Development From the Viewpoint of Nonconvergence: History: Inequality and Markets

1. Introduction

- Recall our hypothesis of **historically conditioned divergence:**

  Two societies with the same fundamentals can evolve along very different paths depending on

  – past expectations

  – aspirations

  – actual history.

- So far we have considered **inertial self-reinforcement:**

  Multiple equilibria (associated with differing levels of development) that are driven by alternative degrees of optimism or pessimism, with the equilibria in turn 'justifying' these beliefs – *expectations* or *aspirations*.

- This view of underdevelopment may be usefully complemented by a related, though distinct approach:

  Historical self-reinforcement: Historically given initial conditions can persistently influence current outcomes, thereby reinforcing historical legacies.

- Historical legacies need not be limited to a nation's inheritance of capital stock or GDP from its ancestors.
  - Various diverse factors may serve as initial conditions with a long reach:
    - the distribution of economic or political power,
    - legal structure,
    - traditions,
    - group reputations,
    - colonial heritage,
    - specific institutional settings.
  - Factors that have received special attention in the literature include
    - historical inequalities,
    - nature of colonial settlement,
    - character of early industry and agriculture,
    - early political institutions.

- But, of all these factors, perhaps the darkest shadow is cast by *initial inequalities in the distribution of asset ownership*.
  - With imperfect capital markets, the poor are limited in their access to credit necessary for production and investment.
    - Hence, increased inequality can exert negative effects on both levels and growth rates of per capita income.
  - High initial inequalities may also create conditions for self-perpetuation,
    - generating a lock-in effect with economic stagnation.
  - The very same fundamental economy would perform differently
    - faced with a different level of initial inequality, or
    - jolted by a one-time redistribution.
- The three readings that will be discussed in the lectures emphasize various aspects of this connection between inequality and development:
  - Galor and Zeira (1993); Banerjee and Newman (1993); and Ghatak and Jiang (2002).

2. Galor and Zeira (1993)

- Analyzes the role of *wealth distribution* in explaining the *persistent differences in per-capita output across countries* through investment in *human capital*.
- Shows that the initial distribution of wealth affects aggregate output and investment both in the short and in the long run in the presence of
  - credit market imperfections, and
  - indivisibilities in investment in human capital.
- Shows how the convergence prediction of the neoclassical growth model can be overturned by dropping the assumptions of a convex technology and perfect capital markets.
  - With setup costs in the acquisition of certain occupations or skills, and borrowing constraints for poor agents,
    - the initial distribution of wealth will influence the aggregate skill composition of the economy and total output, resulting in self-reinforcement.

- Poor families will not find it worthwhile to invest in the education of their children,
  - locking their descendants into a poverty trap.
- High initial inequalities thus tend to perpetuate themselves.
- Moreover, countries with a historically higher poverty rate will have a persistently lower per capita income.

2.1 The Basic Model

- A small open economy in a one-good world.
  - The good can be used for either consumption or investment.
- The good can be produced by two technologies:
  - Production in *skilled* labour sector:

$$Y_t^S = F\left(K_t, L_t^S\right); \tag{1}$$

    - Y_t^S: output in skilled labour sector at time t;
    - K_t: amount of capital;
    - L_t^S: labour input in skilled labour sector at time t.
    - F is concave with constant returns to scale.
    - Investment in human and physical capital is made one period in advance.
    - No adjustment costs to investment and no depreciation of capital.

– Production in *unskilled* labour sector:

$$Y_t^n = w_n \cdot L_t^n; \tag{2}$$

◦ Y_t^n: output in unskilled labour sector at time t;

◦ L_t^n: labour input in unskilled labour sector at time t;

◦ $w_n > 0$ is marginal product of unskilled labour.

• Individuals live for two periods each in overlapping generations.

– *Either* work as unskilled in both periods of life,

– *Or* invest in human capital when young, and be skilled workers in the second period of life.

◦ Amount of (indivisible) investment in human capital: $h > 0$.

- Indivisibility of the amount of investment implies that there is a region of increasing returns to scale.

– An individual supplies one unit of labour in each of the working periods.

- Each individual has one parent and one child.
  - Creates the connection between generations.
  - Also $\Rightarrow$ no population growth.
- A continuum of individuals of size L in each generation.
- People care about their children and leave them bequests.
- People consume in the second period of life only (simplifying assumption).
- Individual utility function:

$$u = \alpha \ \log \ c + (1 - \alpha) \ \log \ b, \quad 0 < \alpha < 1, \tag{3}$$

  - c: consumption in second period,
  - b: bequest.
- All individuals are born with the same potential abilities and same preferences.
  - Differ only in the amounts they inherit from their parents.

Credit Market Imperfection:

- Capital is perfectly mobile.
  - Free access to international capital markets.
  - World rate of interest, r, is constant over time.
  - Individuals can lend any amount at this rate.
- Credit market imperfection shows up while borrowing.
  - A borrowing individual can evade debt payments.
  - Lenders can avoid such defaults by keeping track of borrowers.
  - If a lender spends z in keeping track of a borrower, the borrower can still evade, but only at a cost of βz, $\beta > 1$.
  - Competitive financial intermediation $\Rightarrow$ zero profit $\Rightarrow$

$$d \cdot (1 + i) = d \cdot (1 + r) + z,$$

    - d: amount of loan,
    - i: borrowing interest rate.

– Lenders choose high enough z to make evasion unprofitable:

$$d \cdot (1 + i) = \beta z.$$

– Follows that borrowing interest rate $>$ lending interest rate:

$$i = \frac{1 + \beta r}{\beta - 1} > r. \tag{7}$$

• Unlike individuals, firms are unable to evade debt payments,

– due to immobility, reputations, etc.

$\Rightarrow$ Firms can borrow at the lenders' interest rate, r.

– Capital in skilled labour sector is adjusted in each period so that

$$F_K \left(K_t, L_t^S \right) = r. \tag{4}$$

$\Rightarrow \frac{K_t}{L_t^S}$ is constant (why?).

$\Rightarrow$ Wage of skilled labour, w_S , is also constant (why?).

• Both labour markets and the good market are perfectly competitive.

2.2 Wealth Distribution and Short-Run Equilibrium

Individual Optimal Decisions:

- Individual's decision problem in second period of life:

$$\left.\begin{array}{l} \underset{\{c,b\}}{\text{Maximize}} \ \alpha \ \log \ c + (1-\alpha) \ \log \ b, \\ \text{subject to, } c + b \leq M. \end{array}\right\}$$

  - M: individual's lifetime income.

- Solution to individual's decision problem:
  - $c^* = \alpha \cdot M$,
  - $b^* = (1-\alpha) \cdot M$.

$\Rightarrow$ Lifetime utility: $U = \log M + \varepsilon$,

  - $\varepsilon = \alpha \log \alpha + (1-\alpha) \log (1-\alpha)$.

- Consider an individual who inherits an amount x from his parent.

- If works as unskilled and not invest in human capital,
  - Lifetime income: $M_n = (x + w_n)(1 + r) + w_n$;
  - Lifetime utility: $U_n(x) = \log[(x + w_n)(1 + r) + w_n] + \varepsilon$;
  - Bequest: $b_n(x) = (1 - \alpha) \cdot [(x + w_n)(1 + r) + w_n]$.
- If inheritance $x \geq h$, and invests in human capital,
  - *Lender* in first period of life;
  - Lifetime income: $M_S = (x - h)(1 + r) + w_S$;
  - Lifetime utility: $U_S(x) = \log[(x - h)(1 + r) + w_S] + \varepsilon$;
  - Bequest: $b_S(x) = (1 - \alpha) \cdot [(x - h)(1 + r) + w_S]$.
- If inheritance $x < h$, but invests in human capital,
  - *Borrower* in first period of life;
  - Lifetime income: $M_S = (x - h)(1 + i) + w_S$;
  - Lifetime utility: $U_S(x) = \log[(x - h)(1 + i) + w_S] + \varepsilon$;
  - Bequest: $b_S(x) = (1 - \alpha) \cdot [(x - h)(1 + i) + w_S]$.

- Note that if $w_S - h(1+r) < w_n(2+r)$, then $U_S(x)|_{\text{Borrower}} < U_S(x)|_{\text{Lender}} < U_n(x)$;

$\Rightarrow$ all individuals prefer to work as unskilled.

– Since this is a case with limited interest we assume that

$$w_S - h(1+r) \geq w_n(2+r). \tag{14}$$

$\Rightarrow U_S(x)|_{\text{Lender}} \geq U_n(x) \Rightarrow$ lenders prefer to invest in human capital.

- Borrowers invest in human capital as long as $U_S(x)|_{\text{Borrower}} \geq U_n(x)$,

– that is, as long as $(x-h)(1+i) + w_S \geq (x+w_n)(1+r) + w_n$,

– that is, as long as

$$x \geq \frac{w_n(2+r) + h(1+i) - w_S}{i-r} \equiv f. \tag{15}$$

$\Rightarrow$ Individuals who inherit an amount smaller than f would prefer not to invest in human capital but work as unskilled.

◦ Education is limited to individuals with high enough initial wealth,

· due to a higher interest rate for borrowers.

Wealth Distribution and Short-Run Equilibrium:

- Inheritance of an individual fully determines
  - decisions whether to invest in human capital or work as unskilled,
  - how much to consume and bequeath.
- Let D_t be the distribution of inheritances by individuals born in period t:
  - $D_t(x_t) =$ proportion of individuals born in period t with inheritance $\leq x_t$.
  - This distribution satisfies: $\int_0^\infty dD_t(x_t) = L.$
- D_t fully determines economic performance in period t:
  - skilled labour: $L_t^S = \int_f^\infty dD_t(x_t)\,.$
  - unskilled labour: $L_t^n = \int_0^f dD_t(x_t)\,.$

$\Rightarrow$ Wealth distribution determines aggregate output and has a strong effect on the macroeconomic equilibrium.

2.3 The Dynamics of Wealth Distribution

- The distribution of wealth (D_t) not only determines equilibrium in period t, but also determines next period distribution of inheritances (D_{t+1}).

- From D_t to D_{t+1}:

$$x_{t+1} = \begin{cases} b_n(x_t) = (1-\alpha)\cdot[(x_t + w_n)(1+r) + w_n], & \text{if } x_t < f \\ b_S(x_t) = (1-\alpha)\cdot[(x_t - h)(1+i) + w_S], & \text{if } f \le x_t < h \\ b_S(x_t) = (1-\alpha)\cdot[(x_t - h)(1+r) + w_S], & \text{if } x_t \ge h. \end{cases} \tag{19}$$

- This dynamic evolution of wealth distribution is illustrated in Figure 1.

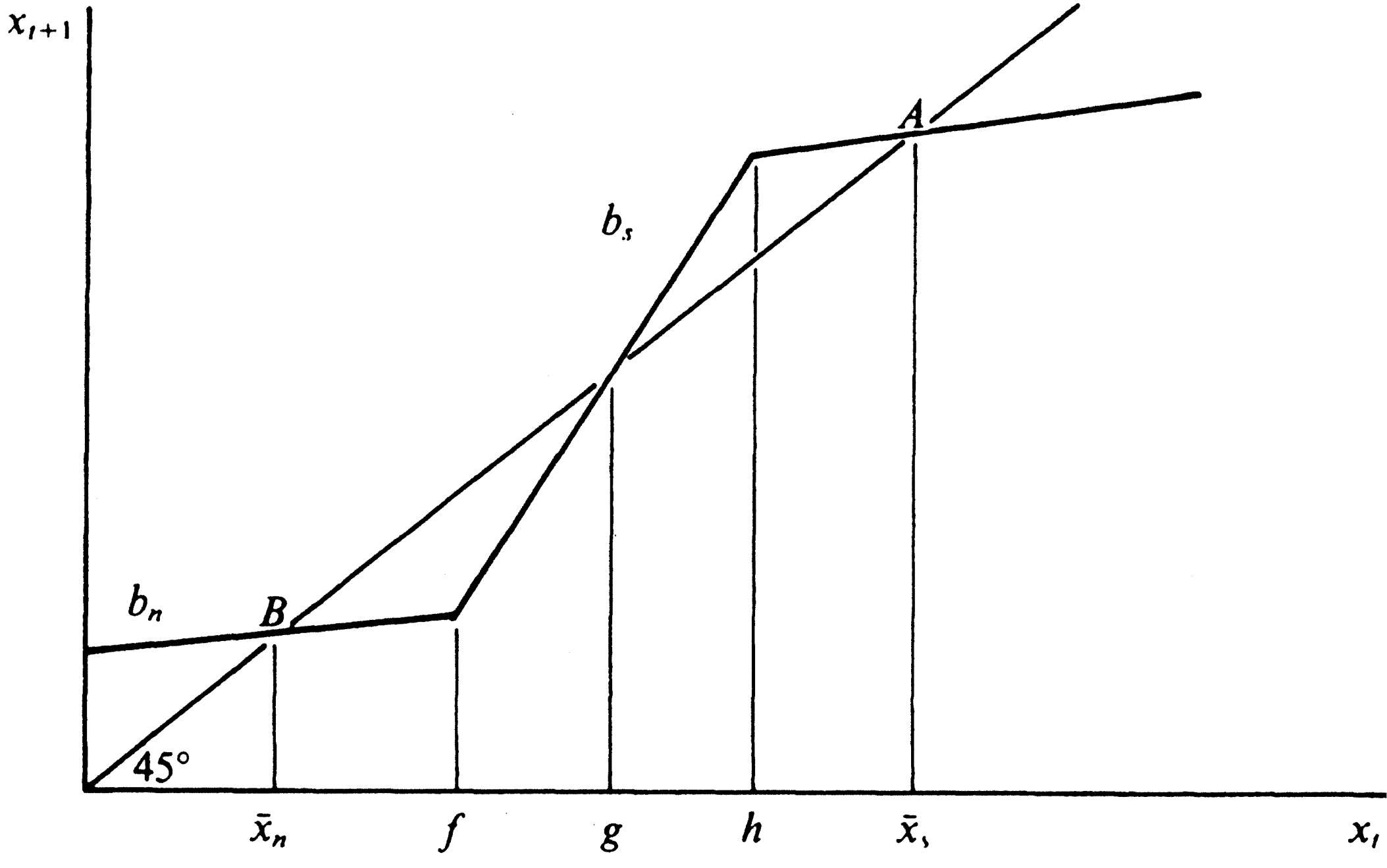

FIGURE 1

- Individuals who inherit *less* than f
  - work as unskilled;
  - their descendants in all future generations also work as unskilled;
  - their inheritances converge to a long-run level $\bar{x}_n$:

$$\bar{x}_n = \frac{w_n (1-\alpha)(2+r)}{1-(1-\alpha)(1+r)}. \tag{20}$$

- Individuals who inherit *more* than f
  - invest in human capital;
  - *not* all descendants remain in skilled labour sector in future generations.
    - The critical point in Figure 1 is g:

$$g = \frac{(1-\alpha)[h(1+i) - w_S]}{(1+i)(1-\alpha) - 1}. \tag{21}$$

- Individuals who inherit *less* than g
  - may invest in human capital for some generations,
  - but, after some generations, their descendants become unskilled workers,
  - their inheritances converge to $\bar{x}_n$.

- Individuals who inherit *more* than g
  - invest in human capital,
  - and so do their descendants, generation after generation;
  - their bequests converge to $\bar{x}_S$:

$$\bar{x}_S = \frac{(1-\alpha)\left[w_S - h\left(1+r\right)\right]}{1-(1-\alpha)\left(1+r\right)}. \tag{22}$$

- In the long run dynasties are concentrated in two groups:
  - **rich dynasties:** generation after generation invests in human capital;
  - **poor dynasties:** unskilled workers generation after generation.

Two Assumptions in Drawing Figure 1:

1. Slopes of b_n and b_S in Figure 1 are less than 1 at $\bar{x}_n$ and $\bar{x}_S$ respectively.
   - That is, we assume that α and r satisfy:

$$(1-\alpha)(1+r) < 1. \tag{23}$$

   - This assumption guarantees that the process of bequest formation from generation to generation is stable and does not explode.

2. Slope of b_S in Figure is greater than 1 for $f < x_t < h$:

$$(1-\alpha)(1+i) > 1, \text{ that is, } \frac{\beta}{\beta-1}(1-\alpha)(1+r) > 1. \tag{24}$$

   - That is, enforcement costs are rather high so that the spread between the lending and borrowing interest rates is high too.
   - If (24) does not hold, all long-run distributions of labour are concentrated in either the unskilled labour sector or in the skilled sector.

The Long-Run Equilibrium:

- The dynamic evolution of the aggregate economy can be deduced from the individual dynamics, as presented in Figure 1.
  - The economy converges to a long-run equilibrium in which the population is divided into two groups:
    - *skilled workers* with wealth $\bar{x}_S$, and
    - *unskilled workers* with wealth $\bar{x}_n$.
  - Relative size of the two groups in the long-run depends on *initial wealth distribution*:
    - poor (unskilled): $L_\infty^n \equiv \lim_{t\to\infty} L_t^n = \int_0^g dD_0(x_0) \equiv L_0^g$.
    - rich (skilled): $L - L_\infty^n$.
  - The long-run level of average wealth is:

$$\frac{1}{L}\left[L_\infty^n \cdot \bar{x}_n + (L - L_\infty^n) \cdot \bar{x}_S\right] = \bar{x}_S - \frac{L_0^g}{L}\left(\bar{x}_S - \bar{x}_n\right).$$

    - The long-run level of average wealth is *decreasing* with $\frac{L_0^g}{L}$.

Characterizing the Long-Run Equilibrium:

- Long-run levels of income and wealth are *positively* related to the *initial* number of individuals who inherit more than g.
  - Initially poor economy ends up poor in the long-run.
  - Initially rich economy, with relatively equal wealth distribution, ends up rich.
  - Economy with large amount of initial wealth, but held by just a few, ends up poor.
- *A country has better growth prospects if it has a relatively larger middle class.*
- The long-run equilibrium depends on initial wealth distribution;
  - *history dependence.*
- *Multiple long-run equilibria*:
  - the specific equilibrium an economy converges to depends on initial wealth distribution.

2.4 The Two Major Assumptions

1. *Credit markets are imperfect*:
   - the interest rate for individual borrowers is higher than that for lenders.
2. *Investment in human capital is indivisible*:
   - there is a *technological non-convexity*.

- The result that wealth distribution affects economic activity in the short run is due to the assumption that credit markets are imperfect.
  - This result is quite intuitive.
    - If borrowing is difficult and costly, those who inherit a large initial wealth and do not need to borrow have better access to investment in human capital.
      - Hence the distribution of wealth affects the aggregate amounts of investment in human capital and of output.

- This result was first shown by Loury (1981).
  - But, in Loury (1981), although credit markets are imperfect, the production function of human capital is smooth and convex.
  - As a result the effect of wealth distribution disappears in the long-run,
    - all initial wealth distributions in Loury's model converge to a unique ergodic distribution.

- Galor and Zeira (1993) shows that if we add the second assumption, that technology is non-convex,
  - the inherited distribution of wealth affects the economy not only in the short run but in the long run as well.
    - As a result of this second assumption there are multiple long-run equilibria and dynamics are no longer ergodic.

2.5 The Model with Variable Wages

- Now the basic model is extended to include variable wages for unskilled workers.
  - Additional Assumptions:
    1. Production by unskilled labour involves a second factor of production, land.
    2. The unskilled work only in first period of life (simplifying assumption).
  - Production by unskilled labour and land is described by:

$$Y_t^n = G\left(L_t^n, N\right); \tag{27}$$

    - N: land; aggregate amount fixed at $\bar{N}$;
    - G is a constant return to scale production function.

  $\Rightarrow$ Wages of unskilled workers are:

$$w_t^n = G_L\left(L_t^n, N\right) = P\left(L_t^n\right), \tag{28}$$

    - $P\left(L_t^n\right)$ describes the diminishing marginal productivity of unskilled labour.
    - (28) is the inverse demand function for unskilled labour.

The Supply of Unskilled Workers:

- Since w_t^n is endogenous, f, the threshold level for investment in human capital defined in equation (15), is now a function of w_t^n:

$$f\left(w_t^n\right) = \frac{w_t^n\left(1+r\right) + h\left(1+i\right) - w_S}{i-r}. \tag{30}$$

  - Compared with (15), w_t^n is now multiplied by $\left(1+r\right)$ instead of $\left(2+r\right)$ reflecting the fact that the unskilled work only in the first period of life.

- The supply of unskilled workers is determined by the number of individuals whose inheritance falls short of the threshold level $f\left(w_t^n\right)$:

$$S_t = \int_0^{f(w_t^n)} dD_t\left(x_t\right). \tag{29}$$

- The supply curve, S_t, is depicted in Figure 2.
  - Note that if $w_t^n > \frac{w_S}{(1+r)} - h$, then $U_S(x)|_{\text{Borrower}} < U_S(x)|_{\text{Lender}} < U_n(x)$, $\Rightarrow S_t = L$.
  - At $w_t^n = \frac{w_S}{(1+r)} - h$, $U_n(x) = U_S(x)|_{\text{Lender}} > U_S(x)|_{\text{Borrower}}$, $\Rightarrow$ the supply curve becomes flat at this wage.
  - The supply curve is upward sloping.
    - As $w_t^n \uparrow$, $f(w_t^n) \uparrow$, and hence $S_t = \int_0^{f(w_t^n)} dD_t(x_t)$ increases.
  - The supply curve can contain horizontal as well as vertical segments.
    - Horizontal segment if there is a group of positive measure who inherit the same amount.
    - Vertical between w_0 and w_1, if the distribution D_t is such that there are no inheritances between $f(w_0)$ and $f(w_1)$.

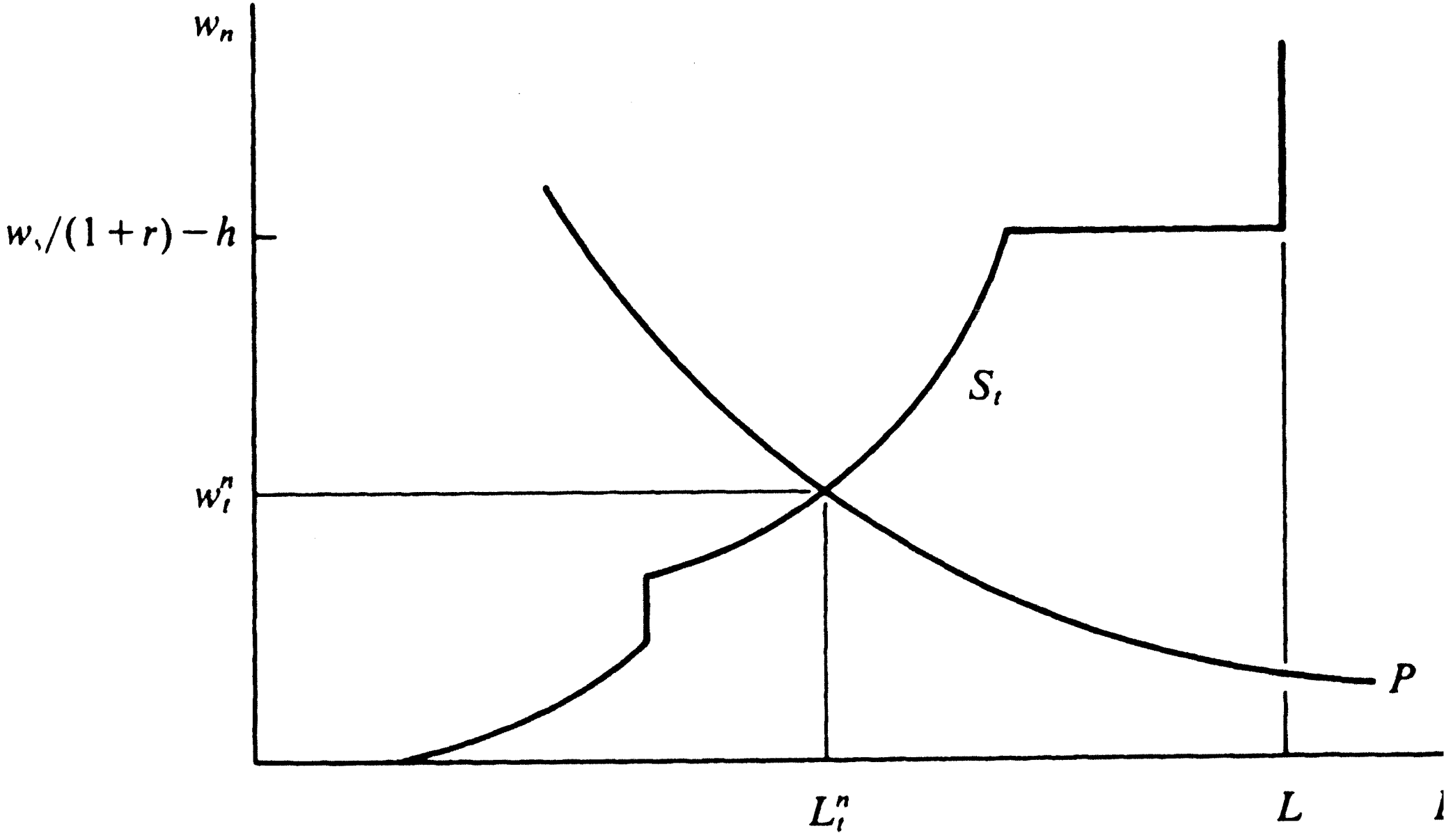

FIGURE 2

- Figure 2 presents demand P, supply S_t and the equilibrium in the unskilled labour market.
  - This equilibrium in the unskilled labour market determines
    - the wage of unskilled,
    - the number of unskilled, and
    - the number of investors in human capital.
  - And the number of skilled and unskilled workers determine the aggregate output.
- It is clear from Figure 2 that this short-run macroeconomic equilibrium depends on the distribution of inheritances D_t.
- Next we show that the historically given initial distribution of wealth D_0 affects the equilibrium not only in the short run, but in the long run as well.

2.6 Wealth Distribution and National Income

- We first describe the dynamic evolution of wealth within dynasties:

$$x_{t+1} = \begin{cases} b_n(x_t) = (1-\alpha)\cdot[(x_t + w_n)(1+r)], & \text{if } x_t < f(w_t^n) \\ b_S(x_t) = (1-\alpha)\cdot[(x_t - h)(1+i) + w_S], & \text{if } f(w_t^n) \le x_t < h \\ b_S(x_t) = (1-\alpha)\cdot[(x_t - h)(1+r) + w_S], & \text{if } x_t \ge h. \end{cases} \tag{31}$$

  - These dynamics are similar to those in the basic model with one exception,
    - w_t^n is no longer fixed, but is endogenous and depends on the wealth distribution.
  - This significantly complicates the dynamic analysis,
    - but the diagrams enable us to describe these dynamics in a fairly simple way.
  - Figure 3 describes this individual bequest dynamics;
    - differs from Figure 1 in that the b_n line is not fixed, shifts with the endogenous w_t^n.

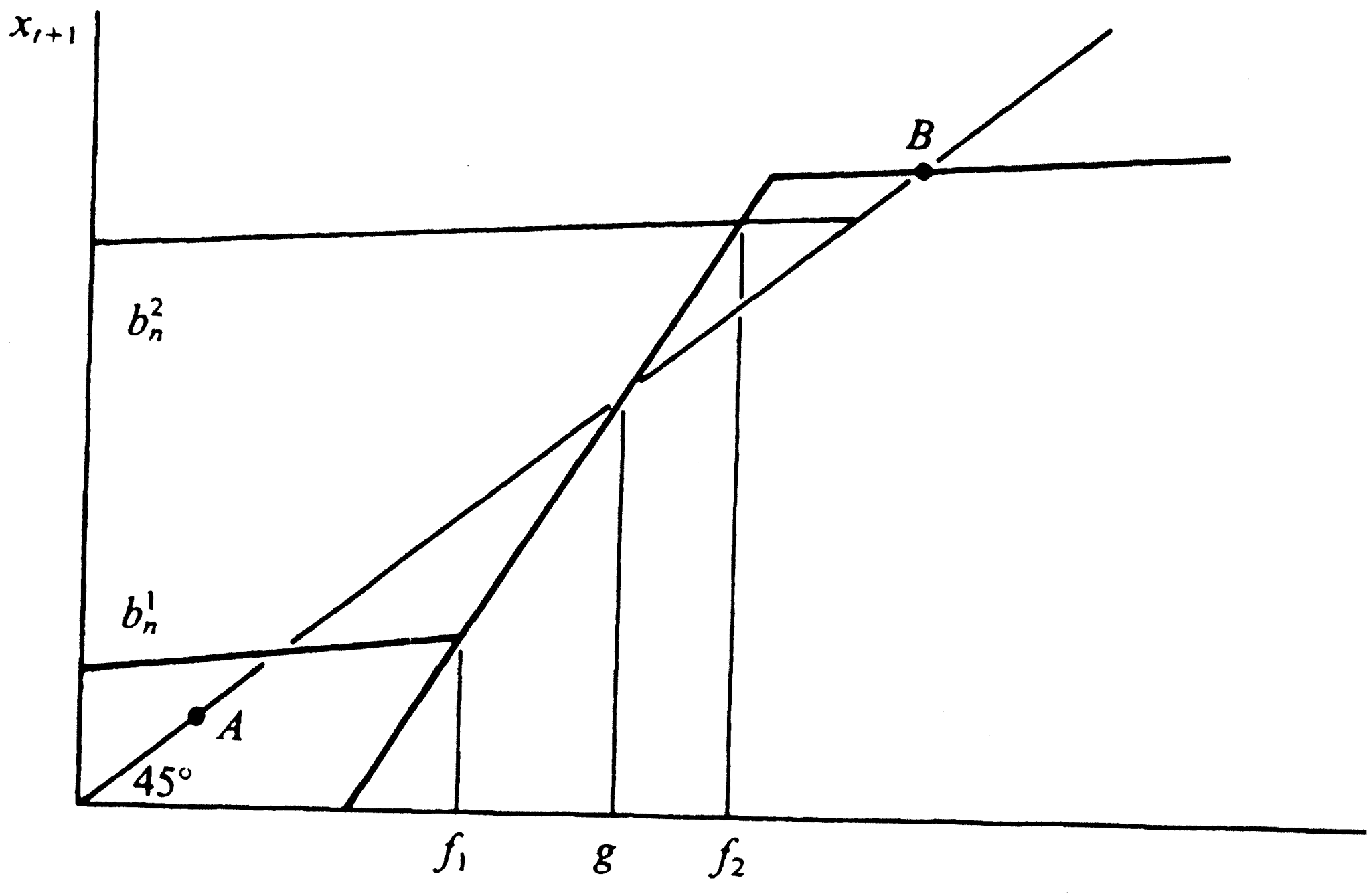

FIGURE 3

- An economy is defined as “developed” if the equilibrium wage of unskilled workers in period 0, w_0^n, is high and satisfies $f\left(w_0^n\right) > g$, where g is given by equation (21).
  - Intuitively an economy is developed if the number of individuals who have high inheritances in 0 is large.
  - Such a case is described by the b_n^2 line in Figure 3.
  - It can be shown that an economy is developed if and only if $w_t^n > w_g$, where w_g is defined by:

$$w_g = \frac{(\alpha + \alpha r - r)\left[w_S - h\left(1+i\right)\right]}{(1+r)\left(\alpha + \alpha i - i\right)}. \tag{32}$$

- Similarly an economy is defined as “less developed” if $w_0^n \leq w_g$.

Dynamics of a Less Developed Economy:

- Individual bequests in this economy in period 0 are described by the lines b_n^1 and b_S in Figure 3.

- Observation:
  - individuals who inherit more than g leave a bequest which is larger than what they have inherited,
  - individuals who inherit less than g leave a bequest which is smaller than what they have inherited.

$\Rightarrow$ The supply curve of unskilled labour in period $t+1$, S_{t+1}, is rotated relative to S_t around w_g, as described in Figure 4.

$\Rightarrow$ The wage of unskilled workers falls and b_n shifts downward.

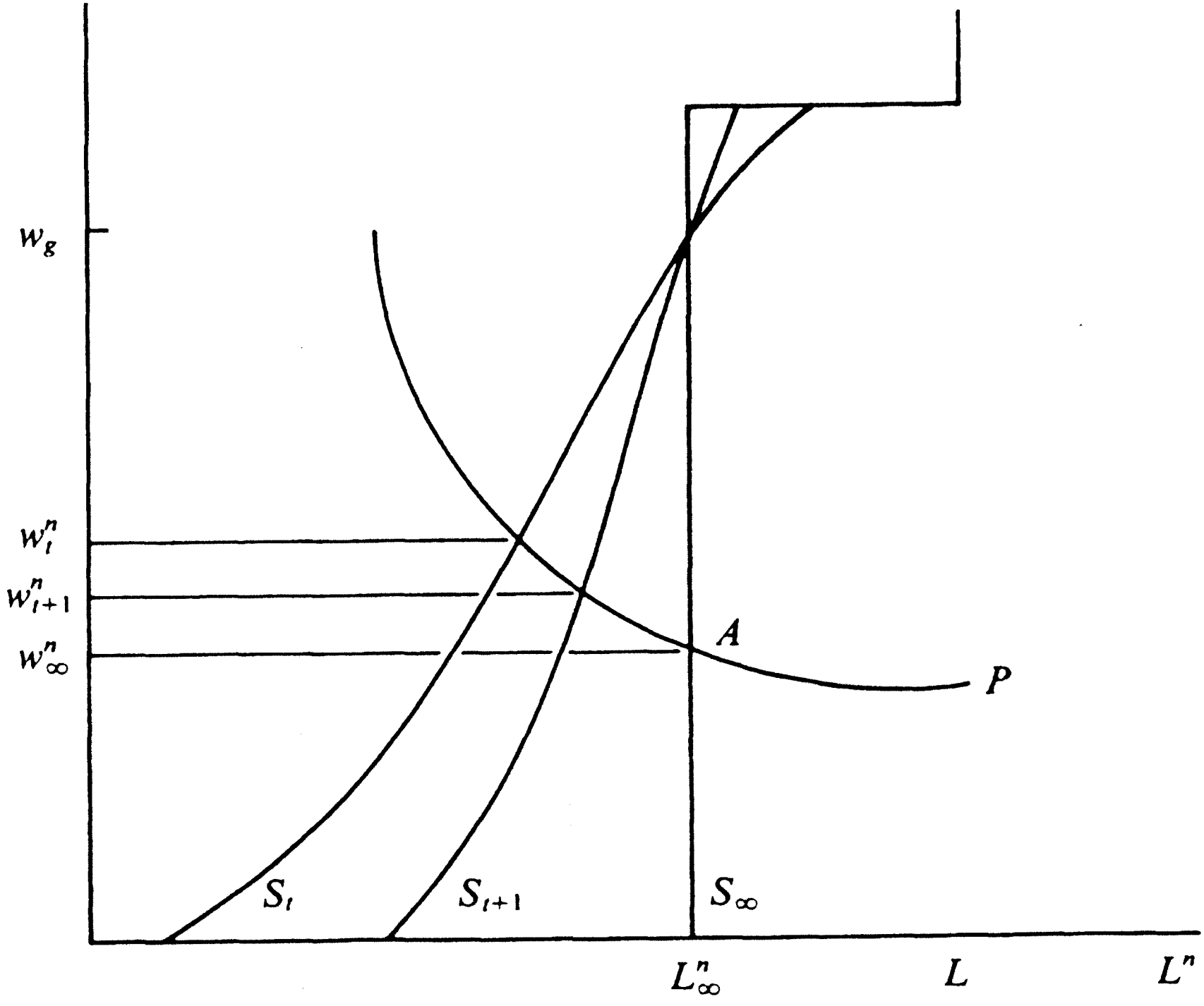

FIGURE 4

- This process continues and the economy converges to the long-run equilibrium at point A in Figure 4, where
  - the wage is w_{∞}^{n},
  - the number of unskilled workers is L_{∞}^{n}, and
  - S_{∞} is the supply curve.
- The long-run wealth of the unskilled is $\bar{x}_n$, given by point A in Figure 3.

• Notice that the long-run number of unskilled workers L_{∞}^{n} equals precisely the number of those who inherit less than g in the initial period, $\int_0^g dD_0(x_0) \equiv L_0^g$.

- This number is time independent and remains constant for all t.

$\Rightarrow$ The above results are time-consistent.

Dynamics of a Developed Economy:

- Individual bequests in this economy in period 0 are described by the lines b_n^2 and b_S in Figure 3.
  - Every individual (in the relevant domain) bequeaths more than she has inherited.

$\Rightarrow$ The supply curve in next period shifts everywhere to the left.

$\Rightarrow$ wages rise: $w_{t+1}^n > w_t^n$, as shown in Figure 5.

  - This process continues until equilibrium is reached at B, where the unskilled wage rate is

$$w_\infty^n = \frac{w_S}{(1+r)} - h,$$

    - and b_n coincides with b_S.

- This is an *egalitarian* long-run equilibrium:
  - net life-time incomes of skilled workers and of unskilled workers are equal.

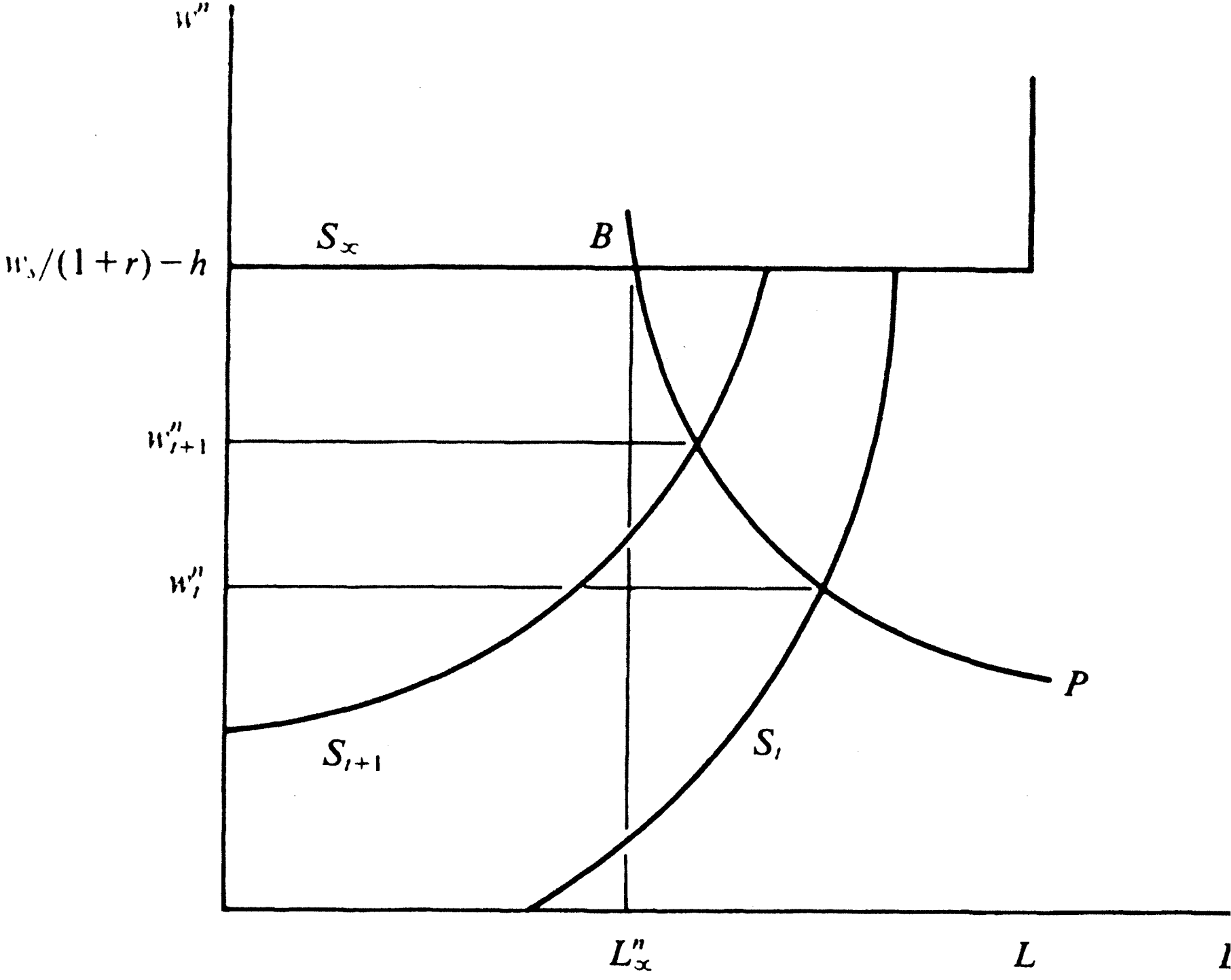

FIGURE 5

- The long-run economic dynamics in this model, therefore, crucially depend on the number of individuals who inherit less than g in period 0, L_0^g.
  - A country is developed if and only if $w_0^n > w_g$, that is, if and only if $P\left(L_0^g\right) > w_g$.
- Theorem 1 summarizes the long-run economic dynamics.

- **Theorem 1.**

  If an economy satisfies $0 < g < \bar{x}_S$, *its dynamics depend on the number of individuals who inherit less than* g *in period* 0, L_0^g:

(a) *A less developed economy, where* $P\left(L_0^g\right) \leq w_g$, *converges to an unequal distribution of income, where*

$$w_\infty^n < \frac{w_S}{(1+r)} - h.$$

(b) *A rich economy, where* $P\left(L_0^g\right) > w_g$, *converges toward an equal distribution of lifetime income, where*

$$w_\infty^n = \frac{w_S}{(1+r)} - h.$$

- This model shows that wealth and equality are highly correlated and affect one another.
  - On the one hand, countries with greater income per capita have a more equal distribution of income and smaller wage differentials.
  - On the other hand, countries with a more equal initial distribution of wealth grow more rapidly and have a higher income level in the long run.