From Physical to Human Capital Accumulation: Inequality in the Process of Development

Oded Galor and Omer Moav

Objectives

Objectives

A unified theory of inequality and economic development:

Objectives

A unified theory of inequality and economic development:

- Captures the changing role of inequality in the growth process

Objectives

A unified theory of inequality and economic development:

- Captures the changing role of inequality in the growth process
- Unifies the Classical and the Modern Paradigms

Objectives

A unified theory of inequality and economic development:

- 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

Objectives

A unified theory of inequality and economic development:

- 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
- Generates novel testable predictions that may resolve empirical disputes about the relationship between inequality and growth

The Classical Approach

The Classical Approach

Inequality is beneficial for growth

The Classical Approach

Inequality is beneficial for growth

- The marginal propensity to save increases with income

The Classical Approach

Inequality is beneficial for growth

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

The Classical Approach

Inequality is beneficial for growth

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

$$\Longrightarrow \text{increases aggregate savings \& capital accumulation}$$

The Classical Approach

Inequality is beneficial for growth

- 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

The Credit Market Imperfections Approach:

The Credit Market Imperfections Approach:

Inequality is harmful for growth

The Credit Market Imperfections Approach:

Inequality is harmful for growth

- CMI increases the cost of investment in human capital for less endowed individuals
- Inequality increases the fraction of society for which investment in human capital is suboptimal

$$\Longrightarrow \text{reduces human capital accumulation}$$

The Credit Market Imperfections Approach:

Inequality is harmful for growth

- CMI increases the cost of investment in human capital for less endowed individuals
- Inequality increases the fraction of society for which investment in human capital is suboptimal

$\Longrightarrow$ reduces human capital accumulation

$\Longrightarrow$ slows down the development process

A Unified Theory of Inequality and Development

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure

A Unified Theory of Inequality and Development

- A unified theory of the dynamic implications of inequality on the growth process
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

Main Hypothesis

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$

Main Hypothesis

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the qualitative impact of inequality on the process of development
- Early stages of industrialization: physical capital accumulation is a main engine of growth $\Longrightarrow$
  - Inequality enhanced development by channeling resources towards individuals whose marginal propensity to save is higher
- Later stages of development: the return to human capital increases due to capital-skill complementarity and human capital became the prime engine of growth $\Longrightarrow$
  - Inequality, due to credit constraints, is harmful for growth

Central Argument

Central Argument

Fundamental asymmetry between:

Central Argument

Fundamental asymmetry between:

- Human capital accumulation

Central Argument

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

Human Capital vs. Physical Capital Accumulation

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$

Human Capital vs. Physical Capital Accumulation

- Human capital is embodied in humans $\Longrightarrow$
  - Physiological constraints subjects its accumulation *at the individual level* to diminishing returns
  - The accumulation of human capital would be larger if it would be widely distributed among individuals in society
- Physical capital is not embodied in humans $\Longrightarrow$
  - Physical capital accumulation may benefit from the concentration of wealth among individuals whose marginal propensity to save is larger

Inequality and Physical and Human Capital Accumulation

Inequality and Physical and Human Capital Accumulation

- **Inequality** is conducive for **physical capital** accumulation, as long as the marginal propensity to save rises with income

Inequality and Physical and Human Capital Accumulation

- **Inequality** is conducive for **physical capital** accumulation, as long as the marginal propensity to save rises with income
- **Inequality** is harmful for **human capital** accumulation, as long as credit constraints are binding

Inequality and Growth in Different Stages of Development

Inequality and Growth in Different Stages of Development

- **Inequality** stimulates economic growth in stages of development in which **physical capital** accumulation is the prime engine of growth

Inequality and Growth in Different Stages of Development

- **Inequality** stimulates economic growth in stages of development in which **physical capital** accumulation is the prime engine of growth
- **Inequality** is harmful for economic growth in stages of development in which **human capital** accumulation is the prime engine of economic growth and credit constraints are still binding

Early Stages of Industrialization

Early Stages of Industrialization

- Labor (and thus human capital) is abundant and physical capital is scarce

Early Stages of Industrialization

- Labor (and thus human capital) is abundant and physical capital is scarce
- The return to physical capital is higher than the return to human capital

Early Stages of Industrialization

- Labor (and thus human capital) is abundant and physical capital is scarce
- The return to physical capital is higher than the return to human capital
- Physical capital accumulation is the main engine of growth

Early Stages of Industrialization

- Labor (and thus human capital) is abundant and physical capital is scarce
- The return to physical capital is higher than the return to human capital
- Physical capital accumulation is the main engine of growth

$\Longrightarrow$ Inequality is conducive for growth

Later Stages of Development

Later Stages of Development

- Physical capital accumulation complements human capital

Later Stages of Development

- Physical capital accumulation complements human capital
- The return to human capital increases sufficiently so as to induce human capital accumulation (Nelson and Phelps (1966), Shultz (1975), Foster and Rosenzweig (1996))

Later Stages of Development

- Physical capital accumulation complements human capital
- The return to human capital increases sufficiently so as to induce human capital accumulation (Nelson and Phelps (1966), Shultz (1975), Foster and Rosenzweig (1996))
- Investment in human capital is sub-optimal due to CMI $\Rightarrow$ the return to human capital is higher than on physical capital

Later Stages of Development

- Physical capital accumulation complements human capital
- The return to human capital increases sufficiently so as to induce human capital accumulation (Nelson and Phelps (1966), Shultz (1975), Foster and Rosenzweig (1996))
- Investment in human capital is sub-optimal due to CMI $\Rightarrow$ the return to human capital is higher than on physical capital
- Human capital accumulation is the main engine of growth

Later Stages of Development

- Physical capital accumulation complements human capital
- The return to human capital increases sufficiently so as to induce human capital accumulation (Nelson and Phelps (1966), Shultz (1975), Foster and Rosenzweig (1996))
- Investment in human capital is sub-optimal due to CMI $\Rightarrow$ the return to human capital is higher than on physical capital
- Human capital accumulation is the main engine of growth

$$\Longrightarrow \text{ Inequality is harmful for growth}$$

Reconciliation: The Classical and Modern Approaches

Reconciliation: The Classical and Modern Approaches

- A positive effect of inequality on growth underlined by the **Classical Approach** reflects early stages of industrialization when physical capital accumulation was the prime engine of growth

Reconciliation: The Classical and Modern Approaches

- A positive effect of inequality on growth underlined by the **Classical Approach** reflects early stages of industrialization when physical capital accumulation was the prime engine of growth

- A negative effect of inequality on growth underlined by the **Modern Approach** reflects later stages of development when human capital accumulation becomes a prime engine of growth, and credit constraints are still binding

The Basic Structure of the Model

- Overlapping-Generations economy

The Basic Structure of the Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$

The Basic Structure of the Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good

The Basic Structure of the Model

- Overlapping-Generations economy
- $t = 0, 1, 2, 3, ...$
- One good
- Two factors:
  - Physical capital (PC)
  - Human Capital (HC)

The Basic Structure of the Model

- Output per-capita grows over time due to the accumulation of factors of production.

The Basic Structure of the Model

- Output per-capita grows over time due to the accumulation of factors of production.
- The stock of physical capital: Output produced in the preceding period net of consumption and HC investment

The Basic Structure of the Model

- Output per-capita grows over time due to the accumulation of factors of production.
- The stock of physical capital: Output produced in the preceding period net of consumption and HC investment
- The level of HC: Outcome of education decisions, subject to borrowing constraint

Production of Final Output

The output produced at time t :

$$Y_t = F(K_t, H_t) \equiv H_t f(k_t)$$

Production of Final Output

The output produced at time t :

$$Y_t = F(K_t, H_t) \equiv H_t f(k_t)$$

K_t - PC

Production of Final Output

The output produced at time t :

$$Y_t = F(K_t, H_t) \equiv H_t f(k_t)$$

K_t - PC

H_t - HC (efficiency units)

Production of Final Output

The output produced at time t :

$$Y_t = F(K_t, H_t) \equiv H_t f(k_t)$$

K_t - PC

H_t - HC (efficiency units)

$k_t \equiv K_t / H_t$

Factor Prices

Inverse demand for factors of production at time t

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

Individuals

Individuals

- Continuum of measure 1

Individuals

- Continuum of measure 1
- Individuals have 1 parent and 1 child

Individuals

- Continuum of measure 1
- Individuals have 1 parent and 1 child
- Identical in:

  Preferences

  Innate abilities

Individuals

- Continuum of measure 1
- Individuals have 1 parent and 1 child
- Identical in:

  Preferences

  Innate abilities

- Differ in:

  Parental income $\Rightarrow$ Inv't in HC

Individuals of Generation t

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation
- Second period of life (Period $t+1$):
  - Supply their efficiency units of labor

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation
- Second period of life (Period $t+1$):
  - Supply their efficiency units of labor
  - Allocate income & inheritance between:

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation
- Second period of life (Period $t+1$):
  - Supply their efficiency units of labor
  - Allocate income & inheritance between:

    (a) Consumption (b) Transfers to children

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation
- Second period of life (Period $t+1$):
  - Supply their efficiency units of labor
  - Allocate income & inheritance between:

    (a) Consumption (b) Transfers to children
- Transfers are allocated to:
  - Finance of offspring's education

Individuals of Generation t

- First period of life (Period t):
  - Human capital formation
- Second period of life (Period $t+1$):
  - Supply their efficiency units of labor
  - Allocate income & inheritance between:

    (a) Consumption (b) Transfers to children
- Transfers are allocated to:
  - Finance of offspring's education
  - Saving for offspring's future wealth

Individual i of Generation t: Wealth

Second period wealth:

$$I^i_{t+1} = w_{t+1} h^i_{t+1} + x^i_{t+1}$$

Individual i of Generation t: Wealth

Second period wealth:

$$l^i_{t+1} = w_{t+1} h^i_{t+1} + x^i_{t+1}$$

w_{t+1} – wage

Individual i of Generation t: Wealth

Second period wealth:

$$I^i_{t+1} = w_{t+1} h^i_{t+1} + x^i_{t+1}$$

w_{t+1} – wage

h^i_{t+1} – efficiency units of labor

Individual i of Generation t: Wealth

Second period wealth:

$$I^i_{t+1} = w_{t+1} h^i_{t+1} + x^i_{t+1}$$

w_{t+1} – wage

h^i_{t+1} – efficiency units of labor

x^i_{t+1} – inheritance

Individual i of Generation t: Budget Constraint

Second Period budget constraint:

$$c^i_{t+1} + b^i_{t+1} \leq I^i_{t+1}$$

Individual i of Generation t: Budget Constraint

Second Period budget constraint:

$$c^i_{t+1} + b^i_{t+1} \leq I^i_{t+1}$$

c^i_{t+1} – consumption

Individual i of Generation t: Budget Constraint

Second Period budget constraint:

$$c^i_{t+1} + b^i_{t+1} \leq I^i_{t+1}$$

c^i_{t+1} – consumption

b^i_{t+1} – transfers to the offspring

Individual i of Generation t: Intergenerational Transfers

Transfer to offspring, b^i_{t+1}, is allocated between:

Individual i of Generation t: Intergenerational Transfers

Transfer to offspring, b^i_{t+1}, is allocated between:

- Finance of offspring's education - e^i_{t+1}

Individual i of Generation t: Intergenerational Transfers

Transfer to offspring, b^i_{t+1}, is allocated between:

- Finance of offspring's education - e^i_{t+1}
- Saving for offspring's future wealth

$$s^i_{t+1} = b^i_{t+1} - e^i_{t+1}$$

Individual i of Generation t: Intergenerational Transfers

Transfer to offspring, b^i_{t+1}, is allocated between:

- Finance of offspring's education - e^i_{t+1}
- Saving for offspring's future wealth

$$s^i_{t+1} = b^i_{t+1} - e^i_{t+1}$$

- Inheritance

$$x^i_{t+1} = s^i_t R_{t+1} = (b^i_t - e^i_t) R_{t+1}$$

Individual i of Generation t: Human capital formation

Efficiency units of labor in period $t+1$

$$h^i_{t+1} = h(e^i_t)$$

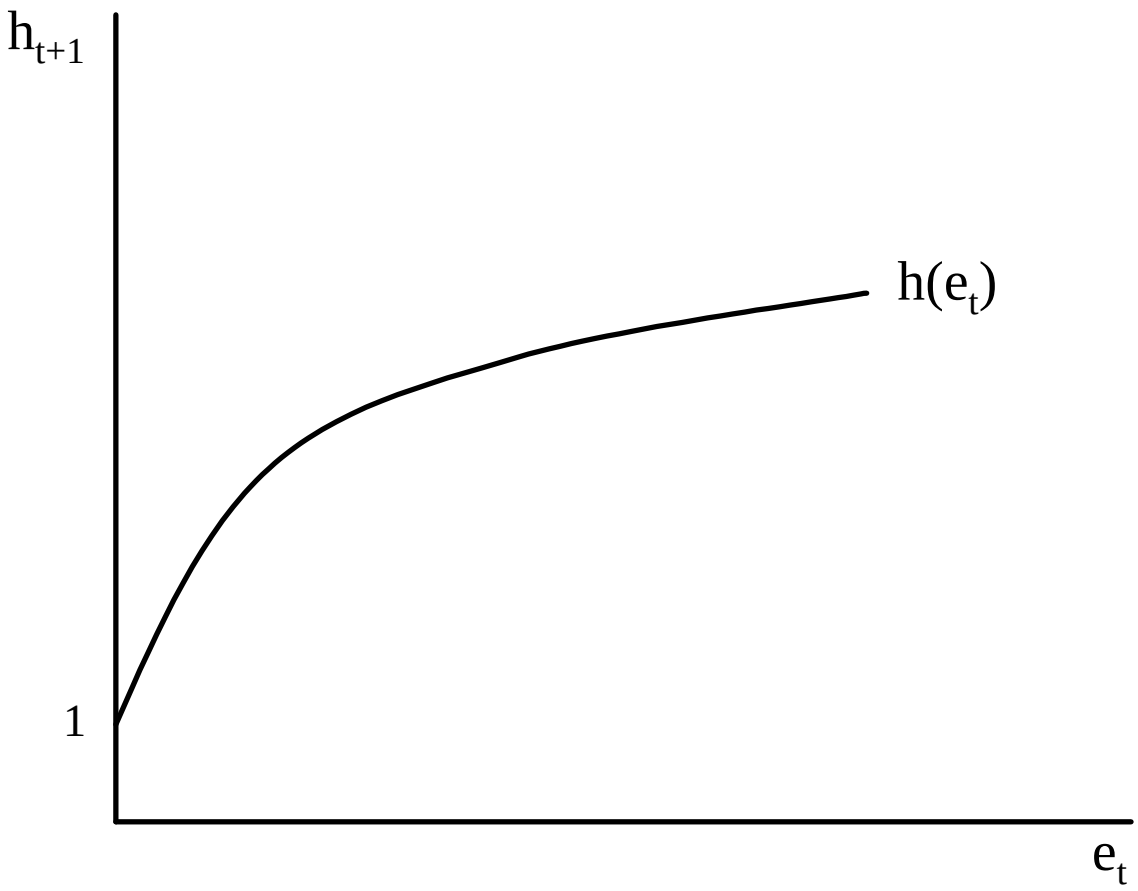
Individual i of Generation t: Human capital formation

Efficiency units of labor in period $t+1$

$$h^i_{t+1} = h(e^i_t)$$

e^i_t – expenditure on education

Individual i of Generation t: Human capital formation



Optimal Inv't in Education of Member i of Generation t

In the absence of borrowing constraints:

$$e_t^i = \arg\max\left[w_{t+1} h(e_t^i) + (b_t^i - e_t^i) R_{t+1}\right]$$

Optimal Inv't in Education of Member i of Generation t

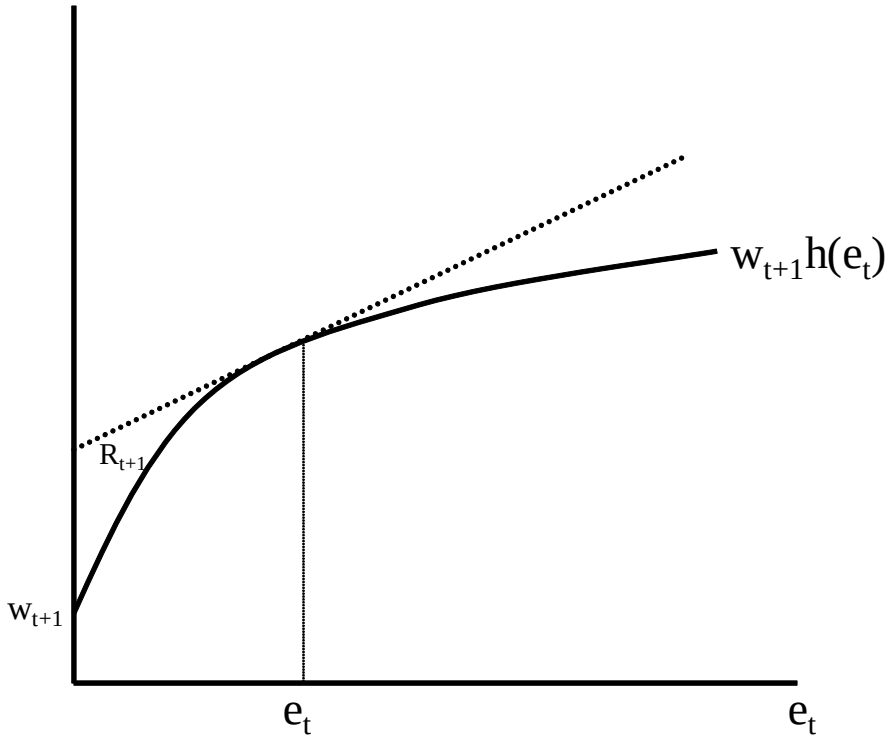
In the absence of borrowing constraints:

$$e_t^i = \arg\max[w_{t+1} h(e_t^i) + (b_t^i - e_t^i) R_{t+1}]$$

e_t is unique and identical across members of generation t

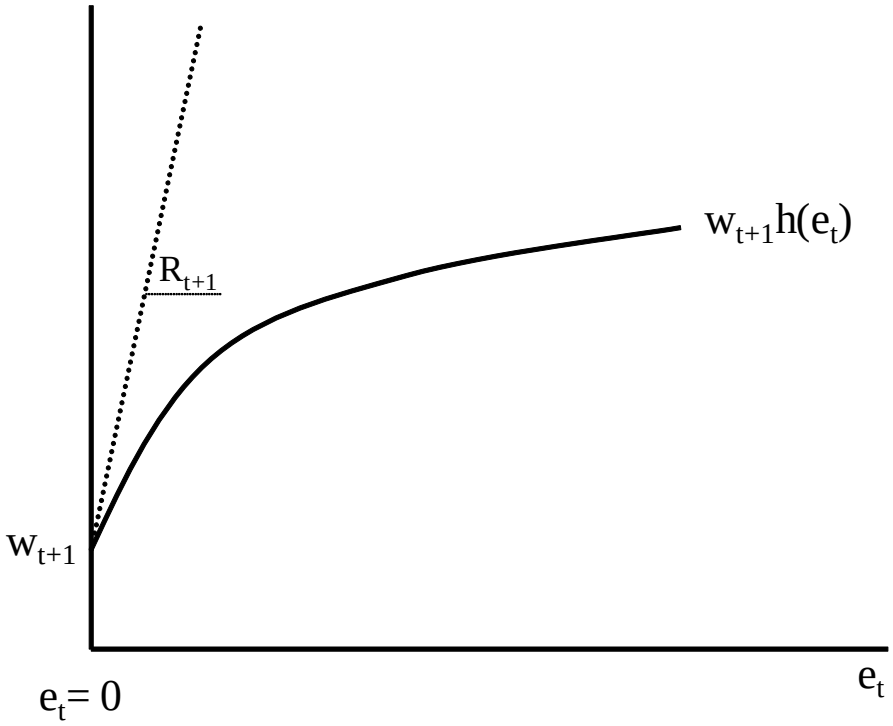
Optimal Inv't in Education of Member i of Generation t

$$e_t > 0 \qquad \text{if} \qquad w_{t+1} h'(e_t) = R_{t+1}$$

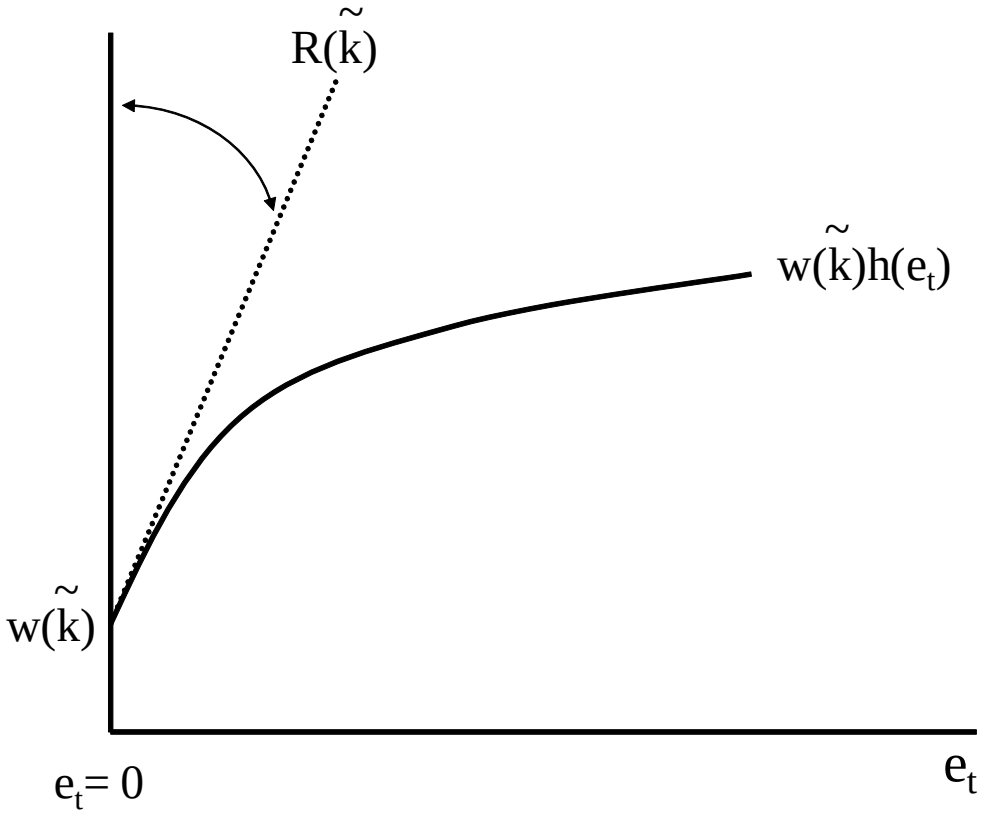


Optimal Inv't in Education of Member i of Generation t

$$e_t = 0 \qquad \text{if} \qquad R_{t+1} > w_{t+1} h'(0)$$



Optimal Inv't in Education of Member i of Generation t



Optimal Inv't in Education of Member i of Generation t

$$e_t = e(k_{t+1}) \begin{cases} = 0 & \text{if} \quad k_{t+1} \leq \widetilde{k} \\ > 0 & \text{if} \quad k_{t+1} > \widetilde{k} \end{cases}$$

Optimal Inv't in Education of Member i of Generation t

$$e_t = e(k_{t+1}) \begin{cases} = 0 & \text{if} \quad k_{t+1} \leq \widetilde{k} \\ > 0 & \text{if} \quad k_{t+1} > \widetilde{k} \end{cases}$$

where

$$e'(k_{t+1}) > 0 \quad \text{if} \quad k_{t+1} > \widetilde{k}$$

Borrowing Constraint of Member i of Generation t

Individuals cannot borrow to finance the education expenditure of their offspring:

Borrowing Constraint of Member i of Generation t

Individuals cannot borrow to finance the education expenditure of their offspring:

$$e_t^i = \min\left[e(k_{t+1}), b_t^i\right]$$

Preferences and Transfers of Member i of Generation t

- Preferences:

$$u_t^i = (1-\beta)\log c_{t+1}^i + \beta \log(\overline{\theta} + b_{t+1}^i)$$

Preferences and Transfers of Member i of Generation t

- Preferences:

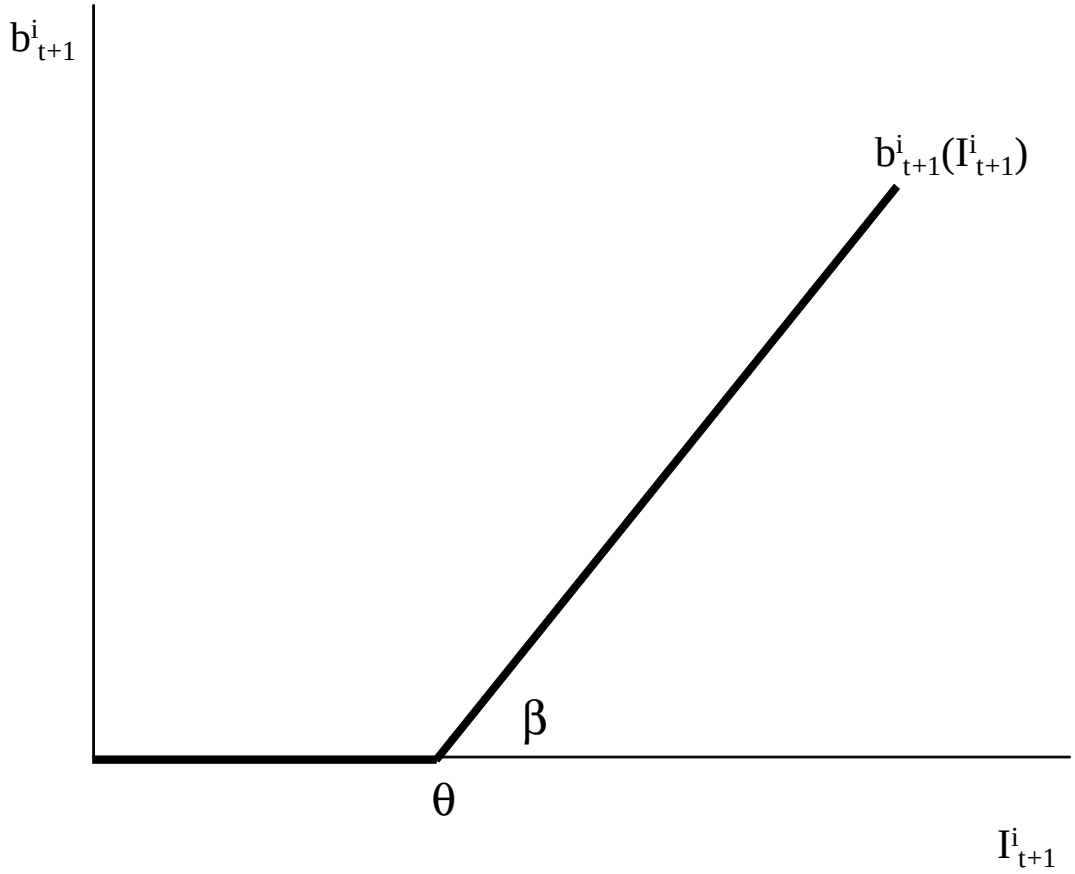
$$u_t^i = (1-\beta)\log c_{t+1}^i + \beta \log(\overline{\theta} + b_{t+1}^i)$$

- Optimal transfer to offspring:

$$b_{t+1}^i = b(I_{t+1}^i) \equiv \begin{cases} \beta(I_{t+1}^i - \theta) & \text{if} \quad I_{t+1}^i \geq \theta \\ 0 & \text{if} \quad I_{t+1}^i \leq \theta \end{cases}$$

where $\theta \equiv \overline{\theta}(1-\beta)/\beta$

Optimal transfer of a member i of generation t



Saving of Member i of Generation t

$$s_t^i = \begin{cases} b_t^i & if \quad k_{t+1} \leq \widetilde{k} \\ b_t^i - e_t^i & if \quad k_{t+1} > \widetilde{k} \end{cases}$$

Saving of Member i of Generation t

$$s_t^i = \begin{cases} b_t^i & if \quad k_{t+1} \leq \widetilde{k} \\ b_t^i - e_t^i & if \quad k_{t+1} > \widetilde{k} \end{cases}$$

Saving rate $s_{t+1}^i / \ I_{t+1}^i$ is increasing in I_{t+1}^i

Initial Wealth Distribution

The economy consists of two groups in period 0:

Initial Wealth Distribution

The economy consists of two groups in period 0:

- Capitalists (R)
  - Fraction λ of all adult individuals

Initial Wealth Distribution

The economy consists of two groups in period 0:

- Capitalists (R)
  - Fraction λ of all adult individuals
  - Equally own the *initial* capital stock

Initial Wealth Distribution

The economy consists of two groups in period 0:

- Capitalists (R)
  - Fraction λ of all adult individuals
  - Equally own the *initial* capital stock
- Workers (P)
  - Fraction $1-\lambda$ of all adult individuals

Initial Wealth Distribution

The economy consists of two groups in period 0:

- Capitalists (R)
  - Fraction λ of all adult individuals
  - Equally own the *initial* capital stock
- Workers (P)
  - Fraction $1-\lambda$ of all adult individuals
  - No ownership over the *initial* capital stock

Factor Accumulation

$$
\begin{aligned}
K_{t+1} &= \int_0^1 s_t^i di = \lambda(b_t^R - e_t^R) + (1-\lambda)(b_t^P - e_t^P) \\
&= K(b_t^R, b_t^p, k_{t+1}) \\
H_{t+1} &= \int_0^1 h_{t+1}^i di = \lambda h(e_t^R) + (1-\lambda) h(e_t^P) \\
&= H(b_t^R, b_t^P, k_{t+1})
\end{aligned}
$$

The Capital-Labor Ratio

$$k_{t+1} = \frac{K_{t+1}}{H_{t+1}} = \frac{K(b_t^R, b_t^P, k_{t+1})}{H(b_t^R, b_t^P, k_{t+1})}$$

$$\Longrightarrow$$

$$k_{t+1} = \kappa(b_t^R, b_t^P)$$

The Evolution of Transfers within group i = R,P

$$b^i_{t+1} = \max\{\beta[w_{t+1}h(e^i_t) + (b^i_t - e^i_t)R_{t+1} - \theta], 0\}$$

The Evolution of Transfers within group i = R,P

$$b^i_{t+1} = \max\{\beta[w_{t+1}h(e^i_t) + (b^i_t - e^i_t)R_{t+1} - \theta], 0\}$$

$$\Longrightarrow$$

$$b^i_{t+1} = \phi(b^i_t, k_{t+1})$$

The Evolution of Transfers within group i = R,P

$$b^i_{t+1} = \max\{\beta[w_{t+1}h(e^i_t) + (b^i_t - e^i_t)R_{t+1} - \theta], 0\}$$

$$\Longrightarrow$$

$$b^i_{t+1} = \phi(b^i_t, k_{t+1})$$

There exists $\widehat{k}$, a critical level of k below which individuals who do not receive parental transfers (i.e., $b^i_t = e^i_t = 0$) do not transfer income to their offspring: $w(\widehat{k}) = \theta$

The Evolution of Transfers within group i = R,P

$$b^i_{t+1} = \max\{\beta[w_{t+1}h(e^i_t) + (b^i_t - e^i_t)R_{t+1} - \theta], 0\}$$

$$\Longrightarrow$$

$$b^i_{t+1} = \phi(b^i_t, k_{t+1})$$

There exists $\widehat{k}$, a critical level of k below which individuals who do not receive parental transfers (i.e., $b^i_t = e^i_t = 0$) do not transfer income to their offspring: $w(\widehat{k}) = \theta$

$$b^i_{t+1} = \phi(0, k_{t+1}) \begin{cases} = 0 & if \quad k_{t+1} \leq \widehat{k} \\ > 0 & if \quad k_{t+1} > \widehat{k} \end{cases}$$

The Evolution of Transfers within Group i =R,P

$$b^i_{t+1} = \phi(b^i_t, k_{t+1}) = \phi(b^i_t, \kappa(b^R_t, b^P_t))$$

$$\equiv \psi^i(b^R_t, b^P_t)$$

The dynamical system

$\{b_t^P, b_t^R\}_{t=0}^{\infty}$ such that:

The dynamical system

$\{b_t^P, b_t^R\}_{t=0}^{\infty}$ such that:

$$b_{t+1}^P = \psi^P(b_t^R, b_t^P)$$

$$b_{t+1}^R = \psi^R(b_t^R, b_t^P)$$

The Process of Development

- Regime I: PC Accumulation $(k \leq \widetilde{k})$

The Process of Development

- Regime I: PC Accumulation $(k \leq \widetilde{k})$
- Regime II: HC Accumulation $(k > \widetilde{k})$

The Process of Development

- Regime I: PC Accumulation $(k \leq \widetilde{k})$
- Regime II: HC Accumulation $(k > \widetilde{k})$
  - Stage I of Regime II $(\tilde{K} < K \leq \hat{K})$

The Process of Development

- Regime I: PC Accumulation $(k \leq \widetilde{k})$
- Regime II: HC Accumulation $(k > \widetilde{k})$
  - Stage I of Regime II $(\tilde{K} < K \leq \hat{K})$
  - Stage II of Regime II $(\hat{K} < K < K^*)$

The Process of Development

- Regime I: PC Accumulation $(k \leq \widetilde{k})$
- Regime II: HC Accumulation $(k > \widetilde{k})$
  - Stage I of Regime II $(\tilde{K} < K \leq \hat{K})$
  - Stage II of Regime II $(\hat{K} < K < K^*)$
  - Stage III of Regime II $(K > K^*)$

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

- K is the main engine of growth: $\rho^{HC} < \rho^{K}$

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

- K is the main engine of growth: $\rho^{HC} < \rho^{K}$
- No investment in education

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

- K is the main engine of growth: $\rho^{HC} < \rho^{K}$
- No investment in education
- No Transfers within Group P

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

- K is the main engine of growth: $\rho^{HC} < \rho^{K}$
- No investment in education
- No Transfers within Group P
- Transfers within Group R $\uparrow$

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

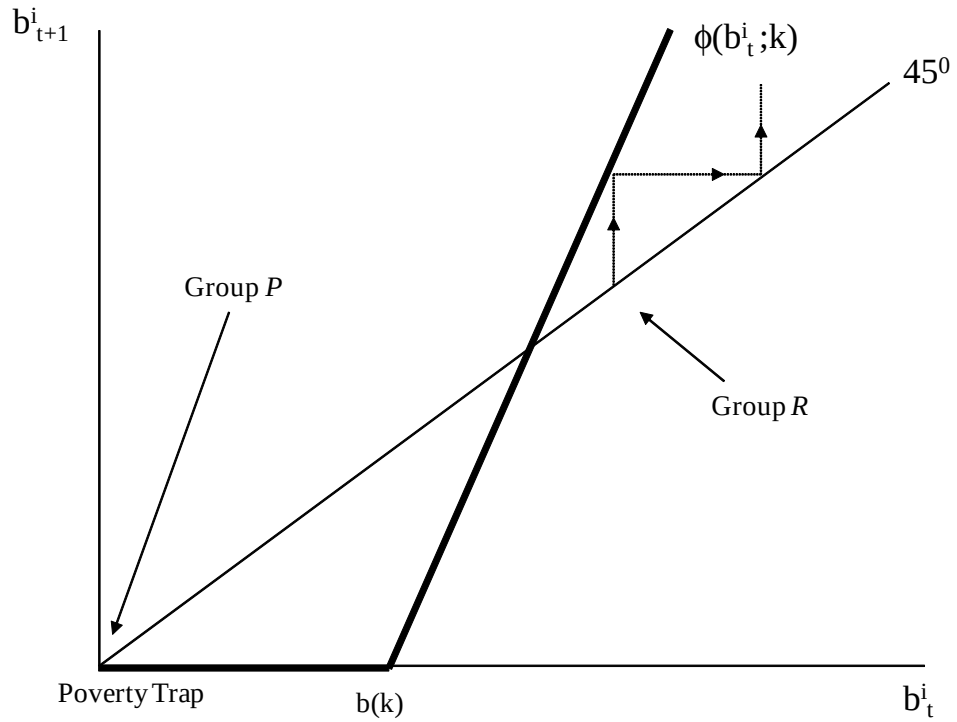
- K is the main engine of growth: $\rho^{HC} < \rho^{K}$
- No investment in education
- No Transfers within Group P
- Transfers within Group R $\uparrow$
- Wages $\uparrow$

Regime I: Physical Capital Accumulation

Early stages of development $(k \leq \widetilde{k})$

- K is the main engine of growth: $\rho^{HC} < \rho^{K}$
- No investment in education
- No Transfers within Group P
- Transfers within Group R $\uparrow$
- Wages $\uparrow$
- Income inequality $\uparrow$

The Conditional Dynamical System: Regime I



Regime I: Effect of Inequality

Inequality enhances the process development

Regime I: Effect of Inequality

Inequality enhances the process development

- A transfer of wealth from Group R to P $\Longrightarrow$

Regime I: Effect of Inequality

Inequality enhances the process development

- A transfer of wealth from Group R to P $\Longrightarrow$
  - Aggregate consumption $\uparrow$

Regime I: Effect of Inequality

Inequality enhances the process development

- A transfer of wealth from Group R to P $\Longrightarrow$
  - Aggregate consumption $\uparrow$
  - Aggregate intergenerational transfers $\downarrow$

Regime I: Effect of Inequality

Inequality enhances the process development

- A transfer of wealth from Group R to P $\Longrightarrow$
  - Aggregate consumption $\uparrow$
  - Aggregate intergenerational transfers $\downarrow$
  - Rate of capital accumulation $\downarrow$

Regime II: Human Capital Accumulation

Mature stages of development: $(k > \widetilde{k})$

Regime II: Human Capital Accumulation

Mature stages of development: $(k > \widetilde{k})$

- HC is the engine of growth: $\rho^{HC} \geq \rho^{K}$

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II $(\tilde{K} < K \leq \hat{K})$

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers
  - No investment in education

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers
  - No investment in education
- Members of group R

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers
  - No investment in education
- Members of group R
  - Transfers $\uparrow$

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers
  - No investment in education
- Members of group R
  - Transfers $\uparrow$
  - Expenditure on education $\uparrow$

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

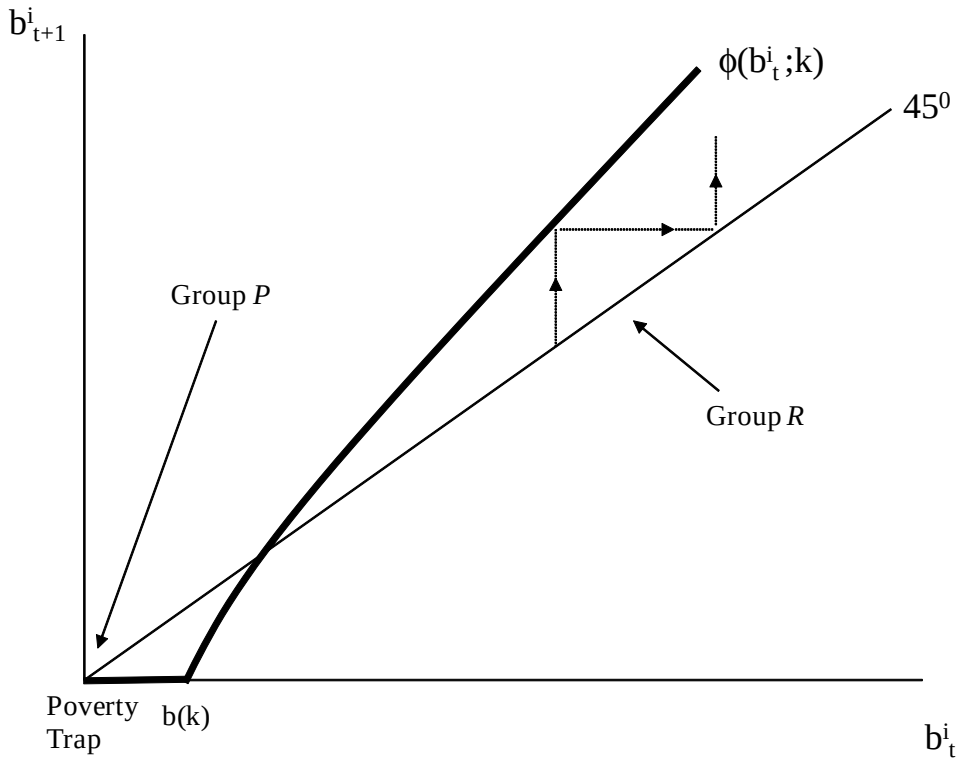
- Members of group P
  - No intergenerational transfers
  - No investment in education
- Members of group R
  - Transfers $\uparrow$
  - Expenditure on education $\uparrow$
- Wages $\uparrow$

Stage I of Regime II: HC Accumulation by group R

Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)

- Members of group P
  - No intergenerational transfers
  - No investment in education
- Members of group R
  - Transfers $\uparrow$
  - Expenditure on education $\uparrow$
- Wages $\uparrow$
- Income inequality $\uparrow$

The Conditional Dynamical System: Stage I of Regime II



Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

- Members of group P (credit constrained): $\rho^{HC} > \rho^{K}$

Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

- Members of group P (credit constrained): $\rho^{HC} > \rho^K$
  - Start to transfers

Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

- Members of group P (credit constrained): $\rho^{HC} > \rho^{K}$
  - Start to transfers
  - Start to acquire education

Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

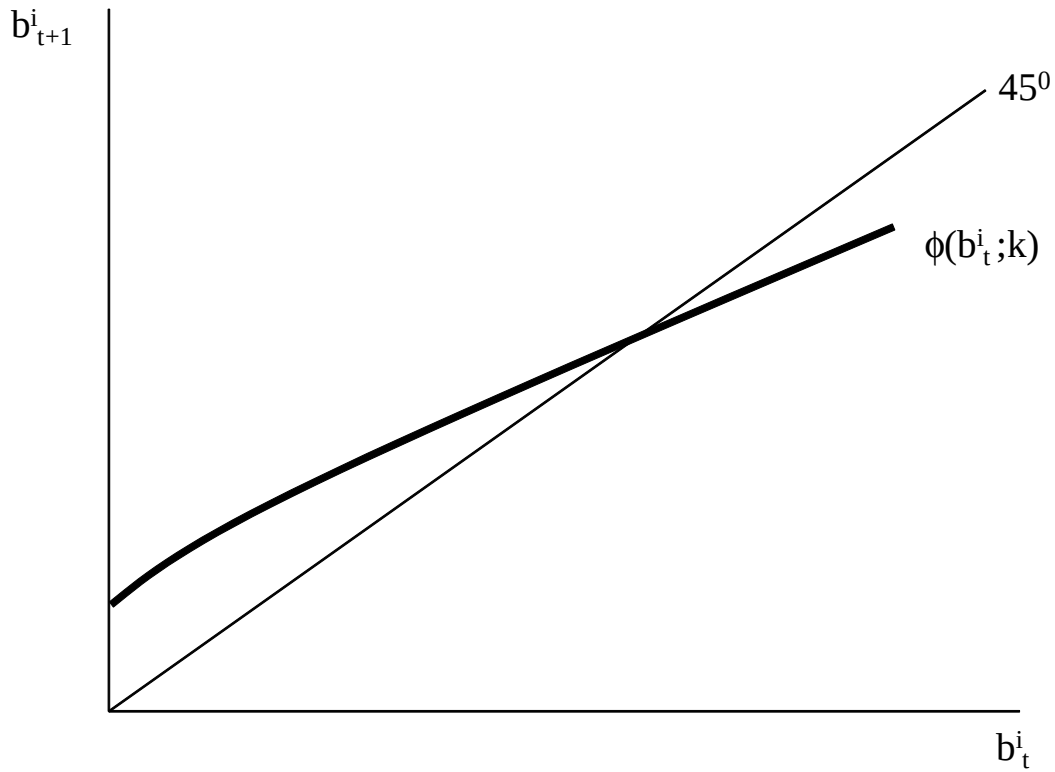
- Members of group P (credit constrained): $\rho^{HC} > \rho^K$
  - Start to transfers
  - Start to acquire education
- Members of group R (not credit constrained): $\rho^{HC} = \rho^K$

Stage II of Regime II : HC Accumulation by the Poor

Stage II of Regime II $(\hat{K} < K < K^*)$

- Members of group P (credit constrained): $\rho^{HC} > \rho^K$
  - Start to transfers
  - Start to acquire education
- Members of group R (not credit constrained): $\rho^{HC} = \rho^K$
  - Invest optimally in human and physical capital

Conditional Dynamical System: Stage II-III of Regime II



Stage II of Regime II: Effect of Inequality

- More equality is beneficial for the process development

Stage II of Regime II: Effect of Inequality

- More equality is beneficial for the process development
  - A transfer of wealth from group R to group P allows (due to credit constraint) a more efficient allocation of aggregate investment between HC and PC

Stage III of Regime II : Credit Constraints are not Binding

- All individuals are not credit constrained: $R^{HC} = R^{K}$

Stage III of Regime II : Credit Constraints are not Binding

- All individuals are not credit constrained: $R^{HC} = R^{K}$
- Inequality has no effect on the process of development

The changing Role of Inequality in the Development Process

0 _____ $\tilde{k}$ _____

Regime I	**Regime II**
$\rho^K > \rho^H$	$\rho^K \leq \rho^H$
K only engine	HC main engine
Inequality (+)	Inequality (-)

Effect of Inequality in Regime II

$\tilde{k}$ _____ $\hat{k}$ _____ k^* _____

Stage I	**Stage II**	**Stage III**
$\rho^K < \rho^H_p$ $\rho^K = \rho^H_R$	$\rho^K < \rho^H_P$ $\rho^K = \rho^H_R$	$\rho^K = \rho^H$
2 engines	HC main engine	2 engines
	Inequality (-)	

Testable Implications

Testable Implications

The CMI approach

- The effect on inequality depends on the country's level of income. Inequality is beneficial for poor economies and harmful for rich ones

Testable Implications

The CMI approach

- The effect on inequality depends on the country's level of income. Inequality is beneficial for poor economies and harmful for rich ones

The Unified Approach

- The effect of inequality on growth depends on the relative return to human and physical capital. The higher is the relative return to human capital the more harmful is inequality for economic growth

Implications for DC and LDCS

Implications for DC and LDCS

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the impact of inequality on the process of development

Implications for DC and LDCS

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the impact of inequality on the process of development
  - Inequality stimulates economic growth in stages of development in which physical capital accumulation is the prime engine of growth

Implications for DC and LDCS

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the impact of inequality on the process of development
  - Inequality stimulates economic growth in stages of development in which physical capital accumulation is the prime engine of growth
  - Inequality is harmful for economic growth in stages of development in which human capital accumulation is the prime engine of economic growth

Implications for DC and LDCS

- The replacement of physical capital accumulation by human capital accumulation as a prime engine of economic growth has changed the impact of inequality on the process of development
  - Inequality stimulates economic growth in stages of development in which physical capital accumulation is the prime engine of growth
  - Inequality is harmful for economic growth in stages of development in which human capital accumulation is the prime engine of economic growth
- Int'l capital inflow to LDCs and the adoption of skilled-biased technologies may place economies directly in the second stage in which inequality is harmful

References

References

Main Source:

- Galor, Oded and Omer Moav, 2004, "From Physical to Human Capital Accumulation: Inequality and the Process of Development," Review of Economic Studies, 71(4), 1001-1026.

Related Papers:

- Galor, Oded and Omer Moav, 2006, "Das Human-Kapital: A Theory of the Demise of the Class Structure," Review of Economic Studies, 73(1), 85-117.
- Galor, Oded and Joseph Zeira, 1993, "Income Distribution and Macroeconomics," Review of Economic Studies, 60(1), 35-52.
- Galor, Oded and Omer Moav, and Dietrich Vollrath, 2009, "Inequality in Landownership, Human Capital Promoting Institutions and the Great Divergence" Review of Economic Studies, 76(1), 143-179.