

Inequality and the Process of Development

CICSE Lectures, Naples

Lecture III: Inequality and Human Capital Promoting Institutions

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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) \implies Limits the financial ability of segments of society to optimally invest in education
 - Inequality in Landownership (or Wealth?) \implies 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 (RES, 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 (RES, 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 \implies

- 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

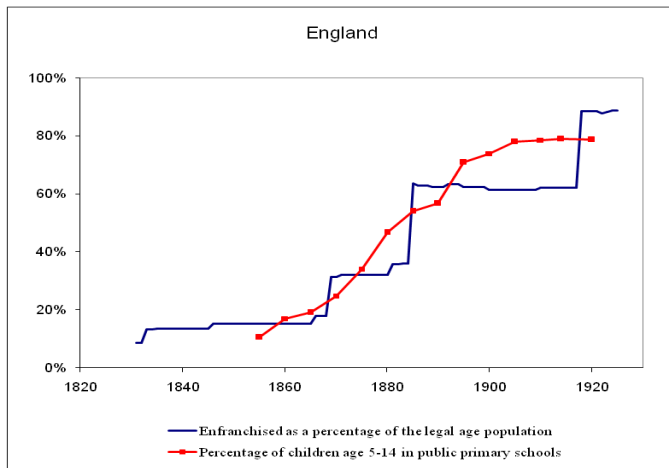
- Conflict of interest *among* the economic elites (industrialists vs. landowners) brought about the delay in the implementation of growth enhancing educational policies (GMV, GM)
 - Conflict of interest *between* the *elite* and the *masses* delayed reforms (ES, AJR)
- Unequal distribution of land ownership 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

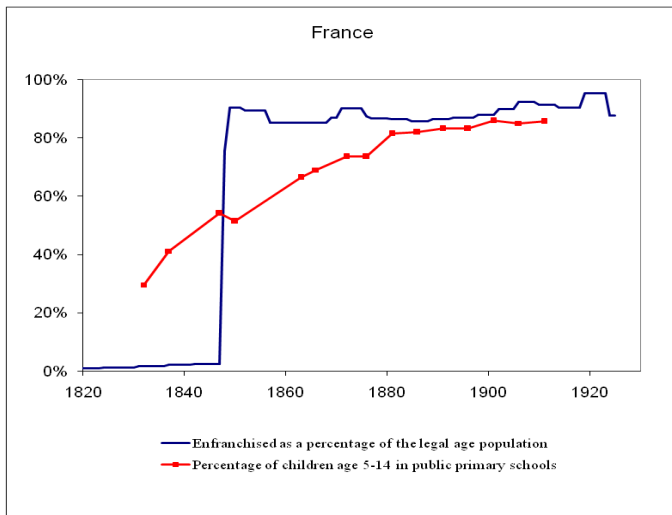
- Growth promoting institutions emerged in the development process as the landed aristocracy increases their stake in the industrial sector and the efficiency of the industrial sector dominates the decisions of the Elite (GMV, GM)
 - Persistent desirability of extractive institutions (ES, AJR)
- Even if the political structure remains unchanged, economic development ultimately triggers the implementation of growth promoting institutions (GMV, GM)
 - Growth promoting policies are implemented only if
 - distribution of political power changes (ES, AJR)
 - inequality significantly diminishes
 - reforms diminish instability and the risk of revolution (Marx) (extension of the franchise is a commitment device to ensure future redistribution from the elite to the masses (Acemoglu and Robinson (2000)))

Voting Rights and School Enrolment: England 1820-1925

Workers gain majority in the ballots only in 1883 and hence, unlike AR (2000), education reforms cannot be viewed as an outcome of the extension of the franchise that permits workers to redistribute resources to themselves



Voting Rights and School Enrolment: France 1820-1925



The Model

- Overlapping-generations economy
- One good produced in two sectors:
- Aggregate output:

$$y_t = y_t^A + y_t^M$$

- Agricultural production y_t^A
inputs: land & raw labor
- Industrial production y_t^M
inputs: physical capital & human capital

Agricultural Sector

$$y_t^A = F(X, L_t)$$

- X - land
- L_t - number of workers

Demand for labor and land

$$w_t^A = F_L(X_t, L_t)$$
$$\rho_t = F_X(X_t, L_t)$$

- w_t^A - wage per worker
- ρ_t - rental rate on land

Industrial Sector

$$y_t^M = K_t^\alpha H_t^{1-\alpha} \quad \alpha \in (0, 1)$$

- K_t - physical capital
- H_t - Efficiency units of labor

Demand for physical and human capital:

$$\begin{aligned} R_t &= \alpha k_t^{\alpha-1} \equiv R(k_t) \\ w_t^M &= (1 - \alpha) k_t^\alpha \equiv w^M(k_t) \end{aligned} \quad k_t \equiv K_t/H_t$$

- R_t - return to physical capital
- w_t^M - wage per unit of human capital

Wages

Labor is mobile across sectors:

$$w_{t+1}^A = h_{t+1} w_{t+1}^M \equiv w_{t+1}$$

- w_{t+1}^M - wage per efficiency unit of labor in M
- w_{t+1}^A - wage per worker in A
- w_{t+1} - equilibrium wage per worker in the economy

Individuals

- Overlapping Generations (each of size 1)
- Each individual has a single parent and a single child
- Identical in:
 - Preferences & Innate abilities
- Differ in:
 - Endowments of: land & capital

Individuals

- Individuals live for two periods:
- 1st period:
 - Receive a transfer from parent
 - Acquire human capital
- 2nd period:
 - Join the labor force
 - Allocate income between:
 - Consumption & Transfers to offspring
 - Transfer land to offspring

Individual i in period t : Income

$$l_{t+1}^i = w_{t+1} + [(1 - \tau_t)b_t^i]R_{t+1} + x^i\rho_{t+1}$$

- $w_{t+1} \equiv$ wage income
- $x^i\rho_{t+1} \equiv$ income from land holding
- $(1 - \tau_t)b_t^iR_{t+1} \equiv$ income from capital holding
- $\tau_t \equiv$ tax rate on initial capital inheritance

Individual i in period t : Optimization

- Preferences:

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

- Budget constraint

$$c_{t+1}^i + b_{t+1}^i \leq l_{t+1}^i$$

$c_{t+1}^i \equiv$ second period consumption

$b_{t+1}^i \equiv$ transfer to the offspring

- Optimization: Intergenerational transfers

$$b_{t+1}^i = \beta l_{t+1}^i$$

Physical Capital Accumulation

The capital stock in period $t + 1$

$$K_{t+1} = (1 - \tau_t)\beta y_t$$

$\beta y_t \equiv$ Aggregate intergenerational transfers

Human Capital Accumulation

- The production of human capital

$$h_{t+1} = h(e_t)$$

$e_t \equiv$ expenditure on public education

$h(0) = 1 \equiv$ basic skills, $h'(e_t) > 0$, $h''(e_t) < 0$

- Education expenditure in period t

$$e_t = \tau_t \beta y_t$$

Efficient Level of Investment in Human Capital

$$\tau_t^* \equiv \arg \max y_{t+1}$$

- τ_t^* equates the marginal return to physical capital and human capital
- $\tau_t^* = \arg \max y_{t+1}^M$
- $\tau_t^* = \arg \max (1 - \tau_t) R_{t+1}$
- $\tau_t^* = \arg \max w_{t+1}$
- $\tau_t^* = \arg \min \rho_{t+1}$

Efficient Level of Investment in Human Capital

- There exists a sufficiently low level of land holding by individual i , \hat{x}^i , such that the desirable level of taxation from the viewpoint of individual i is the level of taxation that maximizes output per capita, τ_t^*
- The level of expenditure on public schooling (and hence the level of taxation) that maximizes aggregate output is optimal from the viewpoint of all individuals except for landowners who own a large fraction of the land in the economy

Political Mechanism

- Changes in the existing educational policy require the consent of all 3 segments of society
- $\tau_0 = 0$

Landowners

- $\lambda \in (0, 1)$ - fraction of Landlords in society
- Distribution of land and capital ownership:
 - Identical among landowners in period 0
 - \rightarrow Identical in every period t

Landowners

- Endowments in 1st period of life:
 - Land - X/λ
 - Capital - $(1 - \tau_t)b_t^L$
- Second period income

$$l_{t+1}^L = w_{t+1} + [(1 - \tau_t)b_t^L]R_{t+1} + [X/\lambda]\rho_{t+1}$$

- Optimal capital transfer to offspring

$$b_{t+1}^L = \beta l_{t+1}^L \equiv b^L(y_t, b_t^L, \tau_t; X/\lambda)$$

The Emergence of Public Education

Lemma

(i) *There exists a critical level of the aggregate capital holdings of all young landowner, \hat{B}_t^L , above which their income under the efficient tax policy τ_t^* is higher than under $\tau_t = 0$, and the economy switches to τ_t^**

$$\hat{B}_t^L \equiv \hat{B}^L(y_t; X, \lambda).$$

(ii) \hat{B}_t^L increases with the degree of land inequality in the economy, i.e.,

$$\partial \hat{B}^L(y_t; X, \lambda) / \partial \lambda < 0;$$

The Process of Development

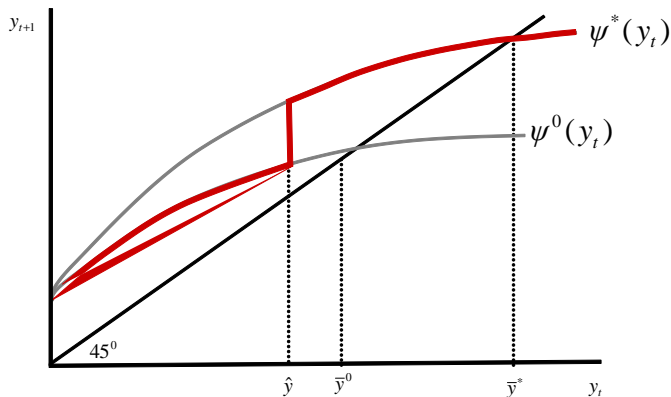
The evolution of output per capita

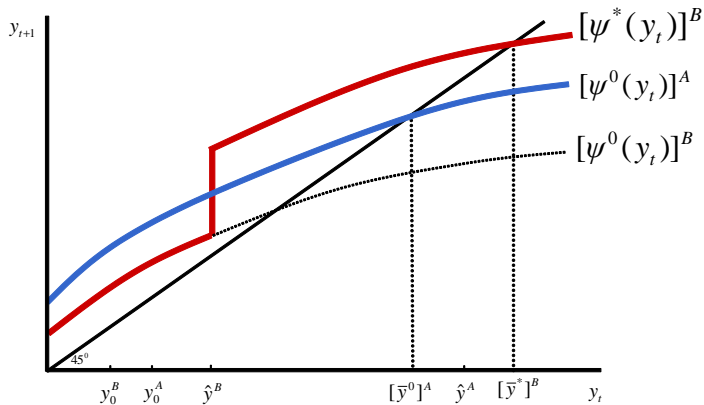
$$y_{t+1} = \begin{cases} \psi^0(y_t) & \text{for } t < \hat{t} \\ \psi^*(y_t) & \text{for } t \geq \hat{t} \end{cases}$$

$\hat{t} \equiv$ time the switch to the efficient tax rate regime occurs:

$$t \geq \hat{t} \Leftrightarrow B_t^L \geq \hat{B}_t$$

The Process of Development: Overtaking





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
1980	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
- $cov(\Delta\varepsilon_{it}, \Delta Z) = 0$
- $\Delta Z \equiv (\Delta S_{i,t-1} - \Delta S_i, \Delta \ln y_{i,t-1} - \Delta \ln y_i, \Delta U_{i,t-1} - \Delta U_i, \dots)$

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

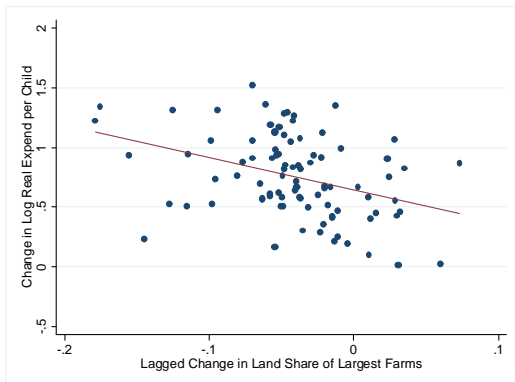
- Education expenditure levels: Historical Statistics of the US: (1920,1940)
- US Bureau of Education: (1880,1900)
- Number of children (US Census)
- Land concentration (US Census)
- Income per capita (Easterlin (1957))
- The percentage of the black population (U.S. Census)
- The percentage of urban 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 ($\Delta S_{i,t-1}$)	-2.71*** (0.99)	-2.67*** (0.86)	-2.16*** (0.75)	-2.12*** (0.78)	-2.34*** (0.80)	-3.68* (2.17)
change in income per capita ($\Delta \ln y_{i,t-1}$)		0.84*** (0.15)	0.72*** (0.13)	0.72*** (0.13)	0.72*** (0.17)	0.71* (0.41)
change in % of the black pop. ($\Delta B_{i,t-1}$)			-3.74*** (0.59)	-3.78*** (0.73)	-2.90*** (0.96)	-5.13** (2.17)
change in % of the urban pop. ($\Delta U_{i,t-1}$)				-0.05 (0.32)	-0.66* (0.40)	-0.12 (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
Hausman Statistic						2.16
Hausman p-value						0.71

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

Interpretation

- A 10 percentage point decline in $S_{i,t-1}$ would have increased expenditure per child at the following period by 21–27%
- In 1920 California $S_{1920} = 0.096$ (25th percentile of the distribution of S across states in the U.S.) and in Vermont $S_{1920} = 0.215$ (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*** (0.80)	-3.23*** (0.91)
change in income per capita ($\Delta \ln y_{i,t-1}$)	0.72*** (0.17)	0.72*** (0.17)
change in % of the black pop. ($\Delta B_{i,t-1}$)	-2.90*** (0.96)	-2.58*** (0.92)
change in % of the urban pop. ($\Delta U_{i,t-1}$)	-0.66* (0.40)	-0.51 (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; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

References

Main Source:

- 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 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.

Related Papers:

- 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.