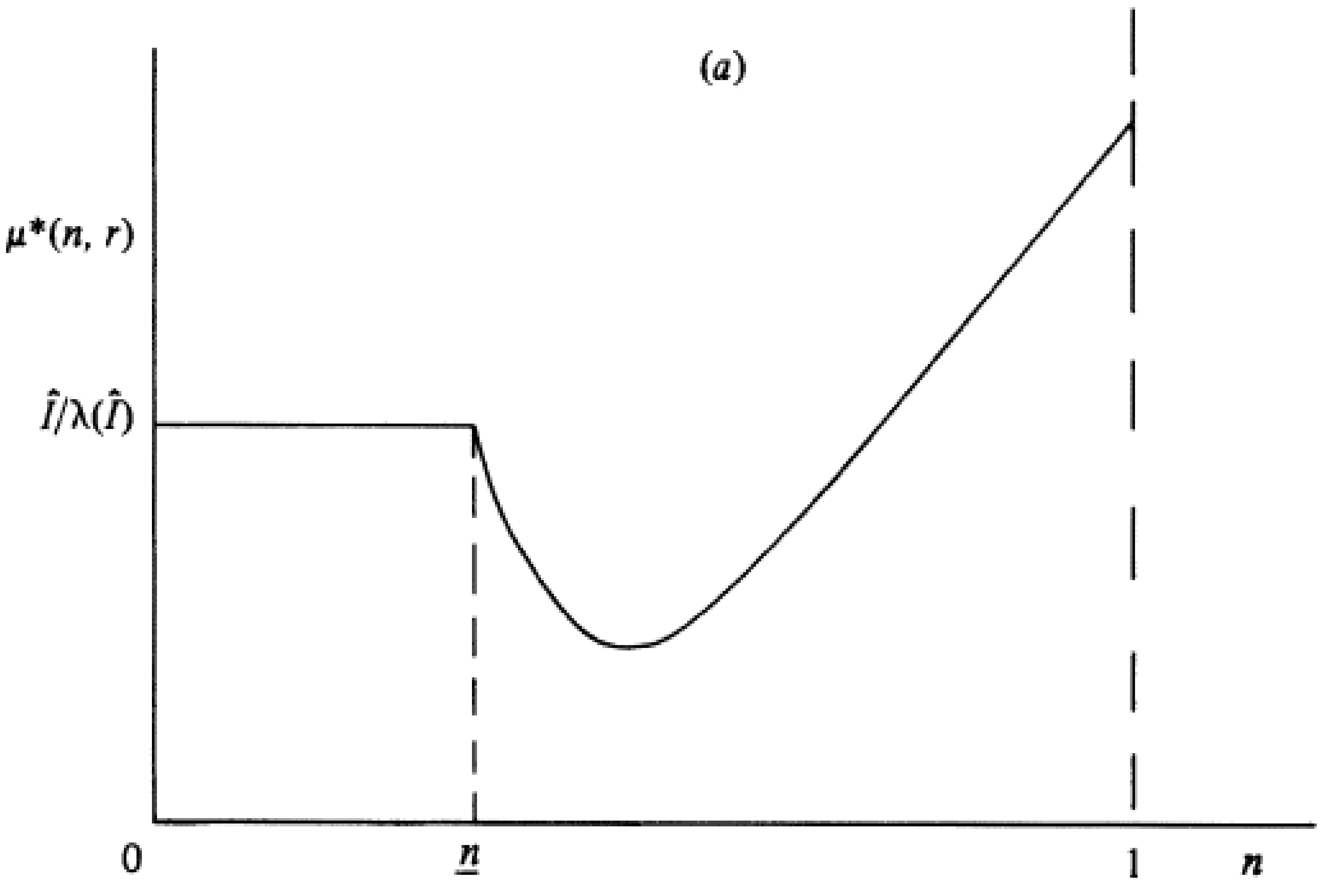
  - Given r, $\mu^*(n,r)$ is the minimum wage per unit of labour power for n-person, subject to the constraint that he is willing to work.

- Bliss and Stern (1978) interpreted $\lambda(I)$ as the (maximum) *number of tasks* a person can perform by consuming I.

  - In this interpretation we may regard $\mu^*(n,r)$ as the *efficiency-piece-rate* of n-person.

    - In what follows we will so regard it.

- In Figure 4(a) a typical $\mu^*(n, r)$ curve has been drawn.
  - $\mu^*(n, r)$ is 'high' for the landless because they have no non-wage income.
    - For the landless, $\mu^*(n, r) = \dfrac{\hat{I}}{\lambda\left(\hat{I}\right)}$.
  - It is relatively 'low' for 'smallish' landowners because they do have some non-wage income and because their reservation wage is not too high.
  - It is 'high' for the big land-owners because their reservation wages are very high.



(a)
μ*(n, r)
Î/λ(Î)
0
n
1
n

- While a ‘typical’ shape of $\mu^*(n,r)$, as in Figure 4(a) is used to illustrate the arguments in the main body of the paper,
  - the assumptions do not, in general, generate this ‘U-shaped’ curve.
  - For a given r, the common features of $\mu^*(n,r)$ are:

(a) $\mu^*(n,r)$ is constant for all landless n-persons and falls immediately thereafter.

(b) $\mu^*(n,r)$ continues to decrease in n as long as the reservation wage constraint is not binding.

$\Rightarrow$ Whenever $\mu^*(n,r)$ increases with n, the reservation wage constraint is binding.

○ $$\frac{d\mu^*(n,r)}{dn} = \frac{\frac{dw^*(n,r)}{dn}\left[\lambda(\cdot) - w^*(n,r)\lambda'(\cdot)\right] - w^*(n,r)\lambda'(\cdot)\, r\hat{T}t'(n)}{[\lambda(\cdot)]^2}.$$

- When the reservation wage constraint is not binding, $\lambda(\cdot) = w^*(n,r)\lambda'(\cdot)$, implying that $\dfrac{d\mu^*(n,r)}{dn} < 0.$

(c) Once the reservation wage constraint binds for some n-person, it continues to bind for all n-person with more land.

◦ We have argued that the reservation wage constraint start binding at n_0 defined by

$$w^*(n_0, r) = \bar{w}\left(r\hat{T}t(n_0)\right),$$

where $w^*(n, r)$ satisfies equation (c) so that, as argued earlier, $\frac{d}{dn}w^*(n, r) < 0$.

- Since both $\bar{w}'(\cdot) > 0$ and $t'(n) > 0$, it follows that the constraint continues to bind for all $n \geq n_0$.

(d) $\mu^*(n, r)$ finally rises as the effect of increasing reservation wage ultimately outweighs the diminishing increments to labour power associated with greater landownership.

2.1.3 Market Equilibrium

- Markets are competitive, and there are two factors – land and labour power.

$\Rightarrow$ Two competitive prices to reckon with: rental rate on land, r, and price of a unit of labour power, that is, the *piece rate*, μ.

- $D(n)$: the market demand for the labour *time* of n-person;
  $S(n)$: the n-person's labour (time) supply.
  - By assumption $S(n)$ is either zero or unity.

- $w(n)$: the wage rate for n-person; G: the set of n-persons who find employment.

- Production enterprises are profit maximizing.

- Each n-person aims to maximize his income given the opportunities he faces.

- *A rental rate* $\tilde{r}$, *a piece rate* $\tilde{\mu}$, *a subset* $\tilde{G}$ *of* $[0, 1]$ *and a real-valued function* $\tilde{w}(n)$ *on* $\tilde{G}$ *sustain a competitive equilibrium if and only if*:

(i) *for all* n*-persons for whom* $\tilde{\mu} > \mu^*(n, \tilde{r})$, *we have* $S(n) = D(n) = 1;$

(ii) *for all* n*-persons for whom* $\tilde{\mu} < \mu^*(n, \tilde{r})$, *we have* $S(n) = D(n) = 0;$

(iii) *for all* n*-persons for whom* $\tilde{\mu} = \mu^*(n, \tilde{r})$, *we have* $S(n) \geq D(n)$, *where*

- $\circ\ D(n)$ *is either* 0 *or* 1 *and*
- $\circ\ S(n) = \begin{cases} 1 & \textit{if } \tilde{w}(n) > \bar{w}\left(\tilde{r}\hat{T}t(n)\right), \\ \textit{either } 0 \textit{ or } 1 & \textit{if } \tilde{w}(n) = \bar{w}\left(\tilde{r}\hat{T}t(n)\right); \end{cases}$

(iv) $\tilde{G} = \{n\text{: } D(n) = 1\}$ *and* $\tilde{w}(n)$ *is the larger of the* (*possibly*) *two solutions of*

$$\frac{w}{\lambda\left(w + \tilde{r}\hat{T}t(n)\right)} = \tilde{\mu}, \textit{ for all } n \textit{ with } D(n) = 1;$$

(v) $\tilde{\mu} = \partial F\left(\tilde{E}, \hat{T}\right)/\partial E$, *where* $\tilde{E}$ *is the aggregate labour power supplied by all who are employed*; *and*

(vi) $\tilde{r} = \partial F\left(\tilde{E}, \hat{T}\right)/\partial T.$

- Conditions (v) and (vi):

  Since producers are competitive, $\tilde{r}$ in equilibrium must be equal to the marginal product of land and $\tilde{\mu}$ the marginal product of aggregate labour power.

- Condition (ii):

  We conclude from (v) that the market demand for the labour time of an n-person whose efficiency-piece-rate exceeds $\tilde{\mu}$ must be nil.

  Equally, such a person cannot, or, given his reservation wage, will not, supply the labour quality the market bears at the going piece rate $\tilde{\mu}$.

  – Suppose he were employed at wage $w \geq \bar{w}\left(\tilde{r}\hat{T}t\left(n\right)\right)$.

    ◦ He can earn this wage only if he is physically capable of delivering the job, that is, $\tilde{\mu} \cdot \lambda\left(w + \tilde{r}\hat{T}t\left(n\right)\right) \geq w$.

  $\Rightarrow \dfrac{w}{\lambda\left(w + \tilde{r}\hat{T}t\left(n\right)\right)} \leq \tilde{\mu} < \mu^{*}\left(n, \tilde{r}\right)$, contradicting the definition of $\mu^{*}\left(n, \tilde{r}\right)$.

- Conditions (i) and (iv):

  Every enterprise wants an n-person whose efficiency-piece-rate is less than $\tilde{\mu}$.

  – His wage rate is bid up by competition to the point where his piece rate is $\tilde{\mu}$.

  – Demand for his labour time is positive.

$$\circ \ \frac{\tilde{w}(n)}{\lambda\left(\tilde{w}(n) + \tilde{r}\hat{T}t(n)\right)} = \tilde{\mu} > \mu^*(n, \tilde{r}) = \frac{w^*(n, \tilde{r})}{\lambda\left(w^*(n, \tilde{r}) + r\hat{T}t(n)\right)}$$

$\Rightarrow \tilde{w}(n) > w^*(n, \tilde{r})$, since $\dfrac{d\mu}{dw} = \dfrac{\lambda(\cdot) - w \cdot \lambda'(\cdot)}{[\lambda(\cdot)]^2} \geq 0$;

$\Rightarrow \tilde{w}(n) > w^*(n, \tilde{r}) \geq \bar{w}\left(\tilde{r}\hat{T}t(n)\right)$,

that is, the wage he is paid exceeds his reservation wage.

$\Rightarrow$ He most willingly supplies his unit of labour time which, in equilibrium, is what is demanded.

- Condition (iii):

  What of an n-person whose efficiency-piece-rate equals $\tilde{\mu}$?

  – Enterprises are indifferent between employing and not employing such a worker.

  – He is willing to supply his unit of labour time:

    ◦ with eagerness if the wage he receives in equilibrium exceeds his reservation wage, and as a matter of indifference if it equals it.

- **Theorem 1.** *Under the conditions postulated, a competitive equilibrium exists*.

- A competitive equilibrium is not necessarily Walrasian.

  – It is not Walrasian when, for a positive fraction of the population, condition (iii) holds; otherwise it is.

  – If in equilibrium, condition (iii) holds for a positive fraction of the population, the labour market does not clear, and

    ○ we take it that the market sustains 'equilibrium' by *rationing*:

      - of this group a fraction is employed while the rest are kept out.

2.1.4 Simple Characteristics of Market Equilibrium

- We will characterize the equilibrium diagrammatically.
  - There are three different regimes depending on the size of $\hat{T}$.

- **Theorem 2.** *A competitive equilibrium is in one of three possible regimes*, *depending on the total size of land*, $\hat{T}$, *and the distribution of land. Given the latter*:

(1) *If* $\hat{T}$ *is sufficiently small*, $\tilde{\mu} < \hat{I}/\lambda\left(\hat{I}\right)$, *and the economy is characterized by malnourishment among all the landless and some of the near-landless*;

(2) *There are ranges of moderate values of* $\hat{T}$ *in which* $\tilde{\mu} = \hat{I}/\lambda\left(\hat{I}\right)$, *and the economy is characterized by malnourishment and involuntary unemployment among a fraction of the landless*;

(3) *If* $\hat{T}$ *is sufficiently large*, $\tilde{\mu} > \hat{I}/\lambda\left(\hat{I}\right)$, *and the economy is characterized by full employment and an absence of malnourishment*.

- Before discussing the equilibrium regimes we note that
  - among those in employment, persons owning more land are doubly blessed:
    - the not only enjoy more rental income, their wages are also higher.

- **Theorem 3.** *Let* $n_1, n_2 \in \tilde{G}$ *with* $t(n_1) < t(n_2)$. *Then* $\tilde{w}(n_1) < \tilde{w}(n_2)$.

- A strong implication of this result is that competition, in some sense, widens the initial disparities in asset ownership by offering larger (employed) land-owners a higher wage income.

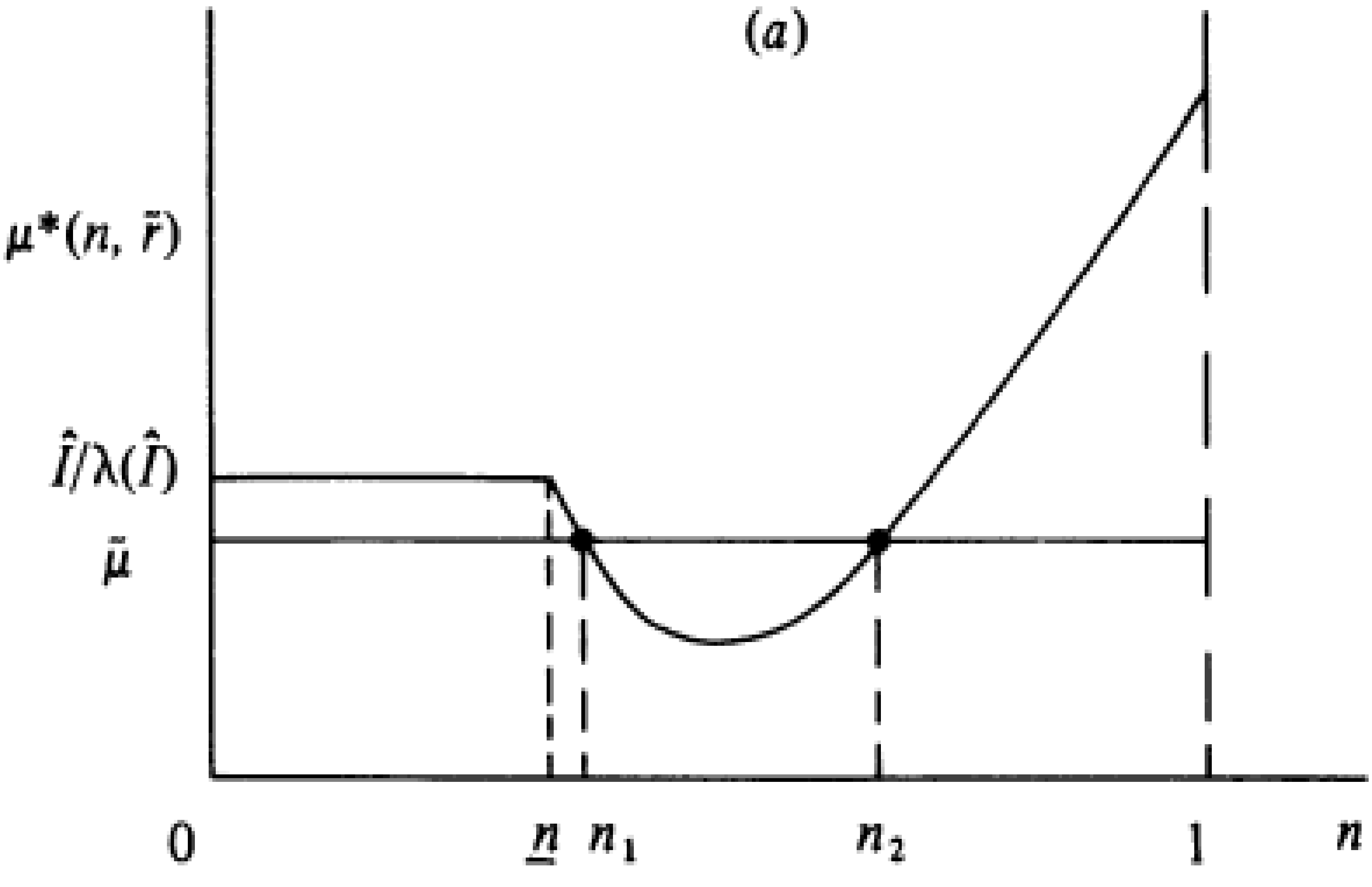
2.1.4.1 Regime 1: Malnourishment among the Landless and Near-landless

- Figure 5(a) depicts a typical equilibrium under regime 1.

- Condition (i) $\Rightarrow$ all n-persons between n_1 and n_2 are employed in production.
  - Typically for the borderline n_1-person $\tilde{w}(n_1) > \bar{w}\left(\tilde{r}\hat{T}t(n_1)\right)$.

- Condition (ii) $\Rightarrow$ all n-persons below n_1 and above n_2 are out of the market:
  - the former because their labour power is too expensive,
  - the latter because their reservation wages are too high – they are too rich.

- In this regime all the landless are *malnourished*.
  - They enjoy their reservation wage which is less than $\hat{I}$.

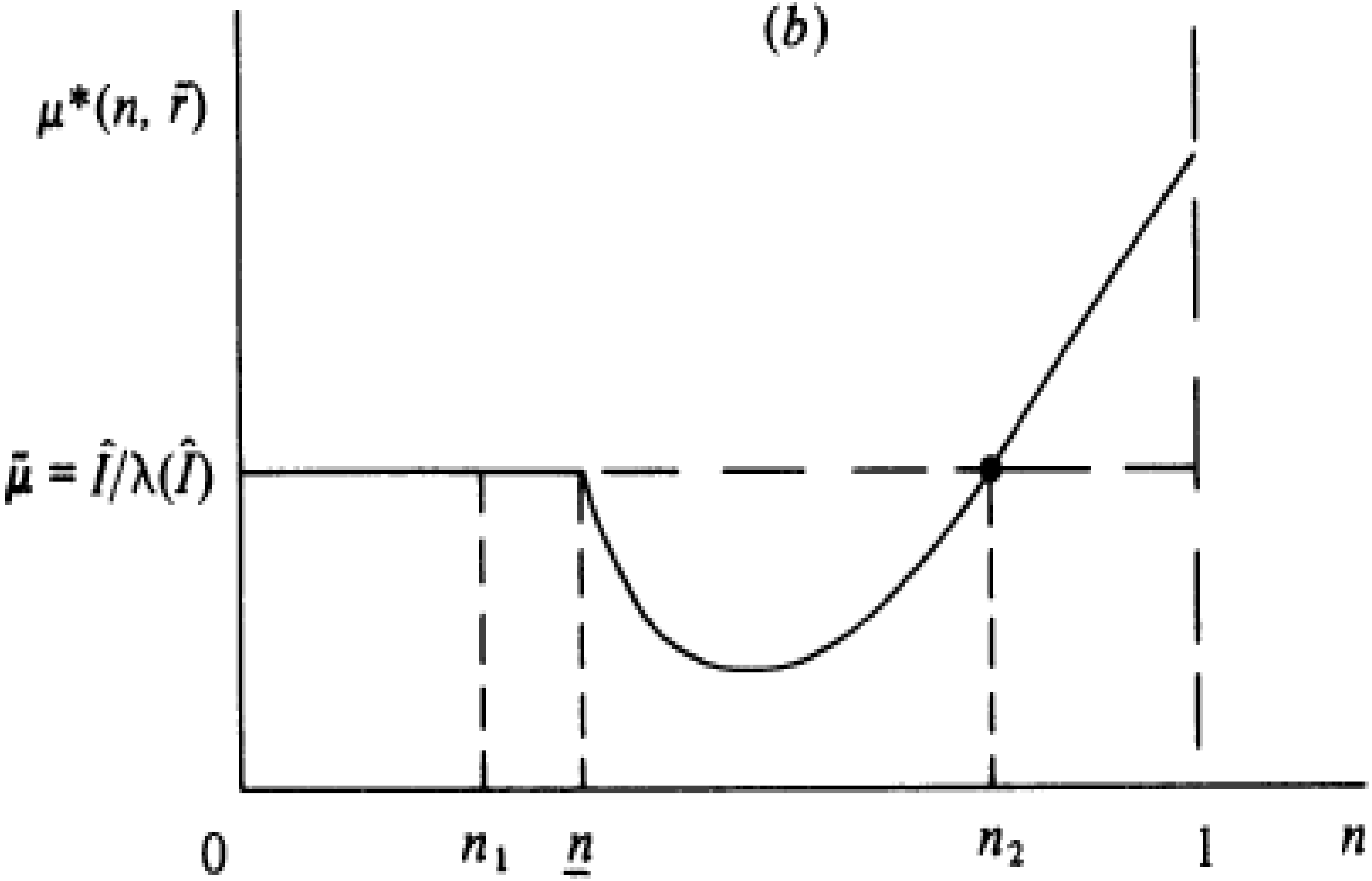

(a)
μ*(n, r̄)
Î/λ(Î)
μ̄
0
n̲
n₁
n₂
1
n

- All persons between $\underline{n}$ and n_1 are also *malnourished*;
  - their rental income is too meagre.
- Some of the employed are also *malnourished*;
  - the employed persons slightly to the right of n_1 consume less than $\hat{I}$.
- Although there are no job queues in the labour market; nevertheless, there is *involuntary unemployment*.
  - $\tilde{w}(n_1) > \bar{w}\left(\tilde{r}\hat{T}t(n_1)\right) \Rightarrow$ We also have $\tilde{w}(n) > \bar{w}\left(\tilde{r}\hat{T}t(n)\right)$ for all n in a neighbourhood to the right of n_1.
  - Since such people are employed, they are distinctly better off than the n-persons in a neighbourhood to the left of n_1,
    - who suffer at their reservation wage.

- Finally, the n-persons above n_2 are *voluntarily* unemployed.
  - Call them the pure rentiers, or the landed gentry.
    - ◦ They are capable of supplying labour at the piece-rate $\tilde{\mu}$ called for by the market, but *choose* not to;
      - their reservation wages are too high.
  - They are to be contrasted with the unemployed people below n_1 who are *incapable* of supplying labour at $\tilde{\mu}$.

2.1.4.2 Regime 2: Malnourishment and Involuntary Unemployment among the Landless

- The relevant curves are drawn in Figure 5(b).
- Here $\tilde{\mu} = \hat{I}/\lambda\left(\hat{I}\right)$.
  - It is not a zero-measure event: it pertains to certain intermediate ranges of $\hat{T}$.
- The economy equilibrates by rationing landless people in the labour market.
- Condition (i) $\Rightarrow$ all n-persons between $\underline{n}$ and n_2 are employed.
- Condition (ii) $\Rightarrow$ all n-persons above n_2 are out of the labour market because their reservation wages are too high.


(b)
μ*(n, r̄)
μ̄ = Î/λ(Î)
0
n₁
n
n₂
1
n

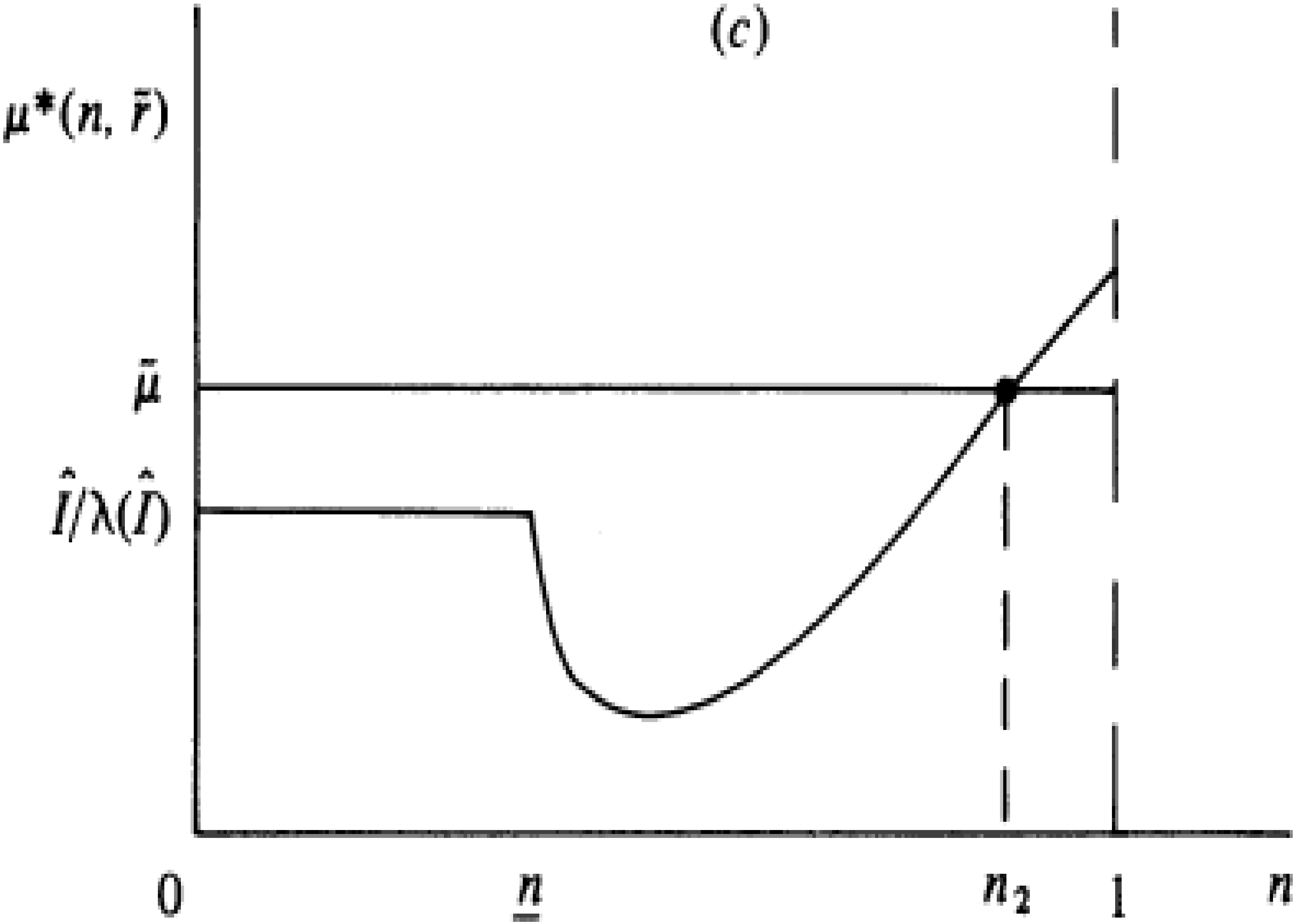
- A fraction of the landless, $\frac{n_1}{\underline{n}}$, is *involuntarily unemployed*;
  - the remaining fraction, $1 - \frac{n_1}{\underline{n}}$, is employed.
  - The size of this fraction depends on $\hat{T}$.
- The *employed* among the landless are paid $\hat{I} \Rightarrow$ *not* malnourished.
- The *unemployed* among the landless suffer their reservation wage.

$\Rightarrow$ They are *malnourished*.

- Under this regime, the group of unemployed and malnourished coincide
  - This is to be contrasted with Regime 1.

2.1.4.2 Regime 3: The Full Employment Equilibrium

- Figure 5(c) presents the third regime pertinent for large values of $\hat{T}$.
- Here $\tilde{\mu} > \hat{I}/\lambda\left(\hat{I}\right)$.
- Condition (i) $\Rightarrow$ all n-persons from 0 to n_2 are employed.
- Condition (ii) $\Rightarrow$ all n-persons above n_2 are out of the labour market.
  - They are the landed gentry, *not* involuntarily unemployed.
- This regime is characterized by full employment and no malnourishment.
- This corresponds to a standard Arrow-Debreu equilibrium.


(c)
μ*(n, r̄)
μ̄
Î/λ(Î)
0
n
n2
1
n

2.2 Dasgupta and Ray (1987)

- The analysis in Dasgupta and Ray (1986) shows the precise way in which *asset advantages* translate themselves into *employment advantages*.
  - This suggests strongly that certain patterns of egalitarian *asset redistributions* may result in greater employment and aggregate output.
- Dasgupta and Ray (1987) confirm such possibilities and
  - explores public policy measures which ought to be considered in the face of massive market-failure of the kind identified in Dasgupta and Ray (1986).
- Dasgupta and Ray (1986) study the implications of aggregate *asset accumulation* in the economy in question.
  - The distribution of assets was held fixed.
- Dasgupta and Ray (1987) study the implication of *asset redistribution*.

- Dasgupta and Ray (1987) hold the aggregate quantity of land fixed and alter the land distribution.

- They first check that redistributive policies are the only ones that are available.
  - This is confirmed by the following theorem.

- **Theorem 1.** *Under the conditions postulated*, *a competitive equilibrium is Pareto-efficient*.

$\Rightarrow$ There is no scope for external interventions to improve the welfare of the poor and malnourished, without making the non-poor worse off.

2.2.1 Partial Land Reforms

- Consider land transfers from the landed gentry (those who do not enter the labour market because their reservation wage is too high) to those who are involuntarily unemployed.

- In Figure 2, a partial land reform is depicted;
  - land is transferred to some of the unemployed as well as those 'on the margin' of being unemployed.
  - People between n_a and n_b gain land;
    - for them, the $\mu^* (\cdot, \tilde{r})$ function shifts downward; that is, their efficiency-piece-rate is lowered.
  - The losers, between n_c and n_d, also experience a downward shift in $\mu^* (\cdot, \tilde{r})$,
    - but for entirely different reasons – their reservation wages have been lowered.

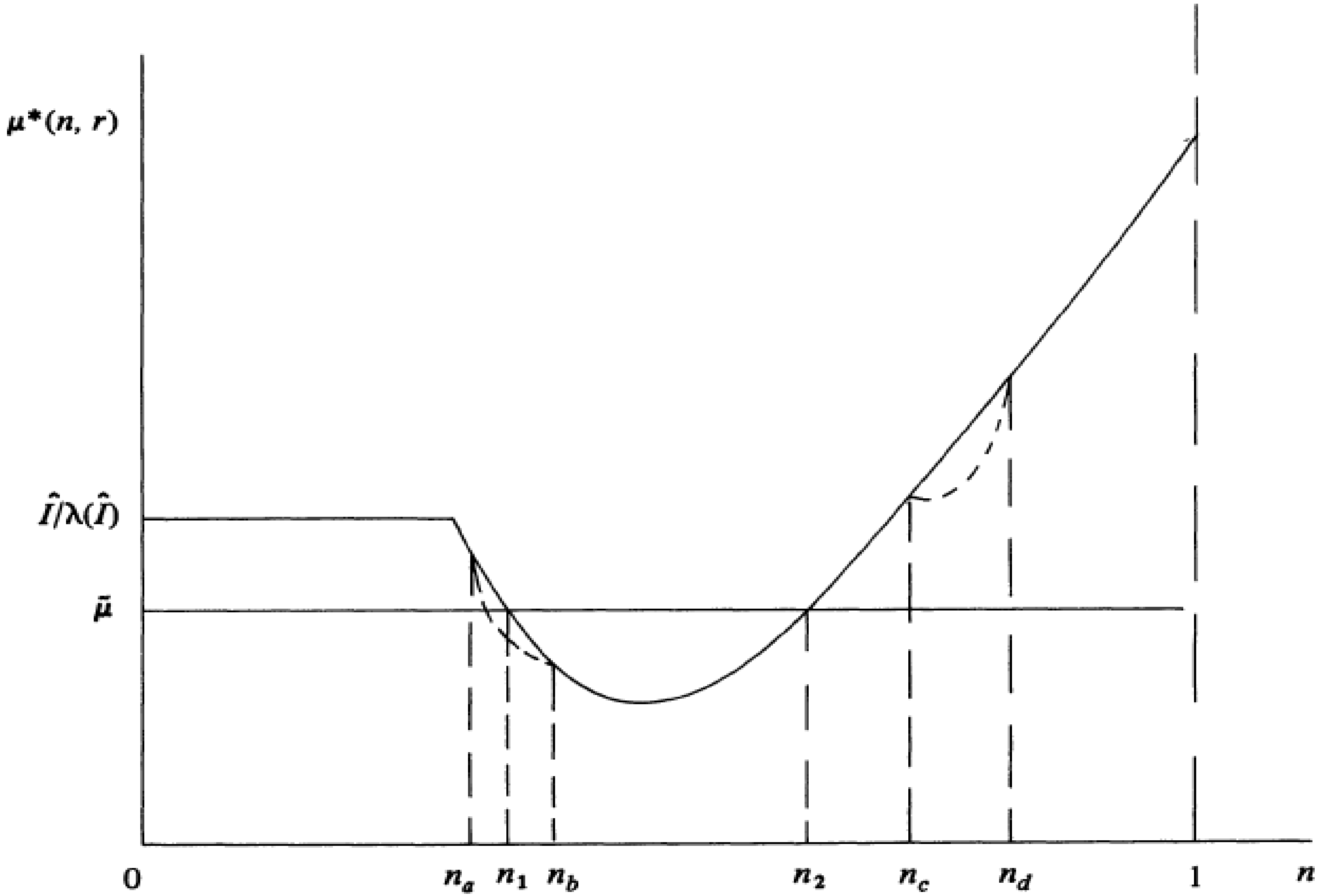


Fig. 2. Partial land reform: n-persons between n_a and n_b gain land, and rentiers between n_c and n_d lose land.

- Can the equilibrium before the partial land reform be compared with the one after land reform?

- **Theorem 2.** *Suppose that for each parametric specification*, *the competitive equilibrium is unique. Then a partial land reform of the kind just described necessarily leads to at least as much output in the economy* (*strictly more*, *if* $\mu^* (n, \tilde{r})$ *is of the form in Figure 2*).

- The result implies there is no necessary conflict between equality-seeking moves and aggregate output in a resource-poor economy.

- Such redistributions have three effects.
  - The unemployed become more attractive to employers as their non-wage income rises.
  - The employed among the poor become more productive to the extent that they too receive land.

- By taking land away from the landed gentry, their reservation wages are lowered;
  - if this effect is strong enough, this could induce them to forsake their state of voluntary unemployment and enter the labour market.

- For all these reasons, the number of employed efficiency units in the economy rises, pushing it to a higher-output equilibrium.

- Theorem 2 is silent on how the *set* of employed persons changes.
  - There is a natural tendency for employment to rise because of the features mentioned above.
  - However, there is a ‘displacement effect’ at work: newly productive workers are capable of displacing previously employed, less productive workers in the labour market.

2.2.2 Full Land Reforms

- This displacement effect cannot exist in the case of full land reforms.

- Recall that total land of the economy is fixed at the level $\hat{T}$.
  - Let $\hat{T}_1$ be smallest value of $\hat{T}$ such that at $\hat{T}_1$ the economy is productive enough (just about) to feed all adequately,
    - that is, at the level of food adequacy standard $\hat{I}$.

- **Theorem 4.** *There exists an interval* $\left(\hat{T}_1, \hat{T}_2\right)$ *such that if* $\hat{T}$ *is in this interval*, *full redistributions yield competitive equilibria with full employment and no malnourishment. Moreover for each such* $\hat{T}$, *there are unequal land distributions which give rise to involuntary unemployment and malnourishment.*

- Theorem 4 has identified a class of cases, namely, a range of moderate land endowments, where
  - *inequality* of asset ownership can be pin-pointed as the *basic* cause of involuntary unemployment and malnourishment.
  - In such circumstances judicious land reforms can *increase* output and *reduce* both unemployment and undernourishment.
  - If land were equally distributed, the market mechanism would sustain this economy in regime 3 in which
    - undernourishment and unemployment are things of the past.

3. Incentive-based Efficiency Wages: Eswaran-Kotwal (1985)

- Eswaran and Kotwal (1985) analyzes an alternative source of efficiency wages,
  - stemming from the problem of eliciting trustworthy behaviour from employees.
- Certain tasks in agriculture require application of effort which is difficult to monitor:
  - water resource management, application of fertilizers, maintenance of draft animals and machines.
- Certain other tasks are routine and menial and less subject to worker moral hazard as the product of the worker's effort is easily monitored:
  - weeding, harvesting, threshing.
- Piece rates may suffice for the second type of tasks, but not for the first type.
  - Performance of the worker on these tasks can be ascertained only much later,
    - at the end of the year or in future years; whereas wages have to be paid upfront.

  - Moreover workers' performance may not be verifiable by third-party contract enforcers.

- For either of these reasons, wages for the first category of tasks will be independent of performance levels;

  - accordingly trust plays a significant role.

$\Rightarrow$ The employer will seek to employ family members or other kins for these tasks.

- If hired hands are employed for these tasks, they have to be induced to behave in a trustworthy fashion.

  - This is made possible by an implicit long-term contract, which is renewed in future years only upon verification of the employee's satisfactory performance.

- To give the employee a stake in the continuation of the employment relationship,

  - long-term workers have to be treated better than short-term workers hired for harvesting tasks.

- This implies in turn that the market for long-term contracts will be characterized by *involuntary unemployment*:
  - all workers will queue up for long-term contracts;
  - but employers will typically be willing to employ a fraction of the entire labour force in long-term contracts,
    - the remaining workers being forced into the residual short-term sector.
- The unemployment will not be eliminated despite wage flexibility,
  - since wage cuts will reduce the stake of long-term workers in the subsequent continuation of the relationship,
    - inducing them to abuse their employers' trust.

- This explanation for long-term contracts is similar to earlier theories advanced by
  - Simon (1951), Klien and Leffler (1981), Shapiro (1983) and Shapiro and Stiglitz (1984).
- What is of particular interest in Eswaran and Kotwal (1985) is the explanation of coexistence of long-term and short-term workers, and
  - how the composition of the work force shifts in response to demand and technology changes.

3.1 The Model

- A single crop is produced each year;
  - the crop takes two periods to produce, each period lasting for one-half year.
    - The first period requires such activities as soil preparation, tiling, sowing, etc.,
    - the second requires activities such as harvesting, threshing, etc.
  - Demand for labour and capital is considerably higher in the second period.
- Production process entails the use of three inputs: land (h), labour, and capital (K).
- Disaggregate labour into two categories according to the nature of the tasks:
  - Type 1 tasks involve considerable care and judgement such as
    - water resource management, application of fertilizers, plowing, maintenance of draft animals and machines, etc.
    - Such tasks do not lend themselves to easy on-the-job supervision.

- Type 2 tasks are those that are routine and menial such as
  - weeding, harvesting, threshing, etc.
  - These tasks are by their very nature easy to monitor.

- All workers are assumed to have identical abilities;
  - but the tasks to which they are assigned are not necessarily the same

- Distinguish between length of employment (l) and the intensity of effort (e).

- Efficient performance of any task requires an effort level $\bar{e} > 0$.

- An efficiency unit of labour is taken to be one worker hired for a whole period ($l = 1$) at an effort level $\bar{e}$.

- Type 1 tasks are performed by workers on long-term contracts, while casual workers are entrusted with only Type 2 tasks.
- Assume that no casual workers are hired in period 1.
  - The tasks to be performed in period 1 are mainly of Type 1 variety.
  - Empirically, casual workers are hired mainly in the peak season (period 2).
- L_p: number of efficiency units of *permanent labour* employed per period on a farm.
  - A permanent worker's contract is over the infinite horizon unless he is found to shirk.
- L_c: number of efficiency units of *casual labour* employed on the farm in period 2.
  - A casual worker's contract lasts for the whole or part of period 2.

- Production function for period 1 output, q_1, is:

$$q_1 = a \cdot \min \ \{g_1(K_1, L_p), \ b \cdot h\}; \tag{1}$$

  - K_1: amount of capital used in period 1;
  - $g_1(K_1, L_p)$ is a twice continuously differentiable, linearly homogeneous function that is increasing and strictly quasi-concave in its arguments.

- (1) implies that there is no substitutability between land and the other two factors.
  - Potential output is determined entirely by the amount of land.

- $g_1(K_1, L_p)$ is an aggregate of the capital and labour inputs in period 1.
  - Assume labour is an essential input in period 1, $g_1(K_1, 0) = 0$, for all K_1.

- a, $b > 0$ are technology parameters;
  - b is introduced to capture land-augmenting technical change;
  - a is introduced to simulate Hicks-neutral technical change.

- Production function for period 2 output, q_2, is:

$$q_2 = \min \ \{g_2 (K_2,\ L_p + L_c)\,,\ q_1\}\,; \tag{2}$$

  - K_2: amount of capital used in period 2;
  - $g_2(\cdot)$ is a twice continuously differentiable, linearly homogeneous function that is increasing and strictly quasi-concave in its arguments.

- In period 2, tasks performed by labour are mostly Type 2 variety.
  - Casual and permanent labour are perfect substitutes and both will be employed to do Type 2 tasks.

- Period 2 output depends crucially on period 1 output.
  - Interpret q_1 as the quantity of unharvested crop and q_2 as the quantity of the final product, that is, the harvested and threshed crop.
    - q_1 is thus a natural upper bound on q_2.

- Output price is exogenously fixed and is normalized to unity.

- All farmers are price takers in the labour and capital markets.

- Assume, for convenience, that all farms are identical.
  - Then, by linear homogeneity of (1) and (2), we can aggregate all farmers into a single price-taking farmer.
    - h now represents the total arable land in the economy,

      - assumed to be fixed.

    - L_p, L_c, K_1, K_2, q_1 and q_2 can similarly be interpreted as aggregates.

- w_p: wage rate of a permanent worker per period;

  w_c: wage rate of a casual worker per period;

  r_i: per period (exogenous) rental rate on capital equipment, $i = 1, 2.$

3.2 Demand Side

- We now turn to the optimal choices of L_p, L_c, K_1, K_2, q_1 and q_2.
- We adopt the convention that all expenses are incurred at the end of the period.
- Note that the optimal choices of factor inputs in period 2 depends on L_p and the decisions of the first period.
  - Farmer's decision making must be foresighted and made with full awareness of
    - how L_p and his period 1 decisions will impinge on period 2's choices.
- Given the nature of the production functions, it follows that it is profitable to cultivate all the arable land.

$\Rightarrow$ The profit-maximizing output levels in the two periods are

$$q_1 = q_2 = abh. \tag{3}$$

- Without loss of generality we set $h = 1$.

- The factor inputs will thus be determined so as to minimize the total present value cost of producing the outputs $q_1 = q_2 = ab$.

- Since the choice of capital and casual labour are dependent on the amount of permanent labour hired,
  - we first determine the demands of $K_1,\ K_2$ and L_c conditional on the choice of L_p.

- Define the cost functions

$$C_2\left(q_2, r_2, w_c\right) \equiv \min_{K_2, L_a} \left\{r_2 K_2 + w_c\left(L_a - L_p\right) \mid g_2\left(K_2,\ L_a\right) \geq q_2\right\}, \tag{4}$$

where $L_a \equiv L_p + L_c$, the aggregate amount of labour used in period 2, and

$$C_1\left(L_p, q_1/a, r_1\right) \equiv \min_{K_1} \left\{r_1 K_1 \mid g_1\left(K_1,\ L_p\right) \geq q_1/a\right\}. \tag{5}$$

- At the profit-maximizing outputs $q_1 = q_2 = ab$, Shephard's Lemma yields the following factor demands:

$$K_1^d(L_p, b, r_1) = \frac{\partial C_1(L_p, b, r_1)}{\partial r_1}, \tag{6a}$$

$$K_2^d(ab, r_2, w_c) = \frac{\partial C_2(ab, r_2, w_c)}{\partial r_2}, \tag{6b}$$

$$L_a^d(ab, r_2, w_c) = \frac{\partial C_2(ab, r_2, w_c)}{\partial w_c}. \tag{6c}$$

- The casual labour demand is thus given by

$$L_c^d(ab, L_p, r_2, w_c) = \max\left\{L_a^d(ab, r_2, w_c) - L_p,\ 0\right\}. \tag{6d}$$

- The optimal choice of L_p is now determined as the solution to

$$\min_{L_p} r_1 K_1^d(L_p, b, r_1) + \beta r_2 K_2^d(ab, r_2, w_c) + (1+\beta) w_p L_p + \beta w_c \left[L_a^d(ab, r_2, w_c) - L_p\right]. \tag{7}$$

- The first-order condition associated with (7) is

$$-r_1 \cdot \frac{\partial K_1^d\left(L_p, b, r_1\right)}{\partial L_p} = \left(1+\beta\right) w_p - \beta w_c \equiv z. \tag{8}$$

- The **demand for permanent labour**, $L_p^d\left(b, r_1, z\right)$, is implicitly determined as the solution to (8).
  - Twice continuous differentiability and strict quasi concavity of $g_1\left(K_1,\ L_p\right)$ implies that the left-hand side of (8) is declining in L_p. **(Explain why)**
    - Thus L_p^d is decreasing in z (see Figure 1).

- Together, $L_p^d\left(b, r_1, z\right)$ and the expressions (6a) – (6d) constitute the demand side of the model.

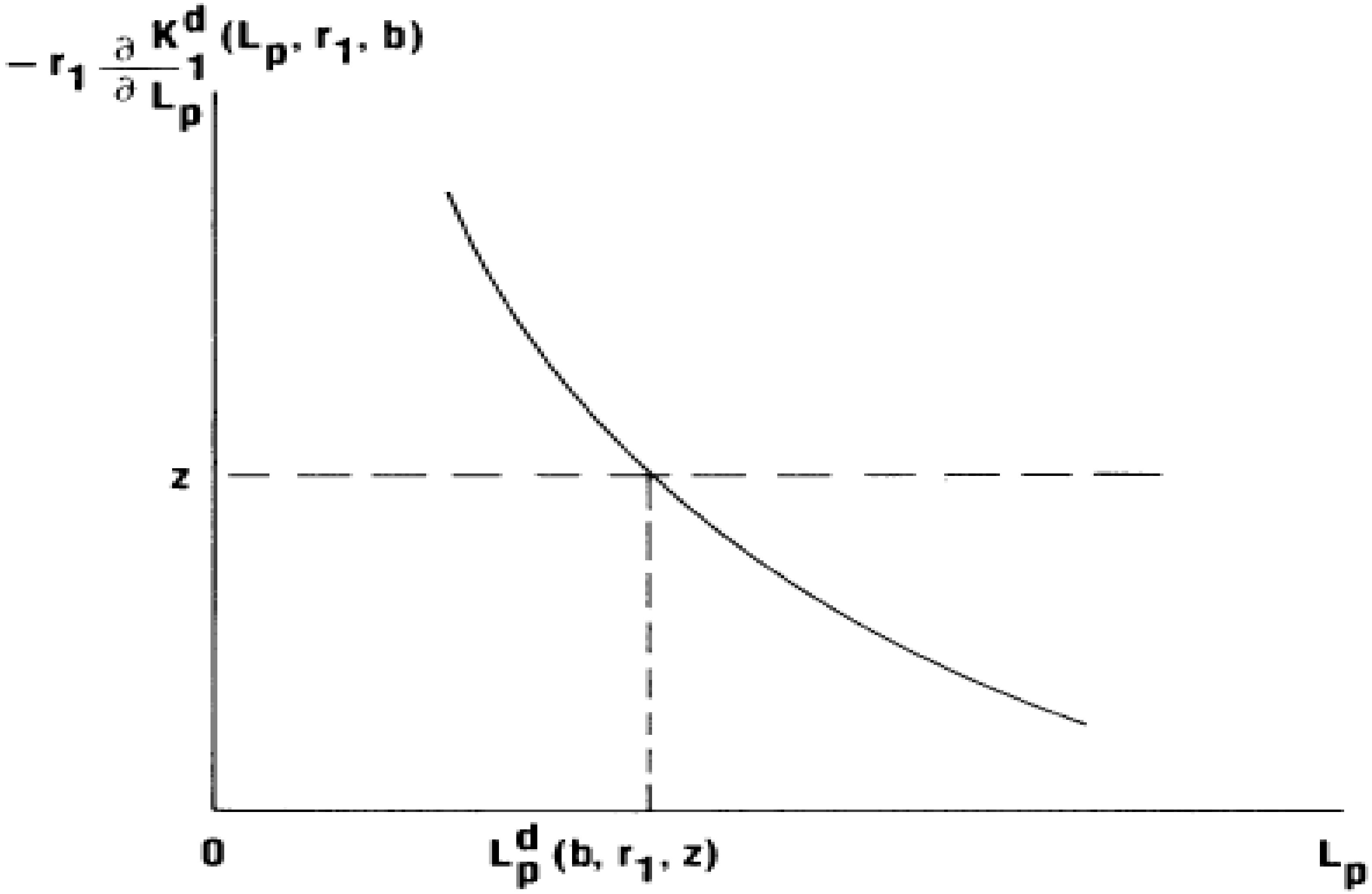


FIGURE 1. DETERMINATION OF THE DEMAND FOR PERMANENT LABOR

3.3 Supply Side

- The utility function of an agricultural worker is

$$U(y,e,l) = (y - el)^{\gamma}\,; 0 < \gamma < 1, \tag{9}$$

  - y: income received for the period;
  - e: intensity of effort;
  - l: fraction of the period for which he is employed.

- For an arbitrarily given e and wage rate w, the supply response, $l^*(w,e)$, of a worker is the solution to

$$\max_{l \leq 1} U(wl,e,l) = l^{\gamma}(w-e)^{\gamma}\,. \tag{10}$$

- The maximization in (10) yields the labour supply response:

$$l^*(w,e) \begin{cases} = 0 & \text{for } w < e \\ \in (0,1) & \text{for } w = e \\ = 1 & \text{for } w > e, \end{cases} \tag{11}$$

and an indirect utility function

$$V(w,e) = \{(w-e)\, l^*(w,e)\}^{\gamma}\,. \tag{12}$$

- Since $V(w,e)$ is a decreasing function of e, there is an obvious moral hazard problem under a fixed wage contract.

⇒ the monitoring of effort is absolutely necessary.

- Since Type 2 tasks are easy to monitor, workers performing these tasks can be costlessly supervised.

⇒ No reason to hire them on long-term contracts, and hiring them on the spot markets serves adequately.

- Since Type 1 tasks involve some discretions and judgement and are difficult to monitor,
  - the landlord needs to provide a self-enforcing (incentive) contract to workers performing Type 1 tasks.

- The landlord offers Type 1 workers a *permanent contract* (over the infinite horizon):
  - the worker receives a wage w_p per period in exchange for the worker's services for the fraction $l^* (w_p, \bar{e})$ of each period at an effort level $\bar{e}$.

- The worker's effort in period 1 is assumed to be accurately imputable at the end of the year.
  - If he is found to have shirked, he is fired at the end of the year.
    - He is, however, paid his wage, w_p, for each of the two periods.

- Once a Type 1 worker is fired, he cannot be rehired except as a casual worker.
  - If w_p is high enough that a worker's increase in utility from shirking is more than offset by the discounted loss in his utility in having to join the casual labour force,
    - he would never shirk.
  - We will determine this w_p in terms of w_c as follows.

- Assume workers discount utility at the same rate β as the landlord discounts profits.

- The present value utility of a permanent worker who never shirks is

$$J_p^h\left(w_p,\beta\right)=\frac{V\left(w_p,\bar{e}\right)}{1-\beta}. \tag{13}$$

  – The opportunity utility of a permanent worker is the discounted lifetime utility of a casual worker:

$$J_c\left(w_c,\beta\right)=\left(\frac{\beta}{1-\beta^2}\right)V\left(w_c,\bar{e}\right). \tag{14}$$

- Now turn to the possibility of shirking on the part of a permanent worker.

  – Since any shirking is guaranteed to termination at the end of period 2,

    ◦ a permanent worker who chooses to shirk, will optimally set $e=0$ in period 1.

    ◦ Shirking is not possible in period 2 since menial tasks are monitored costlessly.

$\Rightarrow$ His discounted utility over this crop year is: $V\left(w_p,0\right)+\beta V\left(w_p,\bar{e}\right).$

$\Rightarrow$ The discounted lifetime utility of a permanent worker who shirks is

$$J_p^s(w_p, w_c, \beta) = V(w_p, 0) + \beta V(w_p, \bar{e}) + \beta^2 J_c(w_c, \beta). \tag{15}$$

- To ensure that a permanent worker never shirks, we require

$$J_p^h(w_p, \beta) \geq J_p^s(w_p, w_c, \beta). \tag{16}$$

  – For given w_c and β, (16) puts a lower bound on the permanent worker's wage which will elicit the required level of effort;

    ◦ we refer to this wage as $\bar{w}_p(w_c, \beta)$, that is, $w_p \geq \bar{w}_p(w_c, \beta)$.

- At any w_p that satisfies (16) a worker obtains a strictly higher utility in a permanent contract than in a series of spot contracts:

$$J_p^h(w_p, \beta) > J_c(w_c, \beta). \tag{17}$$

  – **Verify this.**

- It follows that the number of permanent workers hired will be demand determined.
  - Since a worker strictly prefers being a permanent worker to being a casual worker,
    - there will generally be an *excess supply* of workers seeking permanent contracts.
  - This will *not* result in a downward pressure on permanent workers' wage since any $w_p < \bar{w}_p(w_c, \beta)$ is *not* credible:
    - it leaves an incentive for the permanent worker to shirk.
  - A casual worker who seeks to obtain a permanent contract by offering to work for a wage marginally less than $\bar{w}_p(w_c, \beta)$
    - will find that the landlord will not entertain the offer.
- We shall find later that the behaviour of $\bar{w}_p(w_c, \beta)$ as a function of w_c is of crucial importance for the response of the economy to various exogenous changes.
  - This behaviour is recorded in the following proposition.

- **Proposition 1.** *For $w_c \geq \bar{e}$, an increase in w_c warrants a change in $\bar{w}_p$ that is*

(a) *positive*, *and*

(b) *if* $\bar{w}_p(w_c, \beta) < w_c$, *then* $\dfrac{d\bar{w}_p}{dw_c} < \dfrac{\beta}{1+\beta}$.

- Part (a) is very reasonable since $w_c \uparrow$ amounts to an increase in the permanent worker's opportunity income (and utility).

- According to part (b), when the permanent worker's per period wage rate $\bar{w}_p(w_c, \beta)$ is less than that of a casual worker, w_c,
  - the increase ($\triangle \bar{w}_p$) that is required to compensate a permanent worker for an exogenous increase ($\triangle w_c$) in a casual worker's wage satisfies

$$(1+\beta)\triangle \bar{w}_p < \beta \triangle w_c. \tag{19}$$

    - That is, the increase in present value cost of engaging a permanent worker is less than that of a casual worker.

3.4 Equilibrium

- We now turn to the determination of the equilibrium.
- Equilibrium levels of capital in the two periods are demand determined.
- Since permanent workers are held above their opportunity utilities, their number, L_p^*, is also demand determined:

$$L_p^*(b, r_1, z) = L_p^d(b, r_1, z). \tag{20a}$$

- Demand for casual workers is given by

$$L_c^d(ab, L_p, r_2, w_c) = L_a^d(ab, r_2, w_c) - L_p^*(b, r_1, z). \tag{20b}$$

- Condition (16) translates into

$$\frac{V(w_p, \bar{e})}{1-\beta} \geq V(w_p, 0) + \beta V(w_p, \bar{e}) + \frac{\beta}{1-\beta^2} V(w_c, \bar{e}). \tag{20c}$$

  – For any w_c, (20c) determines the minimum w_p that will prevent a permanent worker from shirking, that is, $w_p \geq \bar{w}_p(w_c, \beta)$.

- (11) $\Rightarrow$ in equilibrium we must have $w_c \geq \bar{e}$ and $w_p \geq \bar{e}$.

- Note also that $w_p = \bar{e}$ is never a solution to (20c) when $w_c \geq \bar{e}$:
  - Follows from the fact that (20c) implies

$$V\left(w_p, \bar{e}\right) > \frac{\beta}{1+\beta} V\left(w_c, \bar{e}\right) \Rightarrow \left(w_p - \bar{e}\right) l^*\left(w_p, \bar{e}\right) > \left(\frac{\beta}{1+\beta}\right)^{\frac{1}{\gamma}} \left(w_c - \bar{e}\right) l^*\left(w_c, \bar{e}\right).$$

- Thus we must have $w_p > \bar{e}; \Rightarrow l^*\left(w_p, \bar{e}\right) = 1$ for a permanent worker;

$\Rightarrow$ each permanent worker provides one efficiency unit of labour per period.

- Assuming N to be the (exogenously given) total number of workers, the aggregate supply of casual labor in the second period is:

$$L_c^s\left(w, e\right) \begin{cases} = 0 & \text{for } w_c < \bar{e} \\ \in \left(0,\ N - L_p^*\right) & \text{for } w_c = \bar{e} \\ = N - L_p^* & \text{for } w_c > \bar{e}. \end{cases} \tag{20d}$$

- This completes the specification of the model.

- Exogenous to the model are:

  – the production and utility functions,

  – the discount factor, β,

  – the rental rates on capital, r_1 and r_2, and

  – the total labour force, N.

- The general equilibrium system defined by (20a) – (20d) determine the following endogenous variables:

  – w_p, w_c, L_p and L_c.

- The two remaining endogenous variables, K_1 and K_2, are demand determined, and hence determined by (6a) and (6b).

- Figure 2 illustrates an equilibrium of the system of equations (20a) – (20d).

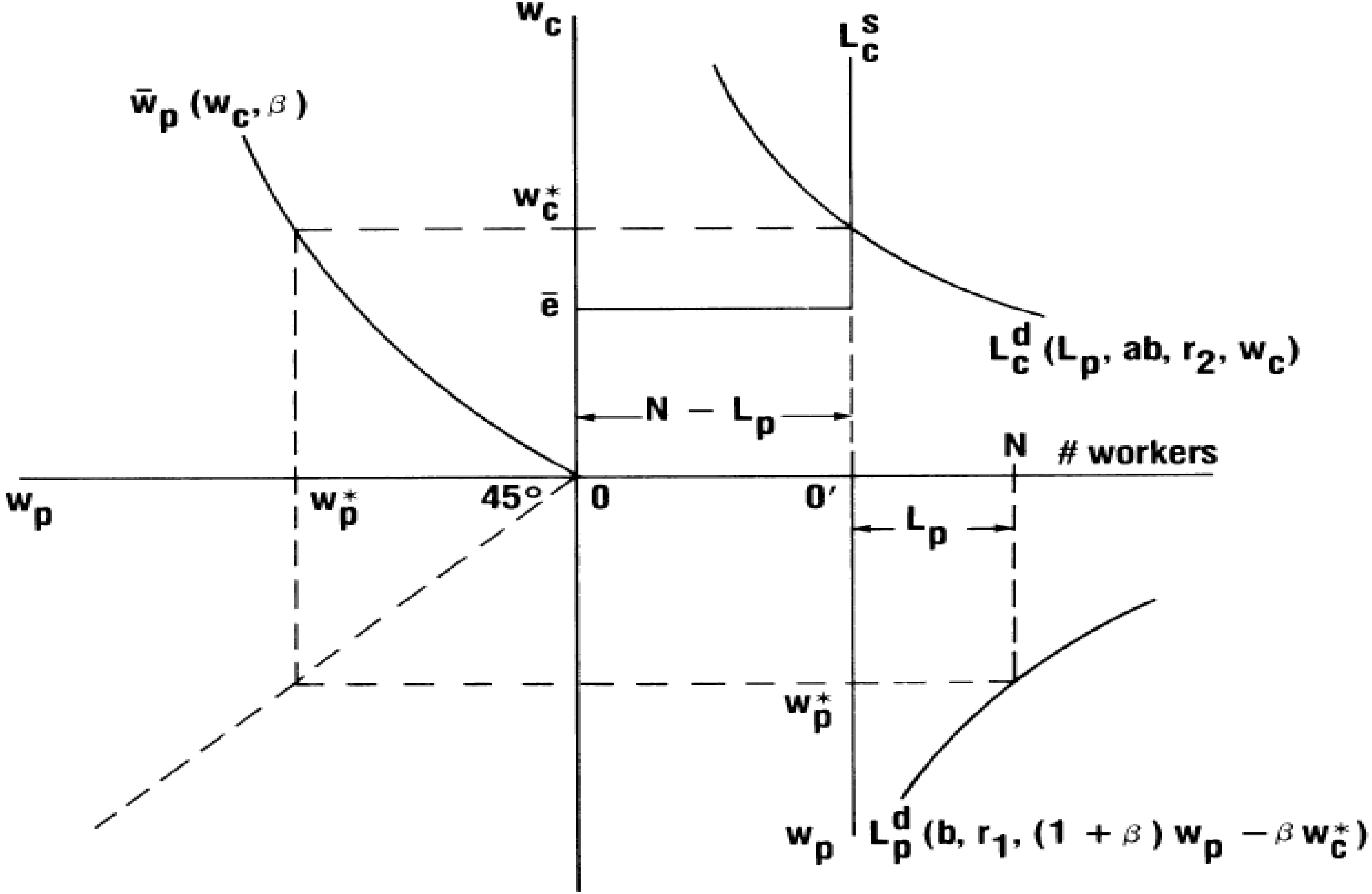


FIGURE 2. AN EQUILIBRIUM WITH UNEMPLOYMENT IN PERIOD 1 AND FULL EMPLOYMENT IN PERIOD 2

- For an arbitrarily chosen L_p, the casual labour supply is given by the kinked curve L_c^s in the first quadrant of Figure 2.
  - Demand for casual labour, L_c^d, is also shown in the first quadrant, obtained from (20b).

  $\Rightarrow$ The casual labour market clears at the wage rate w_c^*.

- The second quadrant displays the relationship $w_p = \bar{w}_p (w_c, \beta)$, obtained from (20c).

$\Rightarrow$ Associated with a casual labour wage rate w_c^* is a permanent labour wage rate w_p^*.

- The fourth quadrant displays the demand for permanent labour as a function of w_p when the casual labour wage rate is w_c^*.
  - This demand for permanent labour is measured from O' along the horizontal axis.

- If we have indeed located an equilibrium, the demand for permanent labour at w_p^* will be exactly equal to the L_p with which we began our construction.

3.5 Results

- We now turn to the comparative static results of the model.
- These results depend crucially on whether $w_c^* \gtreqless w_p^*$.
  - These are endogenous and the model allows for both possibilities.
- Since the purpose is to confront the predictions with empirical evidence, we pursue the empirically relevant case:

$$w_c^* > w_p^*. \tag{21}$$

  - Refer to Richards (1979), Rudra (1982) and Basant (1984).
- Defining $z^* = (1+\beta)\, w_p^* - \beta w_c^*$, we see from (18) that

$$\frac{dz^*}{dw_c^*} = (1+\beta)\left[\frac{dw_p^*}{dw_c^*} - \frac{\beta}{1+\beta}\right] < 0. \tag{22}$$

  - The difference in the present value cost of hiring a permanent worker over that of hiring a casual worker declines with dw_c^*.

- **Proposition 2.** *In an equilibrium*,

(a) *an increase in* N *decreases the proportion of permanent contracts*,

(b) *an increase in* a (*or* b *or both*) *increases the number of permanent contracts*,

(c) *an increase in* a, *with* ab *held constant*, *decreases the number of permanent contracts*,

(d) *an increase in* r_1 *or* r_2 *increases the number of permanent contracts*.

- (a) says the proportion of permanent workers is higher the tighter the labour market.
  - $N \downarrow \Rightarrow w_c^* \uparrow \Rightarrow w_p^* \uparrow$.
  - However, the increases satisfy inequality $(1+\beta)\,\triangle\bar{w}_p < \beta\triangle w_c$,

  $\Rightarrow$ the marginal permanent worker is becoming cheaper to hire relative to a casual worker in period 2,

  $\Rightarrow$ induces a substitution of permanent for casual workers.

- (a) explains the dramatic increase in the percentage of permanent contracts in East Prussian agriculture in the first half of the 19th century.
  - Between 1815-49 there was an increase in the cultivated area by almost 90%, and a simultaneous agrarian reform resulting in peasants losing land to large landlords.
    - ◦ The loss of land forced the peasants into the labour market.
  - Richards (1979) estimates a 3% total net loss of land by peasants, $\Rightarrow$ an overall decrease in the labour-to-land ratio, $\Rightarrow$ a higher proportion of permanent workers.

- (b) says a yield-increasing technological improvement increases the proportion of permanent workers.
  - Technological improvement $\Rightarrow L_c^d \uparrow, \Rightarrow w_c^* \uparrow \Rightarrow w_p^* \uparrow$.
  - However, inequality $(1+\beta)\,\triangle\bar{w}_p < \beta\triangle w_c \Rightarrow$ permanent worker becomes cheaper relative to casual worker, inducing a substitution of permanent for casual workers.

- Bardhan (1983) provides empirical evidence that the percentage of permanent labour in India is positively correlated with the index of land productivity.

- An increase in output price will induce an increase an output.
  - This effect can be simulated by an increase in a in this model.
    - That is, output price $\uparrow$ induces a substitution of permanent for casual workers.

- Part (b) then explains the impact of the opening up of export markets on the labour composition in 19th century Chile.

- In the 1860's, Chile began to export grain to European markets, and this lasted until 1890.

- Bauer (1971) estimated that the percentage of casual workers in the rural labour force of central Chile fell from 72% in 1865 to 39% in 1895.

  - This observation is consistent with part (b) of Proposition 2.

- In part (c) the final output is held fixed and the burden of activity is shifted across the two periods.
  - An increase in a (with ab held constant) implying a decrease in b,
    - makes cultivation less land-intensive in the first period while increasing the activity in the peak season.
  - Since in the second period casual and permanent labour are substitutable, we observe a shift from permanent to casual labour.
- Jan Breman (1974) observes that a change in crops
  - from rice which had relatively even distribution of tasks over the two periods
  - to mangoes which has a very heavy labour demand in period 2
    - resulted in the replacement of permanent contracts by casual labour contracts in Gujarat.

- Part (d) implies $r_1 \downarrow$ would displace permanent workers,
  - consequently increase the use of casual labour in the second period.
- In India, because of the notoriously imperfect capital markets,
  - farms with tractors are those for which the owners face lower capital costs.
  - If tractors were employed on such farms only during period 1 (for operations such as ploughing and sowing),
    - the result would be a displacement of permanent workers by casual workers.
  - While the existing empirical literature – Rudra (1982), Agarwal (1981) – bears out prediction regarding permanent workers,
    - there is conflicting evidence on the effect on casual workers employment.
  - Eswaran and Kotwal (1985) conjectures that this conflict arises because tractors are used on some farms for period 1 operations only, while on others they are also used in period 2.

References

- This note is based on

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

2. Dasgupta, Partha and Debraj Ray (1986), "Inequality as a Determinant of Malnutrition and Unemployment: Theory", *Economic Journal*, 96, 1011-1034.

3. Dasgupta, Partha and Debraj Ray (1987), "Inequality as a Determinant of Malnutrition and Unemployment: Policy", *Economic Journal*, 97, 177-188.

   and

4. Eswaran, Mukesh and Ashok Kotwal (1985), "A Theory of Two-Tier Labour Markets in Agrarian Economies", *American Economic Review*, 75, 162-177.