Inequality and the Process of Development

CICSE Lectures, Naples

Lecture I: From the Classical to the Modern Perspective

Oded Galor

June 9, 2009

The Classical Theory

Inequality is beneficial for growth (in the post-industrialization stage)

Keynes (1920), Kaldor (1957)

- The marginal propensity to save increases with income
- Inequality channels resources towards individuals whose marginal propensity to save is higher

$\Longrightarrow$ increases aggregate savings & capital accumulation

$\Longrightarrow$ enhances the development process

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Equality and Development: Pre-Industrialization Stage

Equality may be essential for industrialization

Rosenstein-Rodan (1948), Lewis (1954), North (1959), Murphy, Shliefer and Vishny (1989)

- In the absence of international demand for domestic industrial goods, a broad distribution of income (from the leading agricultural sector) may be critical for the emergence of industry

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The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
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Inequality and Development: Kuznets' Inverted U

- Panel of Countries, 1960-1990. Normalized Gini coefficient after filtering out the estimated effects of other control variables (but log(GDP) and its square) Peak: \$3320 (1985 U.S. dollars)

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The Modern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution ⇒ the growth process

- Unlike the Classical Perspective

  Underlined the *adverse* effect of Inequality on the process of development

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The Credit Market Imperfections Approach: Assumptions

Main assumptions:

- Credit market imperfections (e.g., differences in the interest rates for borrowers and lenders)

  and either

- Fixed investment cost in education (Galor-Zeira (1993)) or in other individual-specific projects (Banerjee and Newman (1993) and Aghion and Bolton (1997))

  or

- Saving and bequest rates are increasing function of wealth (e.g., subsistence consumption constraint) Galor and Moav (RES 2004)

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The Credit Market Imperfections Approach: Mechanism

- Inequality affects occupational choices – skilled vs. unskilled workers (entrepreneurs vs. workers)
- Non-poor economies:
  - Inequality $\Longrightarrow$ Under-investment traps: under-investment in human capital (inv't projects) that is transmitted across generations $\Longrightarrow$ lower output growth in the short-run and in the long-run
- Poor economies:
  - Inequality may permit some investment in HC (inv't projects) and may thus promote output growth
- The human capital channel is consistent with evidence (Perotti (1996))

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The CMI Approach: Additional Mechanisms

- Segregation and Neighborhood Effects
  - Inequality permits the segregation of individuals into homogenous communities
  - Local externalities in the production of HC $\Longrightarrow$ persistent inequality (Benabou (1996), Durlauf (1996), Fernandez and Rogerson (1996)
- Mobility and Social Status
  - Inequality generates an inefficient allocation of talents across occupations via:
    - limited intergenerational mobility (Galor-Tsiddon (1997))
    - Displacement of poor, high-ability individual by rich, low-ability individuals, if social status is associated with education (Ferstman, Murphy and Weiss (1996))

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Echoes the hypothesis of the CMI Approach

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ Political pressure for redistribution
  - Higher (distortionary) taxation $\Longrightarrow$ lower investment and slower economic growth

Alesina and Rodrik, (2004) Persson and Tebelini (2004

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Gender Inequality

Gender inequality is harmful for the growth process

Galor-Weil (AER 1996)

- Gender inequality reduces the opportunity cost of raising children more than it reduces household income

$\Longrightarrow$ increases fertility

$\Longrightarrow$ reduces human capital investment (quantity-quality trade-off)

$\Longrightarrow$ lowers female labor force participation

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A unified theory of inequality and economic development

(Galor and Moav (2004):

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms
- Provides an intertemporal reconciliation between conflicting viewpoints about the effect of inequality on economic growth
- Underlines the role of inequality in triggering socio-political transition (Galor-Moav-Vollrath (2009), Galor-Moav (2006))

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The Galor-Zeira Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- 3 factors:
  - $K \equiv$ Physical capital
  - $L^s \equiv$ Skilled Labor
  - $L^u \equiv$ Unskilled Labor

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Production

Total output produced

$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

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$$Y_t = Y_t^s + Y_t^u$$

- Production in the skilled-intensive sector:

$$Y_t^s = F(K_t, L_t^s) \equiv L_t^s f(k_t); \qquad k_t \equiv K_t / L_t^s$$

- Production in the unskilled-intensive sector:

$$Y_t^u = aL_t^u$$

Inverse Demand for Factors

- Capital:

$$r_t = f'(k_t) \equiv r(k_t)$$

- Skilled labor:

$$w_t^s = f(k_t) - f'(k_t)k_t \equiv w^s(k_t)$$

- Unskilled labor:

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Factor Prices

- Small open economy
- World interest $= r$

$\Longrightarrow$

$$\begin{aligned} r_t &= r \\ k_t &= f'^{-1}(r) \equiv k \\ w_t^s &= w^s(k) \equiv w^s \end{aligned}$$

$\Longrightarrow$

$$(r_t, w_t^s, w_t^u) = (r, w^s, w^u) \qquad \forall t$$

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Individuals

- Continuum of measure 1
- Each Individual has 1 parent and 1 child
- Identical in:

  Preferences

  Innate abilities

- Differ in:

  Parental income $\Rightarrow$ Inv't in HC

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Member of Generation t: Period of Life

- First period of life (Period t):
  - [invest in HC] or [work as unskilled]
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Member of Generation t: Endowment and Preferences

- Time endowment:
  - 1 units of time in each period
- Capital endowment:
  - $b_t \equiv$ capital inherited in 1^{st} period
- Preferences:

$$u^t = \alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1} \qquad \alpha \in (0,1)$$

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Second period budget constraint:

$$c_{t+1} + b_{t+1} \leq \omega_{t+1}$$

$c_{t+1} \equiv$ consumption

$b_{t+1} \equiv$ transfers to offspring

$\omega_{t+1} \equiv$ wealth in period $t+1$

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Member of Generation t: Optimization

$$\{c_{t+1}, b_{t+1}\} = \arg\max[\alpha \ln c_{t+1} + (1-\alpha) \ln b_{t+1}]$$

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Member of Generation t: Optimization

$$b_{t+1} = (1-\alpha)\omega_{t+1}$$

$$c_{t+1} = \alpha\omega_{t+1}$$

Indirect Utility: $\Longrightarrow$

$$v^t = \alpha \ln \alpha\omega_{t+1} + (1-\alpha)\ln \omega_{t+1}$$

$$= [\alpha \ln \alpha + (1-\alpha)\ln(1-\alpha)] + \ln \omega_{t+1}$$

$\Longrightarrow$ v^t is monotonic increasing in 2nd period wealth, ω_{t+1}

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Fundamental Assumptions

- Imperfect Capital Markets:

$$r < i \qquad \text{(A1)}$$

$r \equiv$ interest rate for lender

$i \equiv$ interest rate for borrowers (for inv't in HC)

- Fixed cost of education (Indivisibility of inv't in HC) Weighted average of the payments to teachers, administrators, and maintenance workers in the school system (i.e., weighted average of the wages skilled and unskilled workers):

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$$\omega_{t+1}^{u} = (w^u + b_t)(1+r) + w^u$$

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$$\omega_{t+1}^{s} = \begin{cases} w^{s} - (h - b_t)(1+i) & if \quad b_t \leq h \\ w^{s} + (b_t - h)(1+r) & if \quad b_t \geq h \end{cases}$$

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Assumptions

- Investment in human capital is *not* beneficial for individuals who must finance the entire cost of education via borrowing

$$w^s - (1+i)h < 0 \tag{A3}$$

- Investment in human capital is beneficial for individuals who can finance the entire cost of education *without* borrowing

$$w^s - (1+r)h > w^u(2+r) \tag{A4}$$

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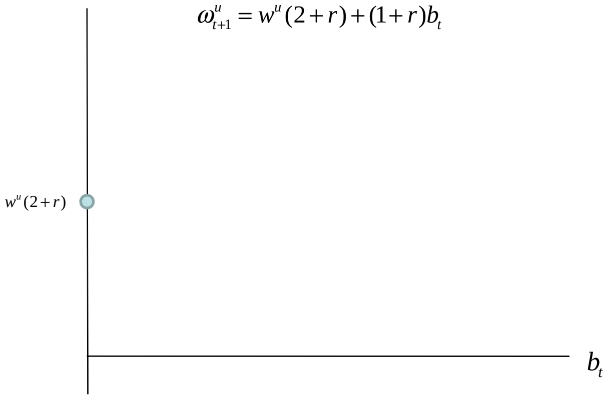

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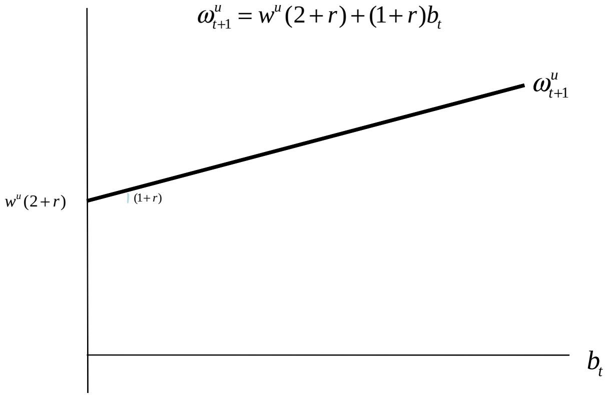
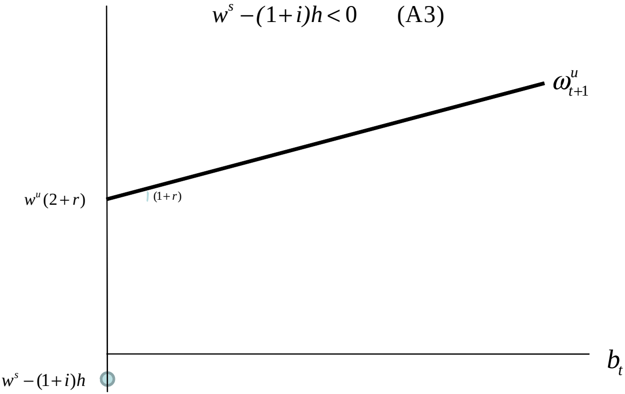


Income from Being Skilled Worker: Borrowers



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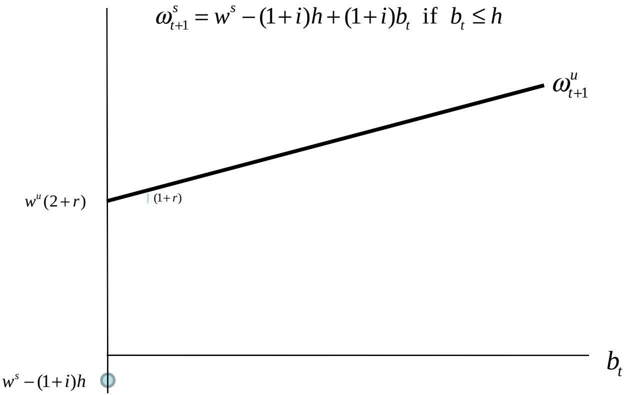

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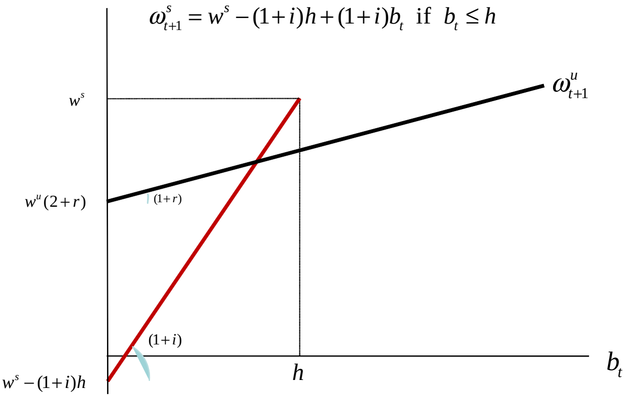

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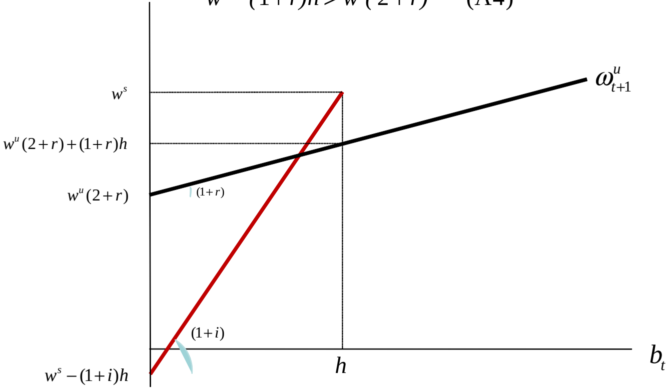
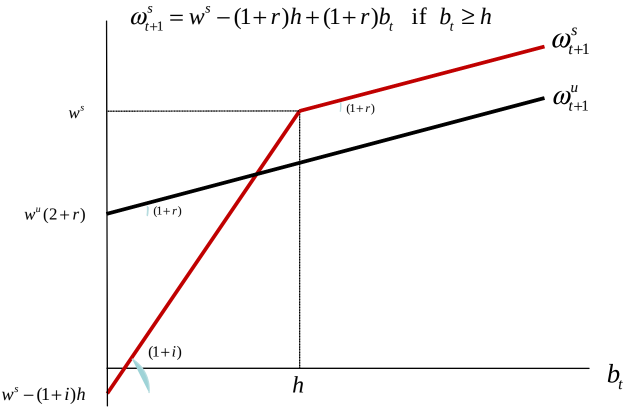
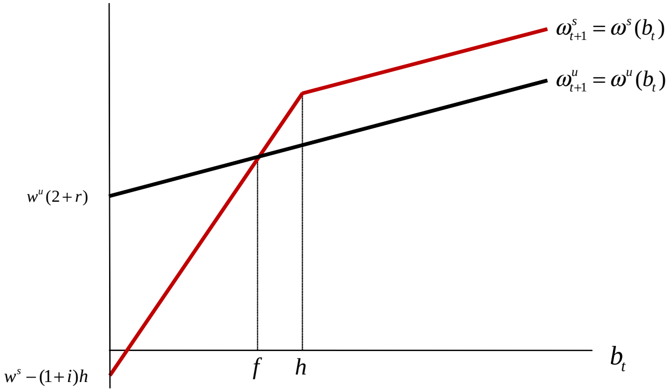


Income from Being Skilled Worker: Lenders



Bequest and Occupational Choice



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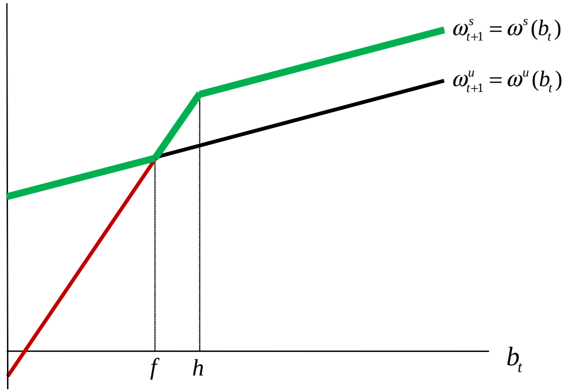

Bequest and Occupational Choice

$$b_t \begin{cases} < f & \rightarrow x^u_{t+1} > x^s_{t+1} \text{ (individual } t \text{ becomes unskilled)} \\ > f & \rightarrow x^u_{t+1} < x^s_{t+1} \text{ (individual } t \text{ becomes skilled)} \end{cases}$$

where

$$f = \frac{w^u(2+r) - [w^s - (1+i)h]}{i-r} > 0$$

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Bequest Dynamics

$$b_{t+1} = (1-\alpha)x_{t+1}$$

$$b_{t+1} = \begin{cases} (1-\alpha)[w^u(2+r)+(1+r)b_t] & b_t \in [0,f] \\ (1-\alpha)[w^s-(1+i)h+(1+i)b_t] & b_t \in [f,h] \\ (1-\alpha)[w^s-(1+r)h+(1+r)b_t] & b_t \in [h,\infty] \end{cases}$$

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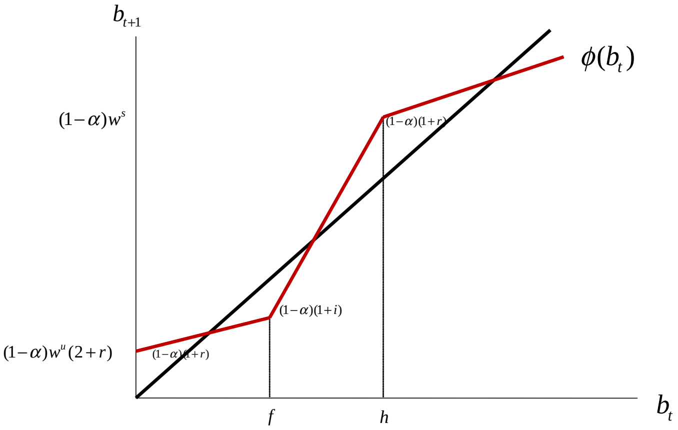
Bequest Dynamics: Sufficiet Conditions for Multiplicity of Steady-Sate

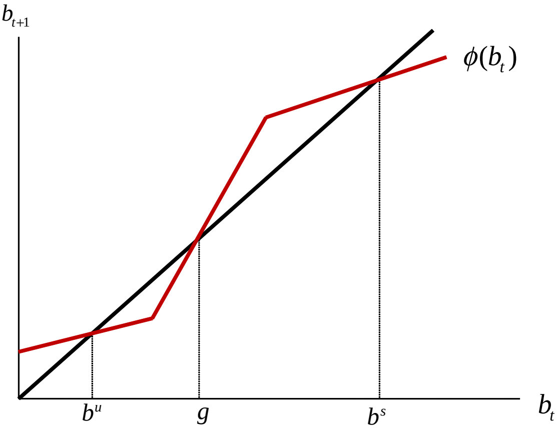
$$
\begin{aligned}
(1-\alpha)(1+r) &< 1 \\
(1-\alpha)(1+i) &> 1
\end{aligned}
\qquad (A5)
$$

$$(1-\alpha)w^s > h \qquad (A6)$$

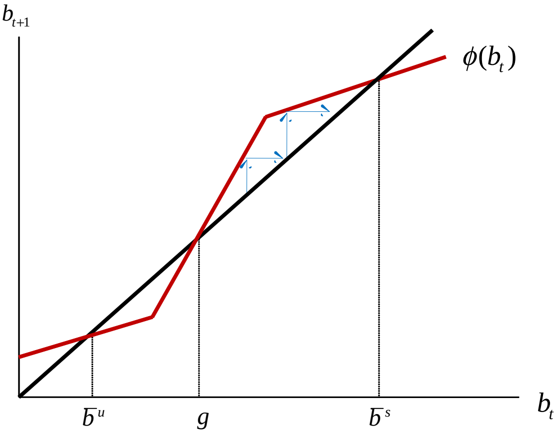
Bequest Dynamics



Bequest Dynamics: Multiple Steady-State Equilibrium



Bequest Dynamics: Stability of High Bequest Equilibrium



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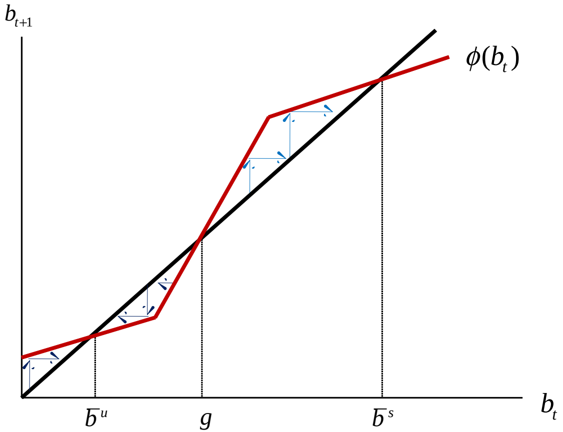
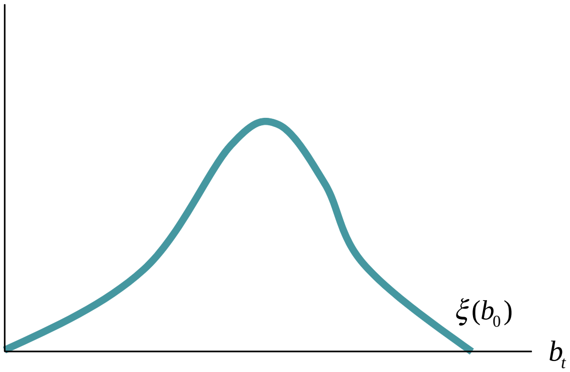


The Distribution of the Inheritance in Period t



Income Distribution and the Long Run Decomposition of the Labor Force

$\xi_t(b_t) \equiv$ Distribution of inheritance at time t

$\Longrightarrow$

$$L_t = \int_0^\infty \xi(b_t) db_t \equiv 1$$

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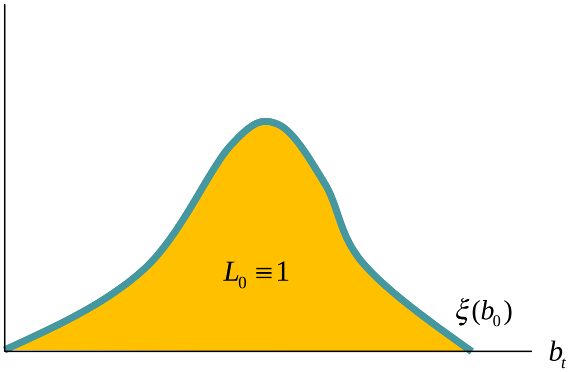

Income Distribution of the Long Run Decomposition of the Labor Force

$$\lim_{t\to\infty} l_t^u = \int_0^g \xi_t(b_t)db_t \equiv \bar{l}^u$$

$$\lim_{t\to\infty} l_t^s = \int_g^\infty \xi_t(b_t)db_t \equiv \bar{l}^s$$

where

$$\partial\bar{l}^s/\partial g < 0$$

and

$$g = \frac{(1-\alpha)[(1+i)h - w^s]}{(1-\alpha)(1+i) - 1} > 0$$

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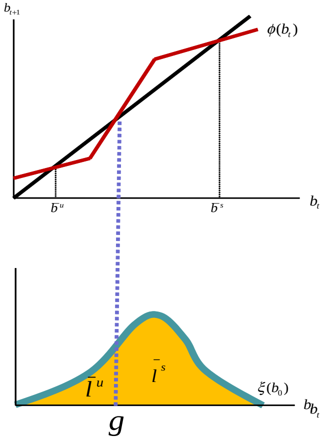
Income Distribution of Skill Composition



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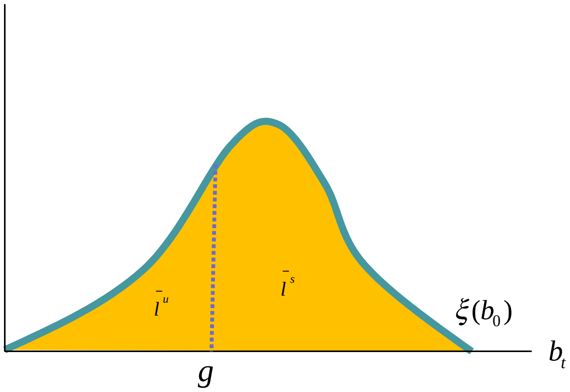

Income Per Capita in the Long Run

- Income of a skilled individual in the second period of life (wage and capital income)

$$I_2^s = w^s + (\bar{b}^s - h)r$$

- Income of an unskilled individual in the second period of life (wage and capital income)

$$I_2^u = w^u + (\bar{b}^u + w^u)r$$

- Income of an unskilled individual in the first period of life (only wage income)

$$I_1^u = w^u$$

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Income Per Capita in the Long Run

- Aggregate income in the steady-state

$$\bar{Y} = I_2^s \bar{l}^s + I_2^u \bar{l}^u + I_1^u \bar{l}^u$$

- Aggregate income (note: $\bar{l}^s + \bar{l}^u = 1$)

$$\begin{aligned} Y &= [w^s - rh + r\bar{b}^s]\bar{l}^s + [w^u(2+r) + r\bar{b}^u](1 - \bar{l}^s) \\ &= w^u(2+r) + r\bar{b}^u + [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]\bar{l}^s \end{aligned}$$

- Income per capita

$$\bar{y} = \bar{Y}/2$$

Income Per Capita in the Long Run

- Aggregate income in the steady-state

$$\bar{Y} = l_2^s \bar{l}^s + l_2^u \bar{l}^u + l_1^u \bar{l}^u$$

- Aggregate income (note: $\bar{l}^s + \bar{l}^u = 1$)

$$\begin{aligned} Y &= [w^s - rh + r\bar{b}^s]\bar{l}^s + [w^u(2+r) + r\bar{b}^u](1 - \bar{l}^s) \\ &= w^u(2+r) + r\bar{b}^u + [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]\bar{l}^s \end{aligned}$$

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$$\bar{y} = \bar{Y}/2$$

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Skill Composition and Income Per Capita in the Long Run

- An increase in the fraction of skilled workers increases income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial \bar{l}^s} = [(w^s - rh) - w^u(2+r) + (\bar{b}^s - \bar{b}^u)]/2 > 0$$

since

$$w^s - (1+r)h > w^u(2+r)$$

$$\bar{b}^s > \bar{b}^u$$

- An increase in g reduces income per capita in the steady-state

$$\frac{\partial \bar{y}}{\partial g} = \frac{\partial \bar{y}}{\partial \bar{l}^s}\frac{\partial \bar{l}^s}{\partial g} < 0$$

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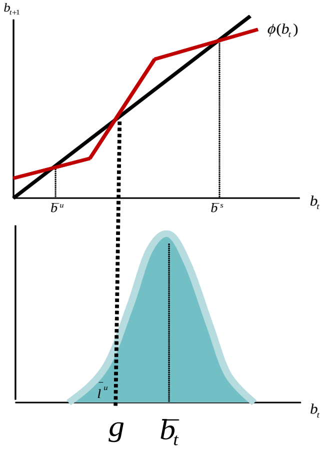
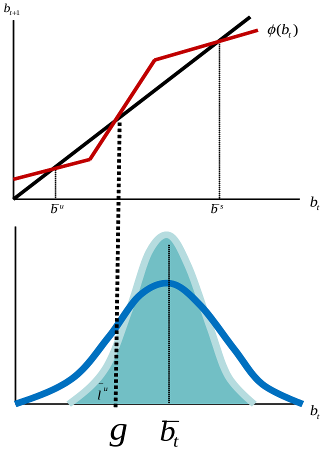
Inequality and Development: Rich Economies



Rich Economies: Inequality is Harmful for Development

Inequality reduces human capital formation



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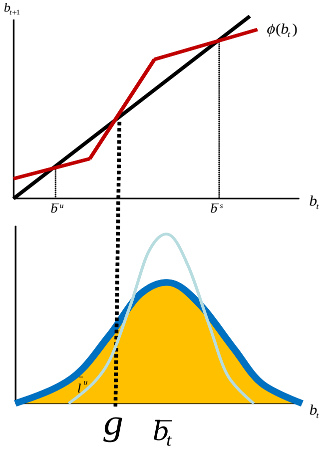

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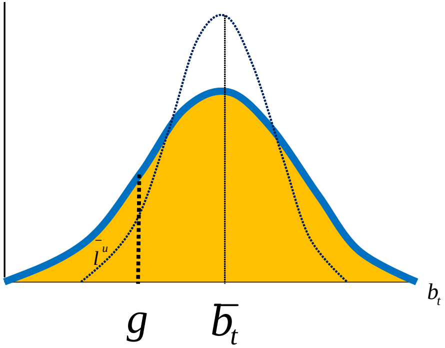
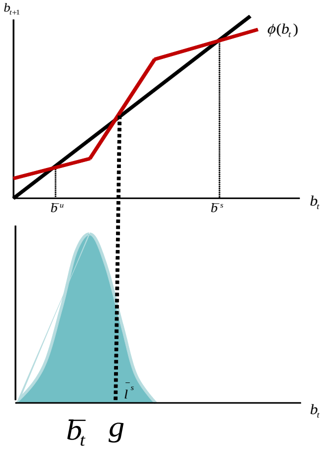
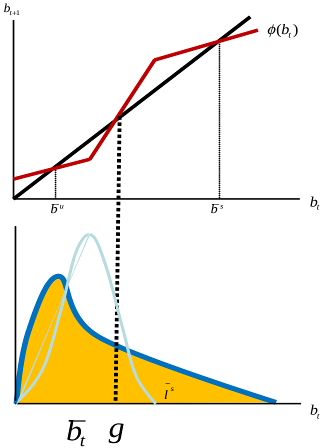


Inequality and Development: Poor Economies



Poor Economies: Inequality may Benefit Development

Inequality stimulates human capital formation



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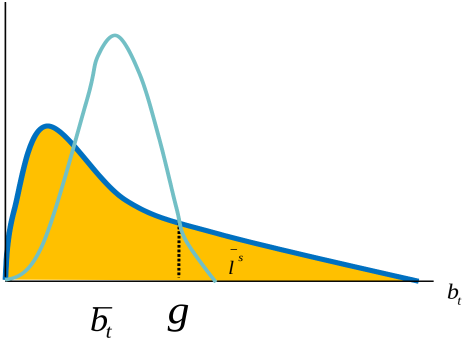

Robustness

The qualitative results are robust to:

- Education cost that is indexed to wages
- Labor augmenting technical change
- Shocks the outcome of investment in human capital, as long as wages are endogenous
- Concave production function of human capital (Moav (EL, 2002), Galor-Moav (RES, 2004))

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Robustness: Technological Progress and Endogenous Education Cost

Labor Augmenting Technological Progress: increases the productivity of workers in both the skilled-intensive and the unskilled intensive sector.

- Production in the skilled-intensive sector

$$Y_t^s = F(K_t, A_t L_t^s) \equiv A_t L_t^s f(k_t); \qquad k_t \equiv K_t / A_t L_t^s$$

- Production in the unskilled-intensive sector

$$Y_t^u = A_t a L_t^u$$

- Technological progress

$$A_{t+1} = (1+\lambda)A_t \qquad \lambda > 0.$$

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Factor Prices

$$w_t^s = A_t[f(k) - f'(k)k] \equiv A_t w^s$$

$$w_t^u = A_t a \equiv A_t w^u$$

$$r_t = r$$

Cost of Education

- Weighted average of the payments to teachers, administrators, and maintenance workers in the school system
- $\Rightarrow$ Weighted average of the wages skilled and unskilled workers

$$C_t^H = \theta A_t w^s + (1-\theta) A_t w^u \equiv A_t h$$

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$$
\begin{aligned}
x^u_{t+1} &= (A_t w^u + b_t)(1+r) + A_{t+1} w^u \\
&= A_t w^u (2 + r + \lambda) + (1+r) b_t
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$$x^s_{t+1} = \begin{cases} A_{t+1} w^s - (A_t h - b_t)(1+i) & \text{if} \quad b_t \leq A_t h \\ A_{t+1} w^s + (b_t - A_t h)(1+r) & \text{if} \quad b_t \geq A_t h \end{cases}$$

$\Longrightarrow$

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Threshold level of Bequest for Becoming Skilled Worker in Period t

$$f = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)}$$

$$\frac{f_t}{A_t} = \frac{A_t\{w^u(2+r) - [w^s - (1+i)h] - \lambda(w^s - w^u)\}}{(i-r)} \equiv \hat{f} > 0$$

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Bequest Dynamics

$$b_{t+1} = \begin{cases} (1-\alpha)\{A_t w^u(2+r+\lambda) + (1+r)b_t\} & b_t \in [0, f] \\ (1-\alpha)\{A_t[w^s(1+\lambda) - (1+i)h] + (1+i)b_t\} & b_t \in [f, A_t h] \\ (1-\alpha)\{A_t[w^s(1+\lambda) - (1+r)h] + (1+r)b_t\} & b_t \in [A_t h, \infty] \end{cases}$$

Bequest Dynamics

Let $\hat{b}_{t+1} \equiv b_{t+1}A_{t+1}$

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$\Rightarrow$ The dynamical system is unaffected qualitatively by labor-augmenting technological progress

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$\Rightarrow$ The dynamical system is unaffected qualitatively by labor-augmenting technological progress

Sufficient Conditions for Multiple Steady-States

$$(1-\alpha)(1+r) < (1+\lambda)$$

$$(1-\alpha)(1+i) > (1+\lambda)$$

$$w^s(1+\lambda) - (1+i)h < 0$$

$\Rightarrow$ The system is characterized by multiple steady-state, where the unstable equilibrium

$$\hat{g} = \frac{(1-\alpha)[(1+i)h - w^s(1+\lambda)]}{[(1-\alpha)(i+i) - (1+\lambda)]} > 0$$