Inequality and the Process of Development: A Unified Perspective

Kuznets Lecture, Yale University

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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 view-points 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 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

Equality and Development: Pre-Industrialization Stage

Equality may be essential for industrialization

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

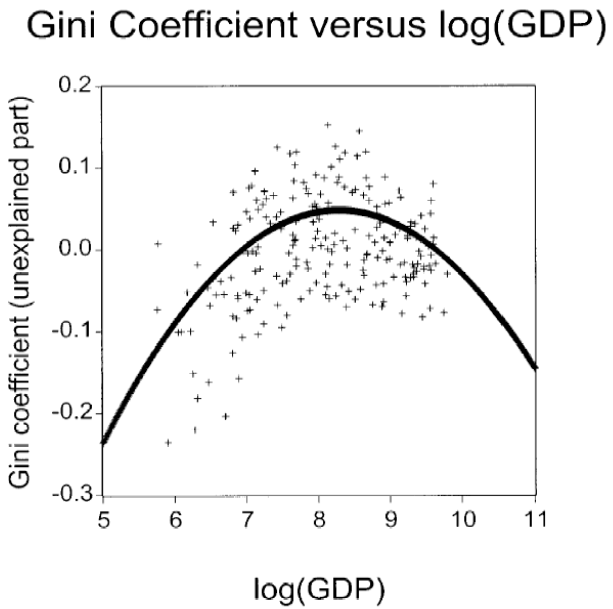
- In the absence of international demand for domestic industrial goods, a broad distribution of income from the leading agricultural sector may be critical for the emergence of industry

The Neoclassical Paradigm

The Representative Agent Approach

- Rejects the role of heterogeneity, and thus income distribution, in economic growth
  - Growth Process $\Rightarrow$ Income Distribution
  - Income Distribution $\not\Rightarrow$ Growth Process

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)

The Modeern Perspective: Origins

Galor and Zeira (1988, 1993)

- Unlike the Neoclassical Paradigm

  Income Distribution $\Rightarrow$ the growth process

- Unlike the Classical Perspective

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

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)

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))

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))

The Political Economy Approach

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

- This channel is inconsistent with evidence Perotti (1996)

The Political Economy Approach: An Alternative Channel

- Inequality is harmful for the growth process
  - Inequality $\Longrightarrow$ incentive for better endowed agents to lobby against redistribution
  - Efficient redistribution policies are not implemented

Benabou, (2000, 2002)

A Unified Theory of Inequaltiy and Development

- A unified theory of the dynamic implications of inequality on the growth process Galor and Moav (ReStud , 2004)
- Places the dominating modern theories within a broader unified structure
- Provides an intertemporal reconciliation between the Classical viewpoint and the Modern perspective

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

Fundamental asymmetry between:

- Human capital accumulation
- Physical capital accumulation

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 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** 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** 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

- 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

- 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

- 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
- $t = 0, 1, 2, 3, ...$
- 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 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 :

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

K_t - PC

H_t - HC (efficiency units)

$k_t \equiv K_t / H_t$

Factor Prices

Demand for factors of production at time t

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

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

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

- 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 to:

    (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:

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

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:

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

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:

- 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

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

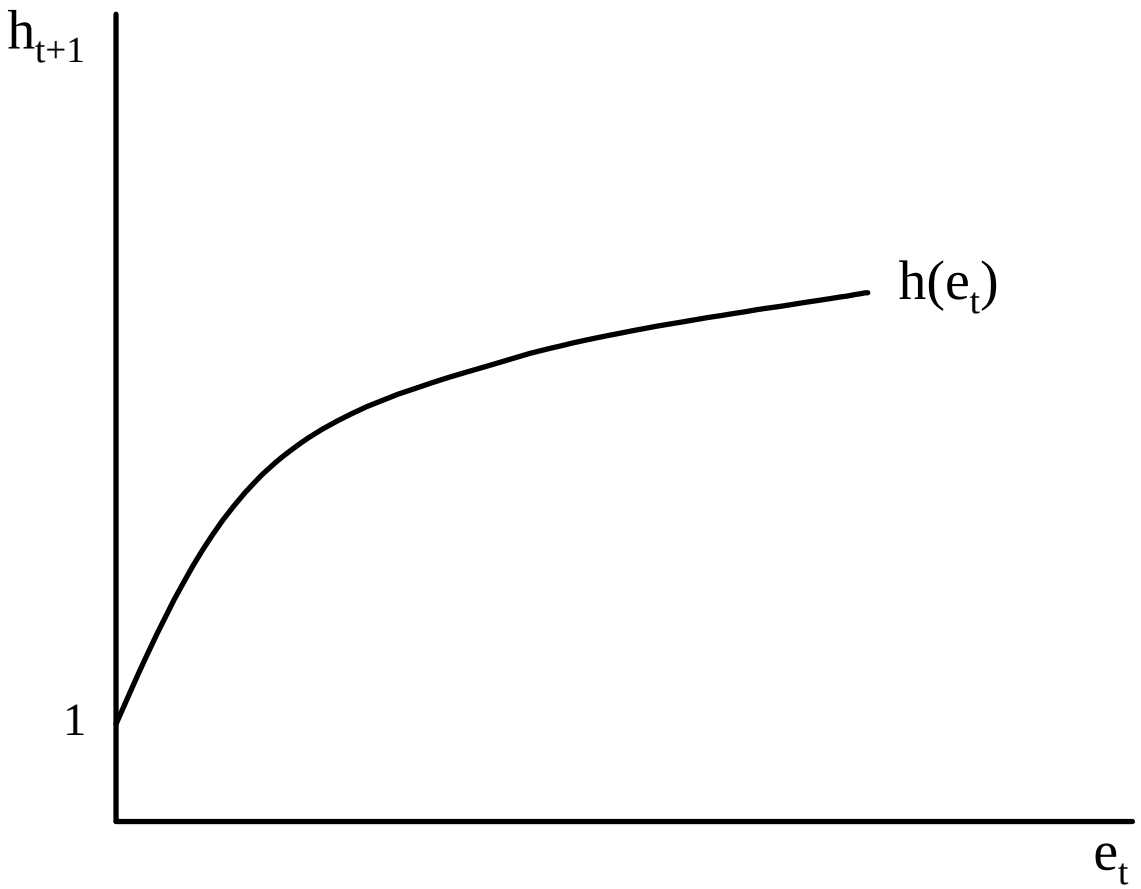
Individual i of Generation t: Human capital formation

Efficiency units of labor in period $t+1$

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

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

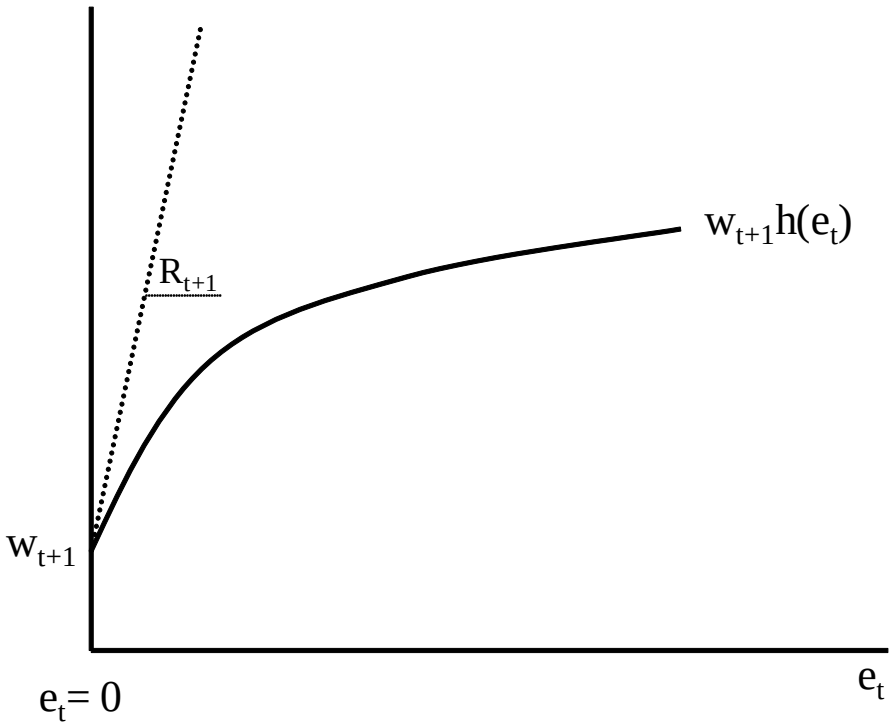
In the absence of borrowing constraints:

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

e_t is unique and identical across members of generation t

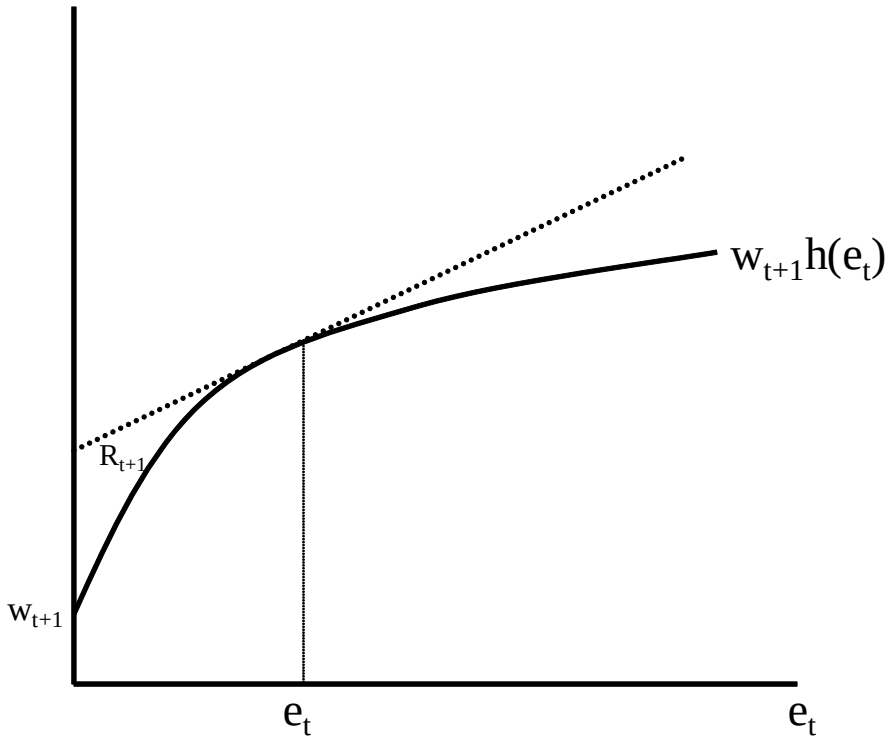
Optimal Inv't in Education of Member i of Generation t

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

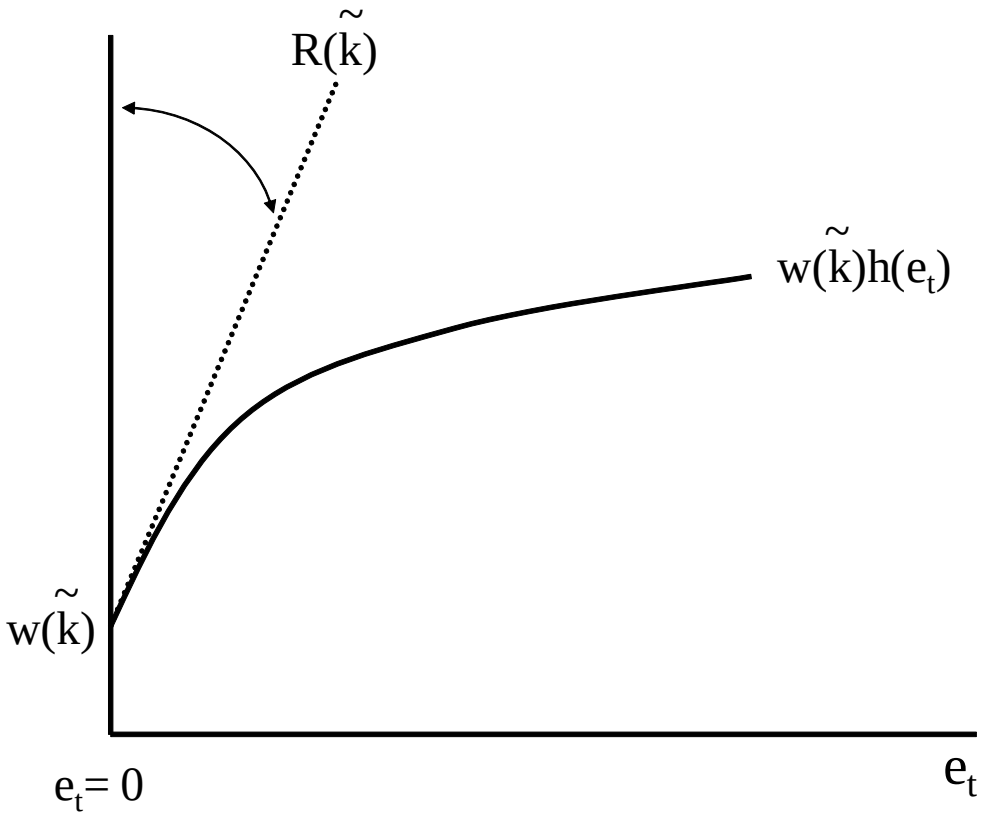


Optimal Inv't in Education of Member i of Generation t

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



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



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

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

where

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

Borrowing Constraint of Member i of Generation t

Individuals can not borrow to finance the education expenditure of their offspring:

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

Preferences and Transfers of Member i of Generation t

- Preferences:

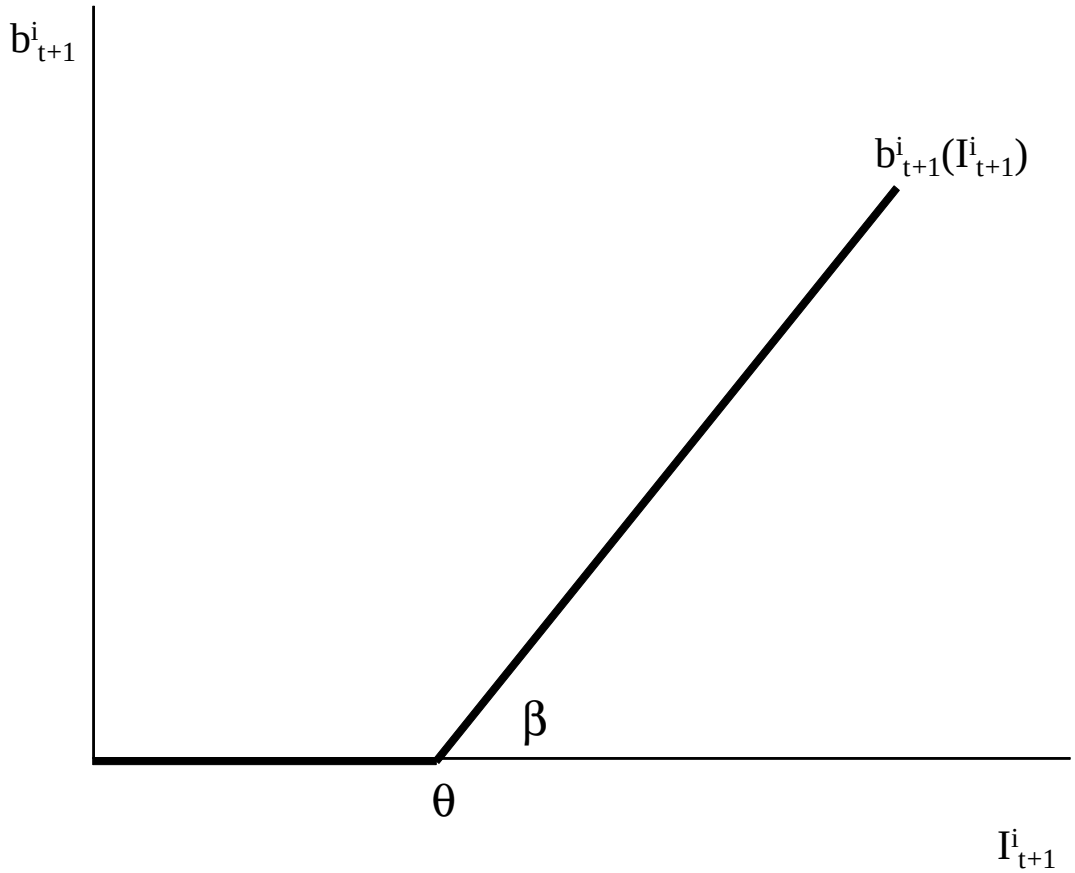
$$u_t^i = (1-\beta)\log c_{t+1}^i + \beta \log(\overline{\theta} + b_{t+1}^i)$$

- 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 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:

- 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

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

$$\Longrightarrow$$

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

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:

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

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

The Process of Development

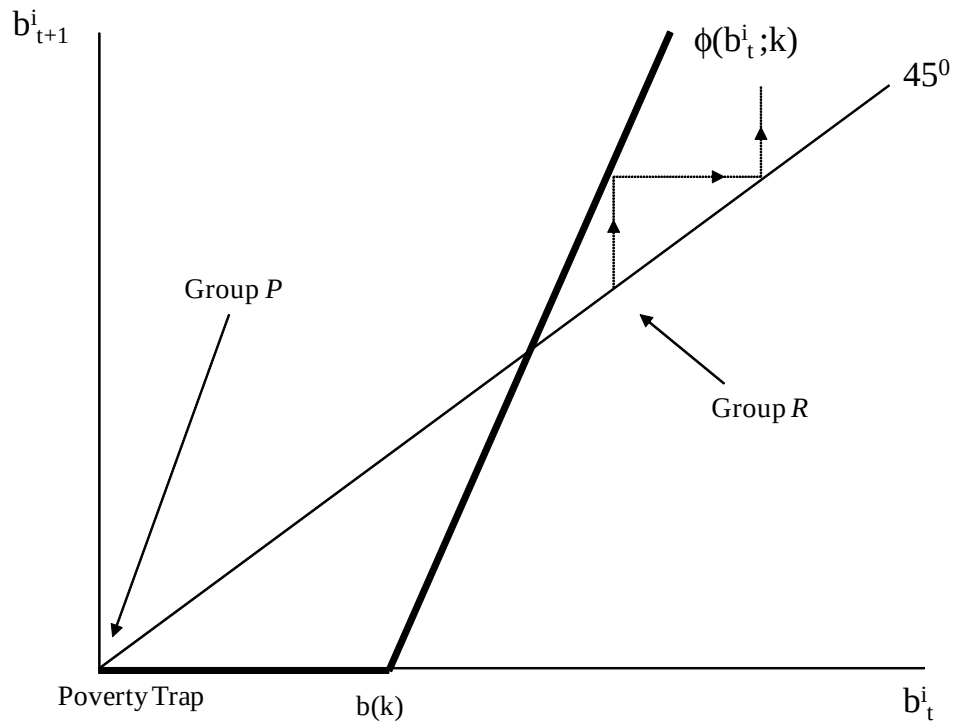
- Regime I: PC Accumulation ($k \leq \widetilde{k}$)
- Regime II: HC Accumulation ($k > \widetilde{k}$)
  - Stage I of Regime II ($\tilde{K} < K \leq \hat{K}$)
  - Stage II of Regime II ($\hat{K} < K < K^*$)
  - Stage III of Regime II ($K > K^*$)

Regime I: Physical Capital Accumulation

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

- 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

- 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: $(k > \widetilde{k})$

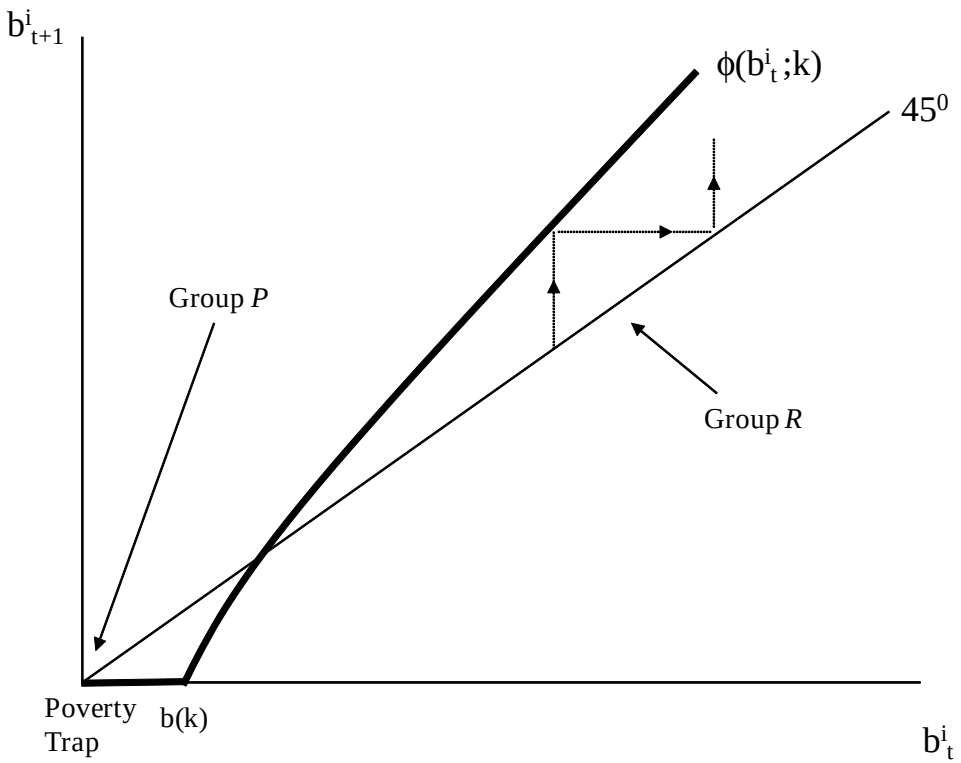
- HC is the engine of growth: $\rho^{HC} \geq \rho^{K}$

Stage I of Regime II: HC Accumulation by group R

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

- 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

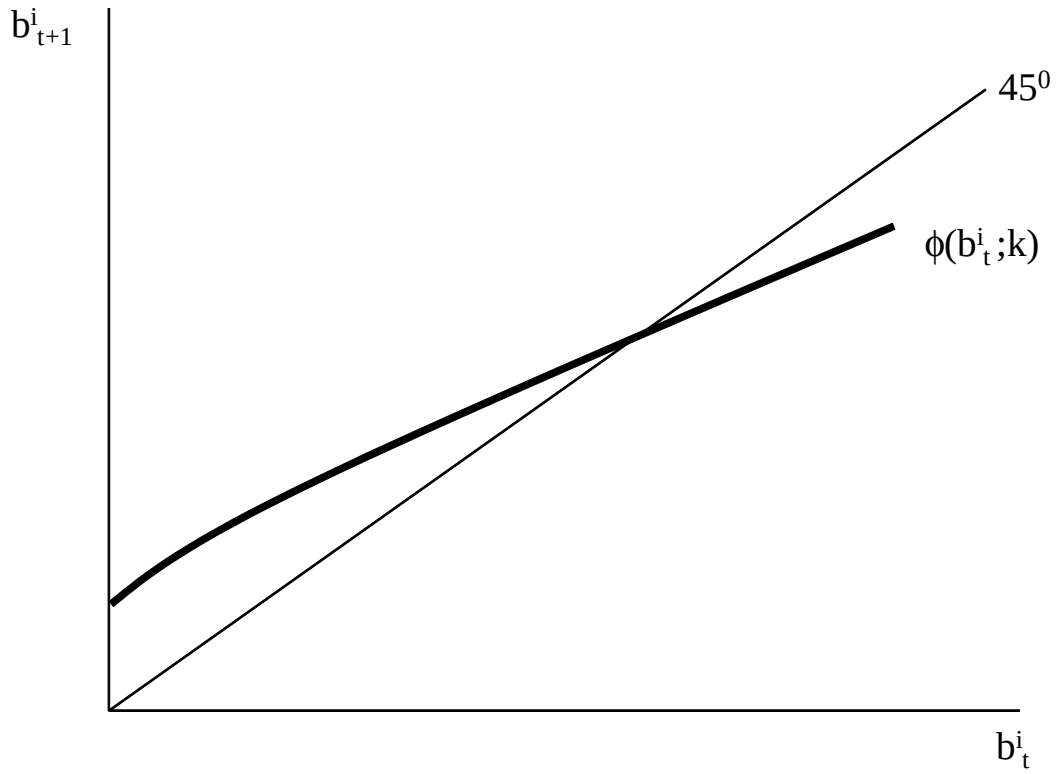


Stage II of Regime II : HC Accumulation by the Poor

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

- 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
  - 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 Constriants 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 Inquality 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 Inquality 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 Imlications

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

- 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

Inequality and Sources of Under-Investment in Human Capital Formation

- The rise in the demand for human capital in the process of development has generated a growth promoting role for human capital formation
- Inequality has adversely affected human capital formation and economic growth:
  - Income inequality (in the presence of CMI) $\Longrightarrow$ Limits the financial ability of segments of society to optimally invest in education
  - Inequality in Landownership$\Longrightarrow$ Delays the implementation of human capital promoting institution (e.g., public education)

Main Hypothesis

- Human capital accumulation has not benefited all sectors of the economy
- Complementarity between [human capital & land] $<$ Complementarity between [human & physical capita]
  - Capitalists, who were striving for an educated labor force, supported policies that promoted the education of the masses (Galor and Moav (ReStud, 2006))
  - Landowners, whose interests lay in the reduction of the mobility of the rural labor force, favored policies that deprived the masses from education (Galor, Moav and Vollrath (ReStud, 2009))

Main Hypothesis

- The transition from an agricultural to an industrial economy changed the nature of the main economic conflict in society:
  - Agrarian economy: Conflict of interest between the landed aristocracy and the masses
  - Industrialization: Conflict between the entrenched landed elite and the emerging capitalist elite

Main Hypothesis

Concentration of landownership $\Longrightarrow$

- Delayed the implementation of human capital promoting institutions
- Human capital promoting institutions has emerged in the process of development only once the landed aristocracy increases their stake in the industrial sector or their political power weakened
- Sub-optimal level of investment in human capital
- Lower skill intensity of the industrial sector
- Slower pace of economic development

Inequality in Landownership vs. Wealth Inequality

- Conflict of interest among the economic elites (industrialists and landowners) brought about the delay in the implementation of growth enhancing educational policies (GMV)
    - Conflict of interest between the ruling elite and the masses delayed reforms (ES, AJR)
- Unequal distribution of land ownership adversely affected the timing of educational reforms (GMV)
    - Unequal distribution of wealth induce the elite to block reforms that may lead to redistribution (ES)

Inequality in Landownership vs. Wealth Inequality

- The implementation of growth promoting institutions emerged in the process of development as the landed aristocracy increases their stake in the industrial sector and the economic well being of the industrial sector dominates the decisions of the Elite
    - Persistent desirability of extractive institutions (ES, AJR)
- Even if the political structure remains unchanged, economic development ultimately triggers the implementation of growth promoting institutions
    - Growth promoting policies will be implemented only if the distribution of political power would change or inequality will significantly diminish (ES and AJR)

Anecdotal Evidence

- Land reforms followed by education reforms in:

  Korea, Taiwan, Japan, Russia

-
  - Land reforms diminish the economic incentives of landowners to block education reforms
  - The feasibility of land reforms is indicative of the political weakness of the landed aristocracy that prevents them from blocking growth enhancing education reforms

Anecdotal Evidence

The concentration of land ownership across countries and regions are inversely related to education expenditure and attainment:

- North and South America
- North vs. South Mexico (After the Revolution of 1910)
- Argentina, Chile & Uruguay vs. rest of South American
- Costa Rica vs. Honduras & El Salvador (small vs. large plantations)

Korea

- Land Reforms: 1948-1950
  - % tenants among farming households: 70% (1945), 0% (1950)
- Education Reforms: 1949 –
  - Education as % of GNP: 8% (1948), 15% (1960)
  - Years of Schooling 3 (1948), 6 (1960)
  - GDP/GDP$_{US}$: 8% (1948), 12% (1960)

Taiwan

- Land Reforms: 1949-1953
  - % tenants among farming households: 43% (1948), 19% (1959)
- Education Reforms: 1950 –
  - Education as % of GNP: 1.78% (1948), 4.12% (1970)

Japan: the Meiji Restoration

The Meiji Restoration 1868 - Downfall of the traditional feudal structure

- Land Reforms: 1871-1883
  - % tenants among farming households: 43% (1948), 19% (1959)
- Education Reforms: 1872, 1879, 1886
  - % of 6-14 in schools: 28% (1873), 51% (1883), 94% (1903)

Russia

- Land Reforms: 1906
  - Large landowners: 40% (1860), 17% (1917)
- Education Reforms: 1908-1912
  - % government's budget devoted to education: 1.4% (1906) 4.9% (1915)
  - % of the population in schools: 1.7% (1897) 5.7% (1915)

Evidence: The High School Movement

- A major transformation of the US high school system from an insignificant secondary education to a universal secondary education that is geared towards industrial needs
- Graduation rates:

	South	Midwest	Northeast	West	US
1910	3%	11%	10%	11%	5%
1950	39%	58%	56%	61%	57%

Evidence: The High School Movement

- Changes in the concentration of land ownership

	South	Midwest	Northeast	West
1880	20%	20%	20%	20%
1900	12%	16%	22%	9%
1920	8%	13%	24%	6%

Hypothesis and Identification Strategy

- Central Hypothesis
  - Inequality in distribution of land ownership adversely affected human capital formation
- Empirical Task
  - Estimating the effect of land inequality on education expenditure
- Identification Strategy
  - Exploit variations in distribution of land ownership and in education expenditures across and within states during the high school movement in the US, controlling for state fixed effects

The Statistical Model

$$\ln e_{it} = \beta_0 + \beta_1 S_{i,t-1} + \beta_2 \ln y_{i,t-1} + \beta_3 U_{i,t-1} + \beta_4 B_{i,t-1} + v_{it}$$

- e_{it} - Expenditure per child in state i in period t
- $S_{i,t-1}$ - Share of land held by large landowners
- $U_{i,t-1}$ - percentage of the urban population
- $B_{i,t-1}$ - percentage of the black population
- v_{it} - error term of state i in period t

Hypothesis: $\beta_1 < 0$

The Statistical Model: Unobserved Heterogeneity

$$v_{it} = \eta_i + \delta_t + \theta_i t + \varepsilon_{it}$$

The specification allows for unobserved heterogeneity between states:

- (a) Time invariant unobserved heterogeneity across states in the level of log expenditure per child
  - η_i - time invariant level of log expenditure per child in state i
- (b) Linear unobserved heterogeneity across states in the time trend of log expenditure per child
  - $\theta_i t$ - time trend of log expenditure per child in state i
- Common time trend δ_t

Estimating Strategy

- Heterogeneity across state in the level of log expenditure per child: Accounted for by estimating the difference equation

$$\Delta \ln e_{it} = \beta_1 \Delta S_{i,t-1} + \beta_2 \Delta \ln y_{i,t-1} + \beta_3 \Delta U_{i,t-1} + \beta_4 \Delta B_{i,t-1} + \Delta \delta_{t-1} + \theta_i + \Delta \varepsilon_{it}$$

  - $\Delta \ln e_{it} \equiv \ln e_{it+1} - \ln e_{it}$ (1920 vs. 1900 & 1940 vs.1920)
  - $\Delta S_{i,t-1} \equiv S_{i,t} - S_{i,t-1}$ (1900 vs. 1880 & 1920 vs.1900)

- $cov(\Delta \varepsilon_{it}, \Delta X) = 0;\ \Delta X \equiv (\Delta S_{i,t-1}, \Delta \ln y_{i,t-1}, \Delta U_{i,t-1}, \Delta B_{i,t-1})$

Estimating Strategy

- Heterogeneity in the time trend across states: Accounted for by estimating the difference equation with state fixed effects
- $cov(\Delta\varepsilon_{it}, \Delta Z) = 0$; $\Delta Z \equiv (\Delta G_{i,t-1} - \Delta G_i, \Delta \ln y_{i,t-1} - \Delta \ln y_i, \Delta U_i,$

Data

- Observations in the years: 1880, 1900, 1920, 1940
  - $\{(t-1,\ t)\} = \{(1880, 1900), (1900, 1920), (1920, 1940)\}$
- Total observations: 79
  - 41 states (2 observations for 38 states & 1 observation for 3 states)

Data Sources

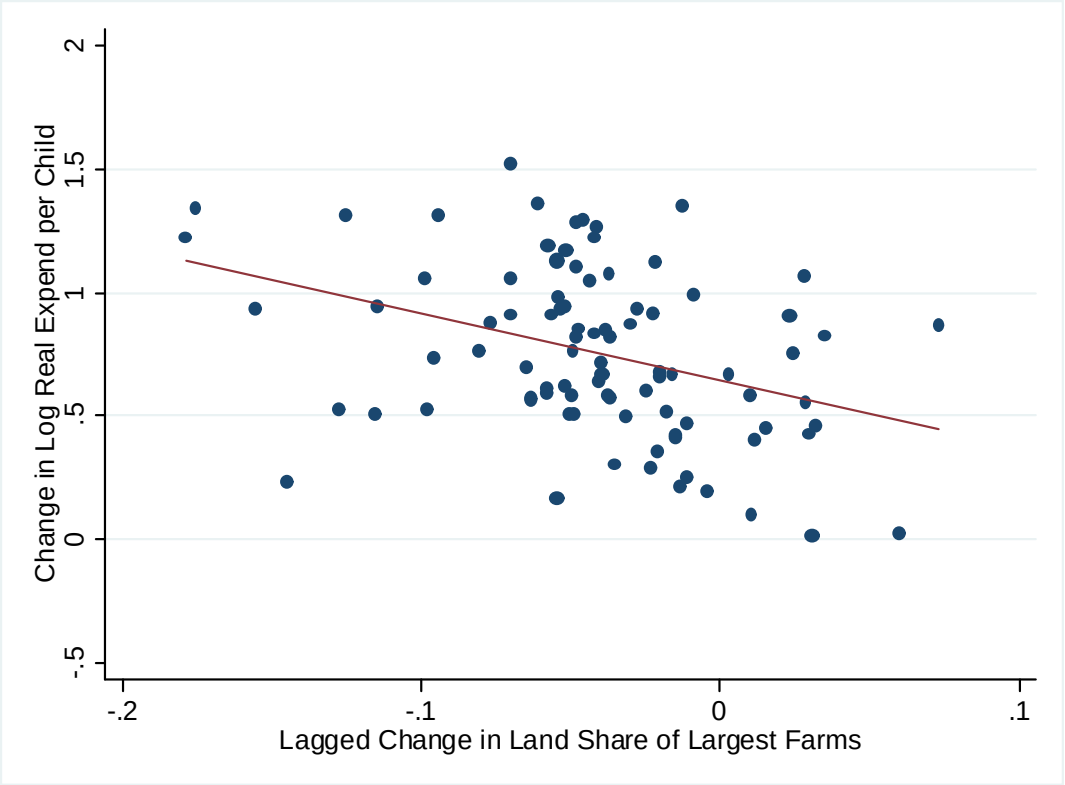
- Education expenditure levels: Historical Statistics of the US: (1920,1940)
- US Bureau of Education: (1880,1900)
- Number of children (US Census)
- Land concentration (US Census)
- Income per capita (Easterlin (1957))
- The percentage of the black population (U.S. Census)
- The percentage of urban population (U.S. Census)

Correlations

	$\Delta \ln e_{it}$	$\Delta G_{i,t-1}$	$\Delta \ln y_{i,t-1}$	$\Delta U_{i,t-1}$	$\Delta B_{i,t-1}$
$\Delta \ln e_{it}$					
$\Delta G_{i,t-1}$	-0.31^{**}				
$\Delta \ln y_{i,t-1}$	0.42^{**}	-0.16			
$\Delta U_{i,t-1}$	-0.03	-0.05	0.13		
$\Delta B_{i,t-1}$	-0.37^{**}	0.23^{**}	-0.26^{**}	0.09	

** significance at the 5% level; * at the 10% level

Land Inequality and Education Expenditure



Controls

- Income per capita
- Percentage of the urban population
  - Capturing urbanization's contrasting effects on education expenditure:
    (i) Negative (economies of scale in education)
    (ii) Positive (industrial (urban) demand for education)
- Percentage of the black population
  - Capturing the adverse effect of the discrimination in the South (where land inequality is more pronounced) on educational expenditure

Effect of Land Concentration on Educational Expenditure

Change in log educational expend per child ($\Delta \ln e_{it}$)

	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
Change in land concentration	-2.71***	-2.67***	-2.16***	-2.12***	-2.34***	-3.68*
($\Delta S_{i,t-1}$)	(0.99)	(0.86)	(0.75)	(0.78)	(0.80)	(2.17)
change in income per capita		0.84***	0.72***	0.72***	0.72***	0.71*
($\Delta \ln y_{i,t-1}$)		(0.15)	(0.13)	(0.13)	(0.17)	(0.41)
change in % of the black pop.			-3.74***	-3.78***	-2.90***	-5.13**
($\Delta B_{i,t-1}$)			(0.59)	(0.73)	(0.96)	(2.17)
change in % of the urban pop.				-0.05	-0.66*	-0.12
($\Delta U_{i,t-1}$)				(0.32)	(0.40)	(0.69)
National time fixed effects	No	No	No	No	Yes	No
State fixed effects (linear time trend)	No	No	No	No	No	Yes
Observations	79	79	79	79	79	79
R-squared	0.11	0.27	0.39	0.39	0.48	0.38

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Interpretation

- A 10 percentage point decline in Si,t-1 would have increased expenditure per child at the following period by 21–27%.
- In 1920 California S1920 = 0·096 (25th percentile of the distribution of S across states in the U.S.) and in Vermont S1920 = 0·215 (75th percentile). Vermont's expenditure per child in 1920 would have been 25% higher if it had a land share of large farms as small as California's. That difference would have eliminated more than a 1/3 of the actual gap in expenditure per child that existed between California ($68 per child) and Vermont ($41 per child) in 1940.

Instrumental Variable

- The price of a pound of cotton relative to a bushel of corn declined monotonically over the period 1880-1940
- In regions that were climatically more receptive to cotton production, the concentration of land ownership held by the largest farms declined
- In 29 states that produced no cotton in 1860 the average change in land concentration was just -0.2% over period 1880-1940
- Among states that produced some cotton in 1860, the average change in the land concentration of the largest landowners was -2.6%
- Cotton production was most prevalent in the South, accounting for over 40% of the value of agricultural production & Land ownership by the largest farms declined

Instrumental Variable

- The interaction between state-specific, but time invariant, climatic conditions and the nationwide changes in the price of cotton relative to corn instruments for the concentration of land ownership
- These instruments appear to satisfy the exclusion restriction, since there is no evidence that the human capital intensity in the production of cotton over this period differs from the average in all other agricultural crops, and changes in the relative price of cotton, therefore, would not have a direct effect on education expenditure, but only indirectly through their effect on concentration of landownership, and possibly via changes in income, that are controlled for in the regressions

Instrumental Variable Regression

Change in log educational expend per child ($\Delta \ln e_{it}$)

	OLS	2SLS
	(1)	(2)
Change in land concentration ($\Delta S_{i,t-1}$)	-2.34***	-3.23***
	(0.80)	(0.91)
change in income per capita ($\Delta \ln y_{i,t-1}$)	0.72***	0.72***
	(0.17)	(0.17)
change in % of the black pop. ($\Delta B_{i,t-1}$)	-2.90***	-2.58***
	(0.96)	(0.92)
change in % of the urban pop. ($\Delta U_{i,t-1}$)	-0.66*	-0.51
	(0.40)	(0.37)
National time fixed effects	Yes	Yes
Observations	79	79
R-squared	0.48	
First stage F-statistic		13.49
First stage p-value		<0.001
Sargan test statistic		1.20
Sargan test p-value		0.27

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

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