Inequality in Land Ownership, the Emergence of Human Capital Promoting Institutions, and the Great Divergence

Oded Galor, Omer Moav and Dietrich Vollrath

Objectives:

Explaining the sources of cross-country variations in the implementation of:

Human capital promoting institution

(public schooling, child labor regulations, and abolishment of slavery)

Thereby explaining:

- Sustained differences in income per capita across countries

The ratio of GDP per capita between the richest and the poorest regions has widened to a large extent

- Overtaking and divergence in the process of development

The ranking of countries in the world income distribution has changed considerably

Main Hypotheses

During the process of industrialization the demand for human capital increased due to the acceleration in technological progress and the accumulation of physical capital, generating a growth promoting role for:

- Human capital formation

- Human capital promoting institutions

Suboptimal Investment in HC

→ Role for *human capital promoting institutions* in particular public schooling

→ Conflict between landowners and capitalists regarding the provision of public Schooling

Unequal distribution of land was a hurdle for human capital accumulation and economic growth. It:

- Delayed education reforms
- Reduced the skill-intensity of the emerging industrial sector
- Adversely affected the growth path in the industrial stage

→ Differences in the distribution of land within and across countries generated:

- Sustained differences in human capital formation, income levels, and growth patterns across countries

- Overtaking in the process of development

→ Land abundance which led to prosperity in the eve the industrial revolution, generated, if unequally distributed, economic incentives for landowners to stifle the growth process

Mechanism:

Complementarity between factors:

HC & land $<$ HC & Physical Capital

A rise in the supply of human capital:

Industrial sector:

Increase in productivity > rise in wages

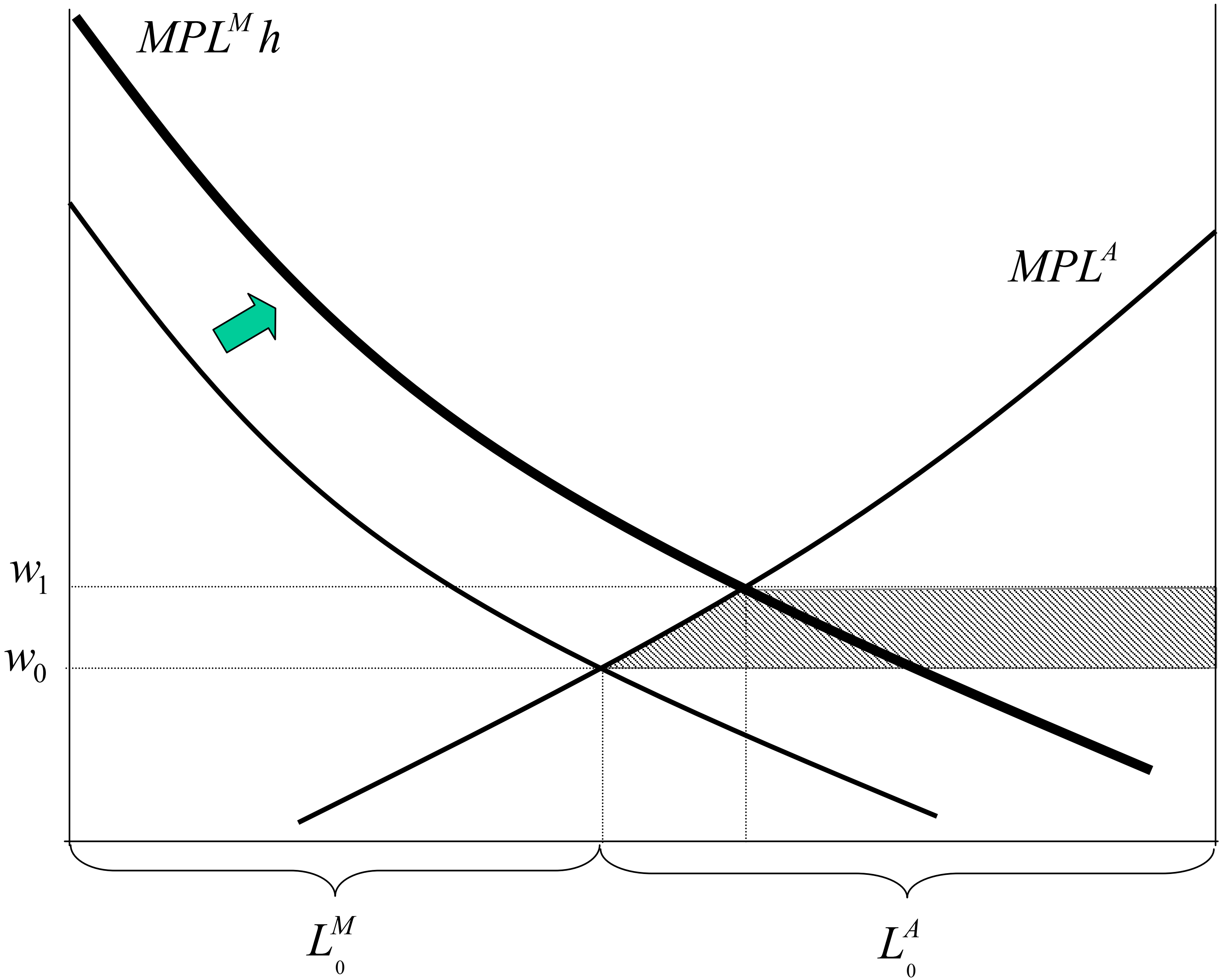
$\Rightarrow$ Return to Capital rises

Agricultural sector

Increase in productivity < rise in wages

$\Rightarrow$ Return to land declines

$\Rightarrow$ Landowners object to education reforms unless their stake in the productivity of other segments of the economy is significant



$MPL^M h$
MPL^A
w_1
w_0
L_0^M
L_0^A

The Model

Overlapping-generations economy

One good produced by two sectors:

Agricultural production y_t^A

using:

land & raw labor

Industrial production y_t^M

using:

physical capital & human capital

Aggregate output:

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

The final good is used for consumption and investment in physical and human capital

- Growth is driven by factor accumulation

Agricultural Production

CRS production technology:

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

X - land

L_t - number of workers

$F_{XL} > 0$

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

Note: Workers' productivity in the agricultural sector is independent of their level of human capital.

Industrial Production

CRS Cobb-Douglas production technology

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

K_t - physical capital

H_t - human capital

$k_t \equiv K_t/H_t$

Demand for physical and human capital:

$$R_t = \alpha k_t^{\alpha-1} \equiv R(k_t)$$
$$w_t^M = (1-\alpha)k_t^{\alpha} \equiv w^M(k_t)$$

R_t - return to physical capital

w_t^M - wage per unit of human capital

Individuals

Overlapping Generations (each of size 1)

Each individual has a single parent and a single child

Identical in:

Preferences & Innate abilities

Differ in:

Endowment of land and capital

Individuals live for two periods:

1st period:

Acquire human capital

Receive a transfer from the parent

2nd period:

Join the labor force

Allocate income between:

Consumption & Transfers to offspring

Transfer land to offspring

The production of human capital

Efficiency units of human capital of each individual in period $t+1$

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

e_t - expenditure on public education

$h'(e_t) > 0, \;\; h''(e_t) < 0, \; \lim_{e_t \to 0^+} h'(e_t) = \infty$

$h(0) = 1$ - basic skills

Labor is mobile across sectors:

$$w^A_{t+1} = h_{t+1} w^M_{t+1} \equiv w_{t+1}$$

income:

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

w_{t+1} - wage per worker

R_{t+1} - return to physical capital

ρ_{t+1} - return to land

x^i - land holding of individual i

τ_t - tax rate

$(1-\tau_t)b_t^i$ - capital holding of individual i

Budget constraint

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

c_{t+1}^{i} - second period consumption

b_{t+1}^{i} - transfer to the offspring

Preferences and intergenerational transfers

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

$\rightarrow$

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

Physical Capital

The capital stock in period $t+1$

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

βy_t - Aggregate intergenerational transfers

Human Capital

Education expenditure in period t

$$e_t = \tau_t \beta y_t$$

Human capital employed in the industrial sector in $t+1$

$$H_{t+1} = \theta_{t+1} h(\tau_t \beta y_t)$$

θ_{t+1} - the fraction of workers in the industrial sector

Output in the manufacturing sector

$$y_{t+1}^{M} = [(1-\tau_t)\beta y_t]^{\alpha}[\theta_{t+1} h(\tau_t \beta y_t)]^{1-\alpha}$$

Output in the agricultural sector

$$y_{t+1}^{A} = F(X, 1-\theta_{t+1})$$

Aggregate Output

$$F(X, 1-\theta_{t+1}) + \theta_{t+1}^{1-\alpha}[(1-\tau_t)\beta y_t]^{\alpha}[h(\tau_t \beta y_t)]^{1-\alpha}$$

Labor market equilibrium

The fraction of workers employed by the manufacturing sector, θ_{t+1} :

(a) is uniquely determined:

$$\theta_{t+1} = \theta(y_t, \tau_t; X)$$

$$\theta_X(y_t, \tau_t; X) < 0, \ \theta_y(y_t, \tau_t; X) > 0$$

(b) maximizes aggregate output:

$$\theta_{t+1} = \arg\max y_{t+1}$$

Given land size, X, prices in period $t+1$ are uniquely determined by y_t and τ_t. That is

$$w_{t+1} = w(y_t, \tau_t)$$

$$R_{t+1} = R(y_t, \tau_t)$$

$$\rho_{t+1} = \rho(y_t, \tau_t)$$

The Efficient Level of Education

Let τ_t^* be the tax rate in period t that maximizes aggregate output in period $t+1$

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

τ_t^* is determined such that:

$$\theta_{t+1} w^M(k_{t+1}) h'(\tau_t^* \beta y_t) = R(k_{t+1})$$

(return to physical capital $=$ return to human capital)

Proposition

$$\tau_t^* = \tau^*(y_t) \in (0,1)$$

$e_t^* = \tau^*(y_t)\beta y_t$, is strictly increasing in y_t

$$\tau_t^* = \arg\max w_{t+1}$$

$$\tau_t^* = \arg\min \rho_{t+1}$$

$$\tau_t^* = \arg\max \theta(y_t, \tau_t; X)$$

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

$$\tau_t^* = \arg\max (1-\tau_t) R_{t+1}$$

Proof:

$$y_{t+1} = F(X, 1-\theta_{t+1}) + \theta_{t+1}^{1-\alpha}[(1-\tau_t)\beta y_t]^{\alpha}[h(\tau_t \beta y_t)]^{1-\alpha}$$

$\theta_{t+1} = \arg\max y_{t+1}$ is increasing with

$$[(1-\tau_t)\beta y_t]^{\alpha}[h(\tau_t \beta y_t)]^{1-\alpha}$$

which is maximized by τ_t^*

$$\rightarrow \tau_t^* = \arg\max F_L$$

$$\rightarrow \tau_t^* = \arg\max w_{t+1} \rightarrow \tau_t^* = \arg\min \rho_{t+1}$$

$$\rightarrow \tau_t^* = \arg\max y_{t+1}^{M}$$

$$\rightarrow \tau_t^* = \arg\max (1-\tau_t) R_{t+1} \beta y_t$$

→ τ_t^* is optimal from the viewpoint of all individuals except for landowners who own a large fraction of the land in the economy.

→ τ_t^* is optimal from the viewpoint of individual i for a sufficiently low x^i.

Political Mechanism

Changes in the existing educational policy require the consent of all segments of society

$$\tau_0 = 0$$

Landowners

$\lambda \in (0,1)$ - fraction of Landlords

land and capital ownership:

Identical among landowners in period 0

$\rightarrow$ Identical in every period t

Endowment in 1st period of life:

Land - X/λ

Capital - b_0^L

Second period income

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

Optimal capital transfer to offspring

$$b_{t+1}^{L} = \beta I_{t+1}^{L}$$

Proposition

$$B_t^L = \lambda b_t^L > \hat{B}_t^L$$

$$\leftrightarrow$$

$$I_{t+1}^{L*} > I_{t+1}^{L0}$$

$$\hat{B}_t^L = \frac{\lambda(w_{t+1}^0 - w_{t+1}^*) + X(\rho_{t+1}^0 - \rho_{t+1}^*)}{(1-\tau_t^*)R_{t+1}^* - R_{t+1}^0}$$

where:

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

$$lim_{\lambda\to 1}\hat{B}^L(y_t;X,\lambda) \leq 0.$$

$$lim_{y_t\to\infty}\hat{B}^L(y_t;X,\lambda) \leq 0.$$

Let $\hat{t}$ be the first period in which the efficient tax policy, $\tau_t = \tau_t^*$, is implemented. The efficient tax policy will remain in place thereafter, i.e.,

$$\tau_t = \tau_t^* \qquad \forall t \geq \hat{t}.$$

Proposition

The evolution of output per capita,

$$y_{t+1} = \begin{cases} \psi^0(y_t) \quad for \quad \tau_t = 0 \\ \\ \psi^*(y_t) \quad for \quad \tau_t = \tau_t^* \end{cases}$$

where,

$\psi^*(y_t) > \psi^0(y_t)$ for $y_t > 0$.

$d\psi^j(y_t)/dy_t > 0,\ d^2\psi^j(y_t)/dy_t^2 < 0,$
$\psi^j(0) = F(X, 1) > 0,\ d\psi^j(y_t)/dX > 0$, and

$lim_{y_t \to \infty} d\psi^j(y_t)/dy_t = 0;\ j = 0, *.$

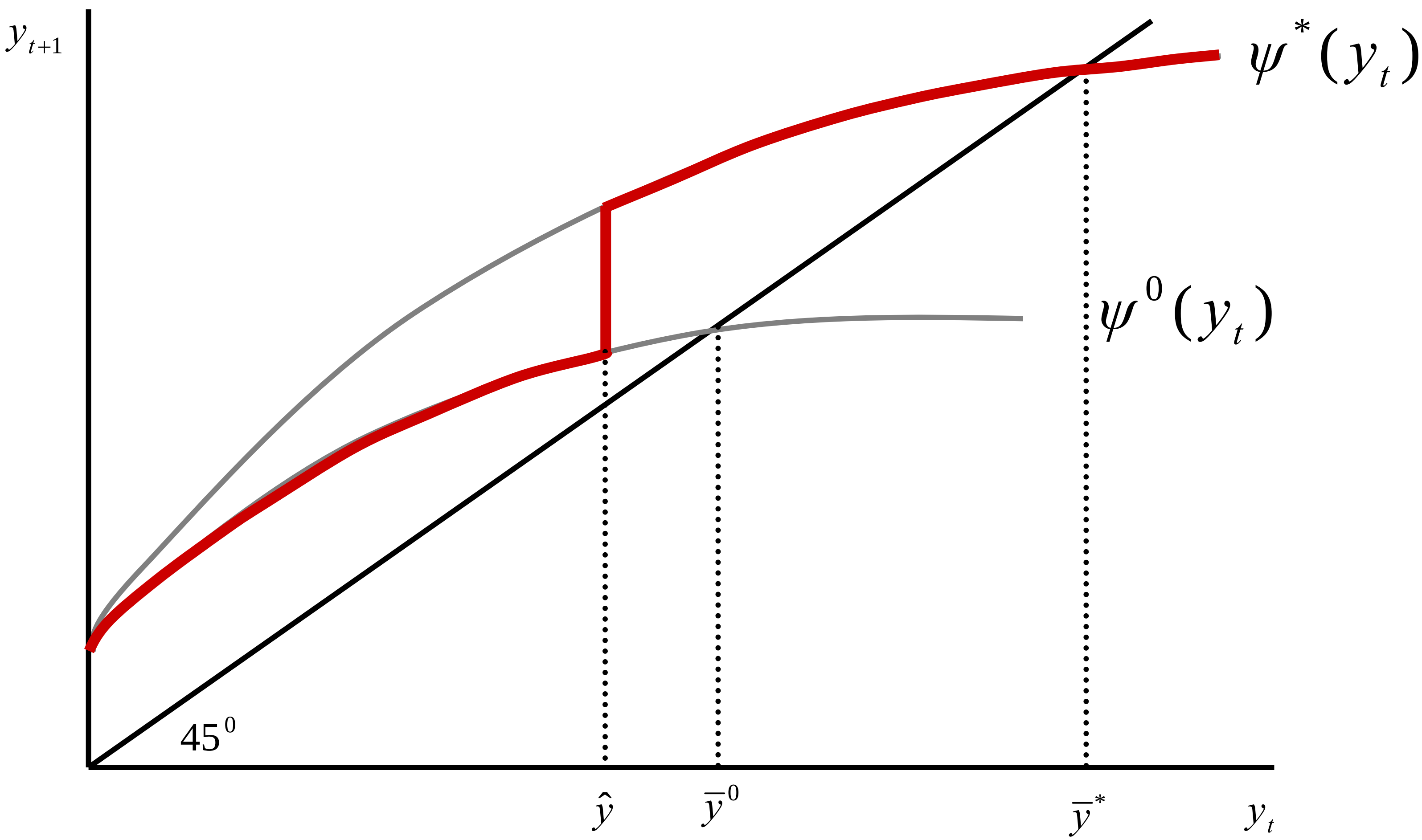
there exists a unique $\bar{y}^0$ and a unique $\bar{y}^*$ such that

$$\bar{y}^0 = \psi^0(\bar{y}^0)$$

$$\bar{y}^* = \psi^*(\bar{y}^*)$$

where

$$\bar{y}^* > \bar{y}^0$$



The evolution of income per capita before and after the implementation of education reforms

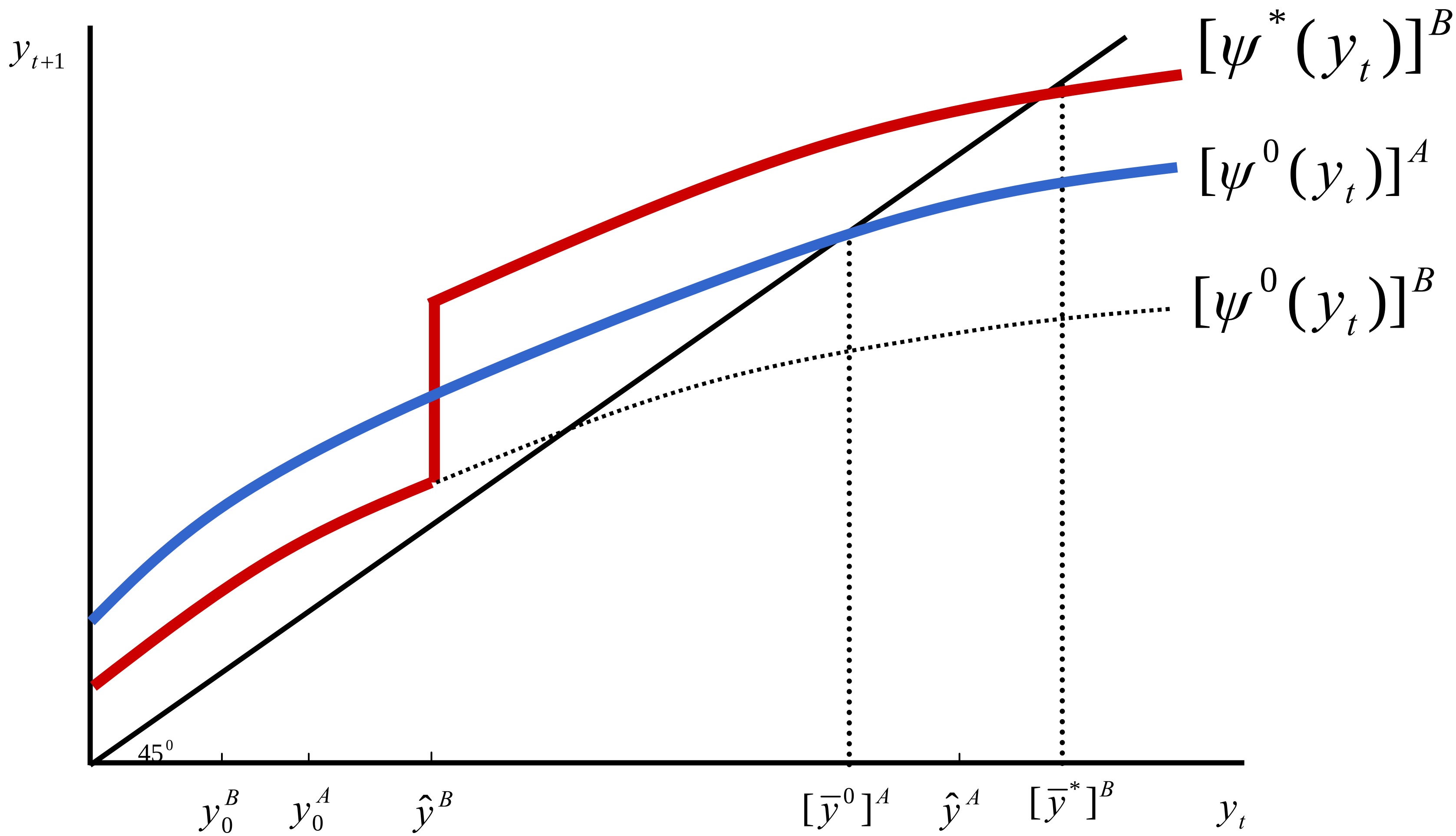
Proposition

Less equal land distribution, (i.e., a low level of λ), will generate a delay in the implementation of an efficient education policy and will therefore result in an inferior growth path.

Proposition

for a sufficiently limited productivity in the manufacturing sector and a sufficiently high degree of complementarity between land and labor:

there exists a sufficiently high level of land inequality (i.e., a sufficiently low λ), such that inefficient education policy will persist indefinitely (i.e., $\hat{t} \to \infty$).



Overtaking – country A is relatively richer in land, however, due to land inequality it fails to implement efficient schooling and is overtaken by country B.

Existing Evidence

Land inequality is inversely related to education and economic growth, 1960-1992 (Deininger and Squire 1998)

Poor countries emerge of poverty through good policies (e.g., human capital promoting policies) and only subsequently improve their political institutions (Glaeser, La Porta, Lopez-de-Silanes and Shleifer 2004)

Anecdotal Evidence

Land Reforms followed by education Reforms in:

Korea, Taiwan, Japan, Russia

Interpretations:

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

The concentration of land ownership across countries and regions is 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

The share of tenants in farming households declined from 70% in 1945 to 0 in 1950

Education Reforms: 1949 –

Government spending on education:

1948	1957	1960	1990
8%	9%	15%	15%

Years of Education:

1950	1973	1992
3	7	14

GDP per Capita Relative to US

1948	1960	1985	1994
8%	12%	15%	44%

Taiwan

Land Reforms: 1949-1953

- The share of tenants in farming households declined from 43% in 1948 to 19% in 1959

Education Reforms: 1950 –

- The share of education in GDP rose from 1.78% in 1951 to 4.12% in 1970

Japan and the Meiji Restoration

The Meiji Restoration 1868 - Downfall of the traditional feudal structure

Land Reforms: 1871 – 1883

Education Reforms: 1872, 1879 & 1886

- Share of children aged 6-14 rose from 28% in 1873 to 51% in 1883 and 94% in 1903

Russia

Early 1900's - the Tsar's power weakened

Land Reforms: 1906

- Rich landowners decline from 40% in 1860 to 17% in 1917.

Education Reforms: 1908-1912

- Share of provincial council's budget allocated to education rose from 20% in 1905 to 31% in 1914
- Share of government's budget devoted to education rose from 1.4% in 1906 to 4.9% in 1915
- Share of the population in schools rose from 1.7% in 1897 to 5.7% in 1915

Empirical Evidence

The High School Movement in the US (1910 – 1950)

A major transformation from an insignificant secondary education to a universal secondary education that is geared towards industrial needs

Graduation rate:

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

Inequality in land distribution

(Gini Coefficient)

	South	*Midwest*	*Northeast*	*West*	*US*
1880	0.51	0.29	0.38	0.43	0.41
1900	0.53	0.42	0.48	0.61	0.51
1920	0.54	0.38	0.47	0.69	0.53
1950	0.62	0. 54	0.54	0.76	0.59

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

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

e_{it} - Expenditure per child in state i in period t

$G_{i,t-1}$ - Gini coefficient of inequality in land ownership in state i in period t–1

$U_{i,t-1}$ - percentage of the urban population in state i in period t–1

$B_{i,t-1}$ - percentage of the black population in state i in period t–1

v_{it} - error term of state i in period t

Hypothesis: $\boldsymbol{\beta_1 < 0}$

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

Statistical Model (Cont.)

Unobserved heterogeneity between states is allowed:

(a) Time invariant unobserved heterogeneity across states in the level of log expenditure per child

(b) Linear unobserved heterogeneity across states in the time trend of log expenditure per child

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

η_i - time invariant *level* of log expenditure per child in state i

$\theta_i t$ - *time trend* of log expenditure per child in state i

Identification

Controlling for heterogeneity across states:

(a) In the *level* of log expenditure per child

Differenced out : estimating the difference equation

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

$\Delta \ln e_{it} \equiv \ln e_{it+1} - \ln e_{it}$ (1920 vs. 1900 & 1950 vs.1920)

$\Delta G_{i,t-1} \equiv G_{i,t} - G_{i,t-1}$ (1900 vs. 1880 & 1920 vs.1900)

Assumption:

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

(b) Heterogeneity in the time trend across states

Controlled: estimating the difference equation with *state fixed effects*

Assumption:

$cov(\Delta\varepsilon_{it}, \Delta Z) = 0$ for

$$\Delta Z \equiv (\Delta G_{i,t-1} - \Delta G_i, \Delta \ln y_{i,t-1} - \Delta \ln y_i, \Delta U_{i,t-1} - \Delta U_i, \Delta B_{i,t-1} - \Delta B_i)$$

Data:

- *Observations in the years:*

  1880, 1900, 1920, 1950

  $$\{(t{-}1,\ t)\} = \{(1880, 1900), (1900, 1920), (1920, 1950)\}$$

- *Total observations:*

  79 observations

  41 states (2 observations for 38 states & 1 observation for 3 states)

Data Sources:

- *Education expenditure levels:*

  Historical Statistics of the US: (1920,1950)

  US Bureau of Education: (1880,1900)

- *Number of children:* (US Census)
- *Land inequality:*

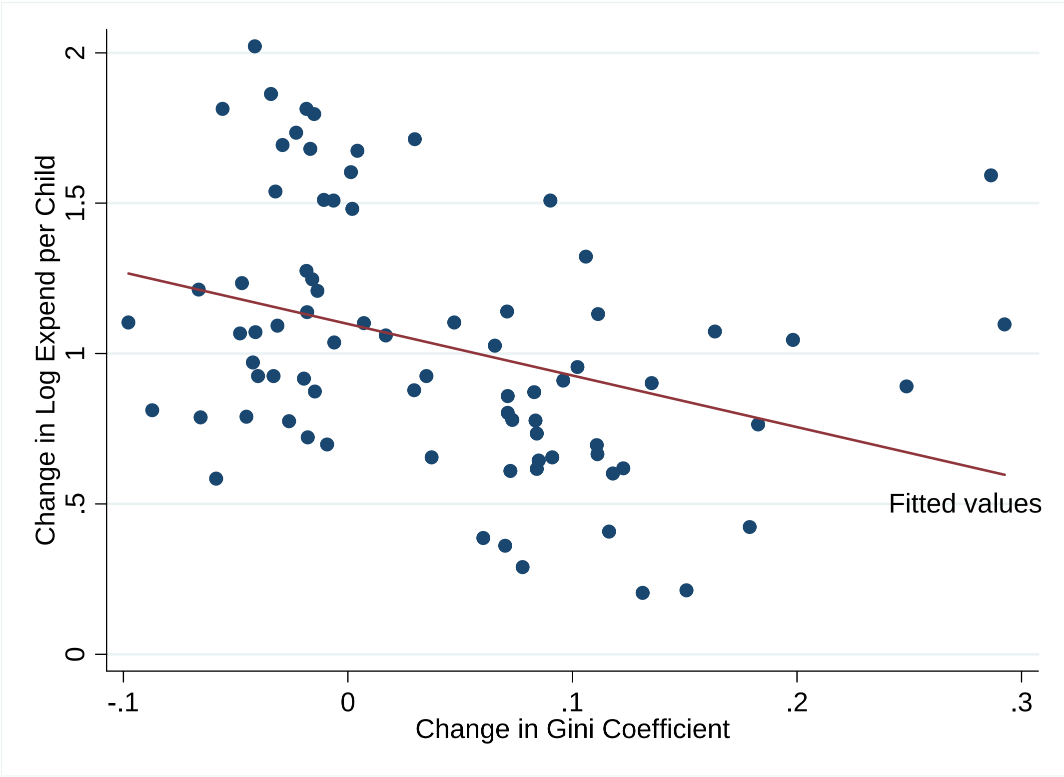
  Gini coefficient for land distribution within a state based on an estimated Lorenz curve for number and area of farms (US Census).

- *Income per capita* (Easterlin (1957))
- *The percentage of the black population* (U.S. Census)
- *The percentage of urban population (*U.S. Census)

Correlations:

	$\Delta \ln e_{it}$	$\Delta G_{i,t-1}$	$\Delta \ln y_{i,t-1}$	$\Delta U_{i,t-1}$	$\Delta B_{i,t-1}$	$\Delta a_{i,t-1}$
$\Delta \ln e_{it}$						
$\Delta G_{i,t-1}$	-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		
$\Delta a_{i,t-1}$	-0.18^{*}	0.09	-0.06	0.11	0.25^{**}	

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



The correlation of changes in the log of education expenditure

and the changes in the lagged land Gini in state i

Exp. Variables	Dep. Variable: Change in log expend per child $(\Delta \ln e_{it})$ (1)	(2)	(3)	(4)	(5)	(6)
$\Delta G_{i,t-1}$ [(a)]	-1.72**	-1.75***	-1.77***	-1.33***	-1.19**	-1.33***
	(0.72)	(0.58)	(0.62)	(0.54)	(0.62)	(0.40)
$\Delta \ln y_{i,t-1}$		1.27	1.31	1.10	1.32	1.10
		(0.21)	(0.20)	(0.16)	(0.47)	(0.21)
$\Delta U_{i,t-1}$			-0.71	-0.37	0.22	-0.37
			(0.67)	(0.51)	(1.00)	(0.50)
$\Delta B_{i,t-1}$				-5.51	-4.75	-5.51
				(1.14)	(2.18)	(1.07)
Constant	0.69	1.10	0.78	0.69	0.55	0.69
	(0.05)	(0.08)	(0.13)	(0.10)	(0.16)	(0.10)
Hausman statistic [(b)]					1.29	
Hausman p-value					0.86	
R^2	0.12	0.37	0.38	0.54		
Observations	79	79	79	79	79	79
Method	OLS	OLS	OLS	OLS	FE	RE
S.E.	Cluster	Cluster	Cluster	Cluster	Standard	Standard

Note: Standard errors in parentheses.

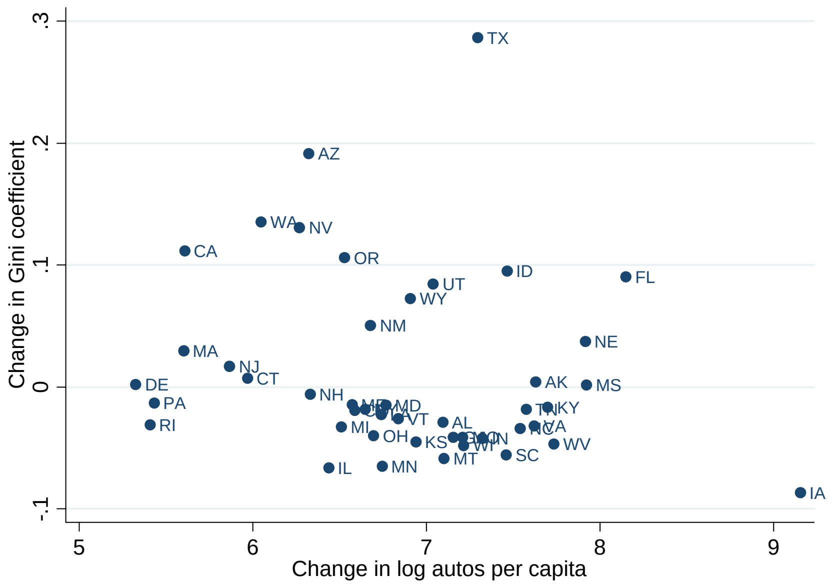
a) A one-sided test that the coefficient on $\Delta G_{i,t-1}$ is less than zero is performed

*** indicates significance at 1% level, ** at the 5% level, * at the 10% level

b) Hausman statistic is distributed $\chi^2(4)$ in column 5

Exp. Variables	Dep. Variable: Change in log expend per child ($\Delta \ln e_{it}$) (1)	(2)	(3)	(4)	(5)
$\Delta G_{i,t-1}$ [(a)]	-1.72**	-1.75***	-1.77***	-1.33***	-1.19**
	(0.72)	(0.58)	(0.62)	(0.54)	(0.62)
$\Delta \ln y_{i,t-1}$		1.27***	1.31***	1.10***	1.32***
		(0.21)	(0.20)	(0.16)	(0.47)
$\Delta U_{i,t-1}$			-0.71	-0.37	0.22
			(0.67)	(0.51)	(1.00)
$\Delta B_{i,t-1}$				-5.51***	-4.75**
				(1.14)	(2.18)
Constant	0.69	1.10	0.78	0.69	0.55
	(0.05)	(0.08)	(0.13)	(0.10)	(0.16)
R^2	0.12	0.37	0.38	0.54	
Observations	79	79	79	79	79
Method	OLS	OLS	OLS	OLS	FE

Land vs. Income Inequality



Comparison of changes in inequality measures

over the period1900-1920

	Dep. Variable: Change in log exp per child $(\Delta \ln e_{it})$							
Exp. Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta G_{i,t-1}$ $^{(a)}$	-1.72**		-1.67**	-1.71***	-1.74***	-1.32***	-1.18**	-1.32***
	(0.72)		(0.73)	(0.58)	(0.62)	(0.54)	(0.62)	(0.41)
$\Delta a_{i,t-1}$		-0.08	-0.07	-0.06	-0.05	-0.01	-0.02	-0.01
		(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.04)
$\Delta \ln y_{i,t-1}$				1.26	1.30	1.10	1.34	1.10
				(0.22)	(0.21)	(0.16)	(0.48)	(0.21)
$\Delta U_{i,t-1}$					-0.63	-0.35	0.31	-0.35
					(0.63)	(0.50)	(1.04)	(0.51)
$\Delta B_{i,t-1}$						-5.45	-4.45	-5.45
						(1.17)	(2.32)	(1.10)
Constant	0.69	1.03	1.10	0.70	0.77	0.69	0.54	0.69
	(0.05)	(0.05)	(0.05)	(0.08)	(0.13)	(0.10)	(0.17)	(0.10)
Hausman statistic $^{(b)}$							1.62	
Hausman p-value							0.90	
R^2	0.12	0.02	0.13	0.38	0.39	0.54		
Observations	79	79	79	79	79	79	79	79
Method	OLS	OLS	OLS	OLS	OLS	OLS	FE	RE
S.E.	Cluster	Cluster	Cluster	Cluster	Cluster	Cluster	Standard	Standard

Note: Standard errors in parentheses.

a) A one-sided test that the coefficient on $\Delta G_{i,t-1}$ is less than zero is performed

*** indicates significance at 1% level, ** at the 5% level, * at the 10% level

b) Hausman statistic is distributed $\chi^2(5)$ in column 7

Exp. Variables	Dep. Variable: Change in log exp per child ($\Delta \ln e_{it}$) (1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta G_{i,t-1}$ [(a)]	-1.72**		-1.67**	-1.71***	-1.74***	-1.32***	-1.18**
	(0.72)		(0.73)	(0.58)	(0.62)	(0.54)	(0.62)
$\Delta a_{i,t-1}$		-0.08**	-0.07**	-0.06**	-0.05*	-0.01	-0.02
		(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
$\Delta \ln y_{i,t-1}$				1.26***	1.30***	1.10***	1.34***
				(0.22)	(0.21)	(0.16)	(0.48)
$\Delta U_{i,t-1}$					-0.63	-0.35	0.31
					(0.63)	(0.50)	(1.04)
$\Delta B_{i,t-1}$						-5.45***	-4.45**
						(1.17)	(2.32)
Constant	0.69	1.03	1.10	0.70	0.77	0.69	0.54
	(0.05)	(0.05)	(0.05)	(0.08)	(0.13)	(0.10)	(0.17)
R^2	0.12	0.02	0.13	0.38	0.39	0.54	
Observations	79	79	79	79	79	79	79

Exp. Variables	Dep. Variable: Change in log expend per child ($\Delta \ln e_{it}$) (1)	(2)	(3)	(4)	(5)
$\Delta S_{i,t-1}$	-2.71***	-2.67***	-2.16***	-2.12***	-3.68*
	(0.99)	(0.86)	(0.75)	(0.78)	(2.17)
$\Delta \ln y_{i,t-1}$		0.84***	0.72***	0.72***	0.71*
		(0.15)	(0.13)	(0.13)	(0.41)
$\Delta B_{i,t-1}$			-3.74***	-3.78***	-5.13**
			(0.59)	(0.73)	(2.17)
$\Delta U_{i,t-1}$				-0.05	-0.12
				(0.32)	(0.69)
R^2	0.11	0.27	0.39	0.39	0.38
Method	OLS	OLS	OLS	OLS	FE

Note: All specifications include 79 observations (41 states).

*** indicates significance at the 1% level, ** at 5%, * at 10%

- The size of the point estimate for S is relatively stable over the first four specifications

- A 10 percentage point decline in S would have increased expenditure per child at the following period by 21-27%.

To illustrate the methodology, in Wisconsin in 1880, the largest 15,145 farms (11% of total farms) held 20% of the farmland. In 1900, the largest 15.145 farms held 16% of the land, declining to 12% in1920

The qualitative results are not affected if we use alternatively as a benchmark the share of land holdings by the minimal number of farms that held 5%, 10%, 25%, 50% or 80% of the land in 1880.

For states in the Northeast, the average share rose from 20% in 1880 to 22% in 1900 and 24% in 1920

Southern states experienced a decline in the average share of land held by the largest farms from 20% in 1880 to 12% in 1900 and to only 8% by 1920

In the West the share drops to 9% in 1900 and to 6% in 1920

In the Midwest the share declines from 20% in 1880 to 16% in 1900 to 13% in 1920

Concluding Remarks

- A conflict of interest among the economic elites, rather than between the elite and the masses (ES, AJR), brought about a delay in the implementation of growth enhancing educational policies.

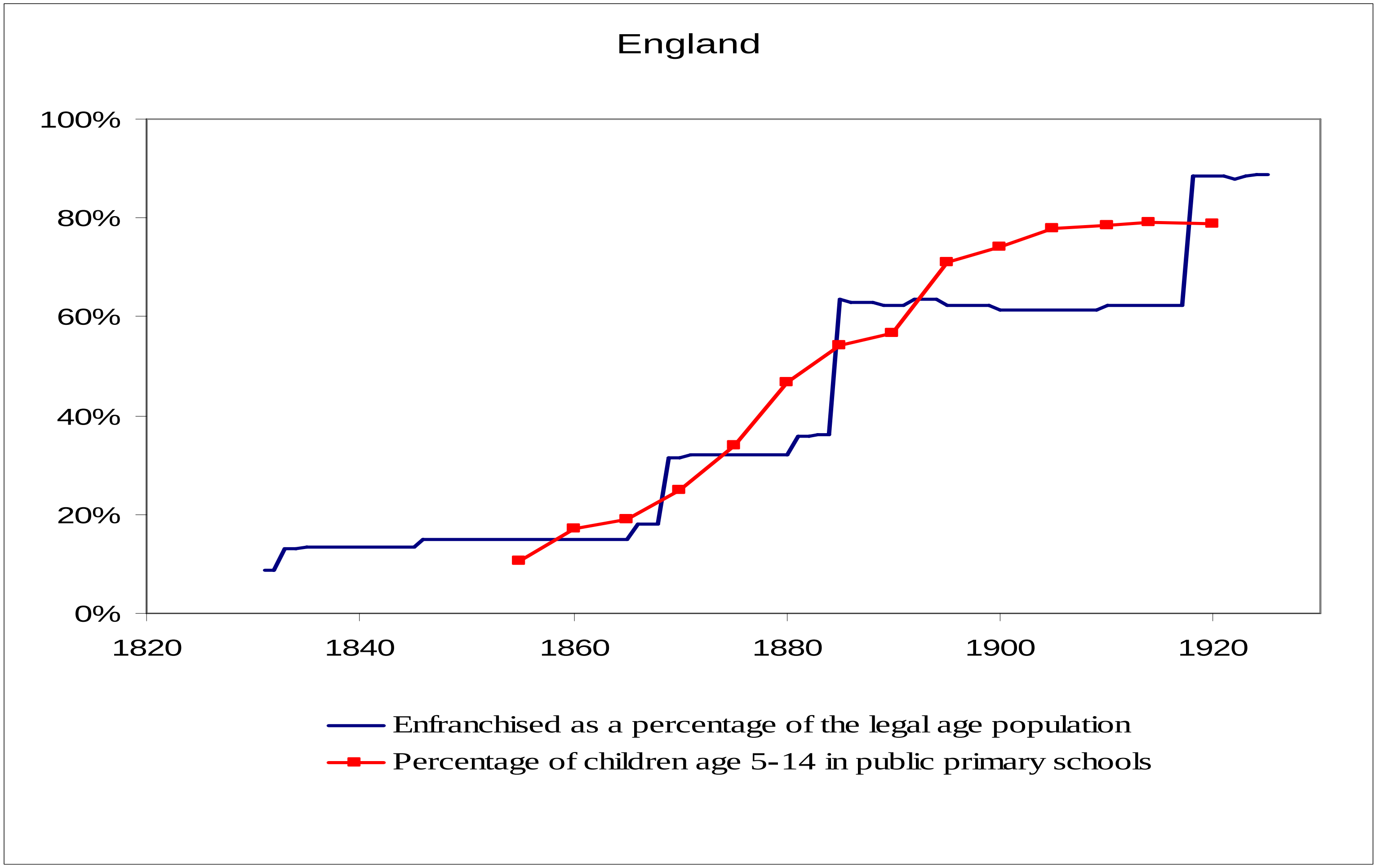
- Growth promoting institutions emerged in the process of development as the economic interest of the industrialists dominated, rather then persistent desirability of extractive institutions of the elite (ES, AJR).

- Unequal distribution of land ownership adversely affected educational reforms. An unequal distribution of wealth would not prevent the capitalists from supporting the accumulation of human capital

- The impact of policies on prices induces the elite's support or objection to education reforms. In contrast ES and AJR mechanism would permit growth promoting policies only if the distribution of political power would change.

Appendix

The Evolution of Voting Rights and School Enrolment England 1820-1925



The Evolution of Voting Rights and School Enrolment France 1820-1925

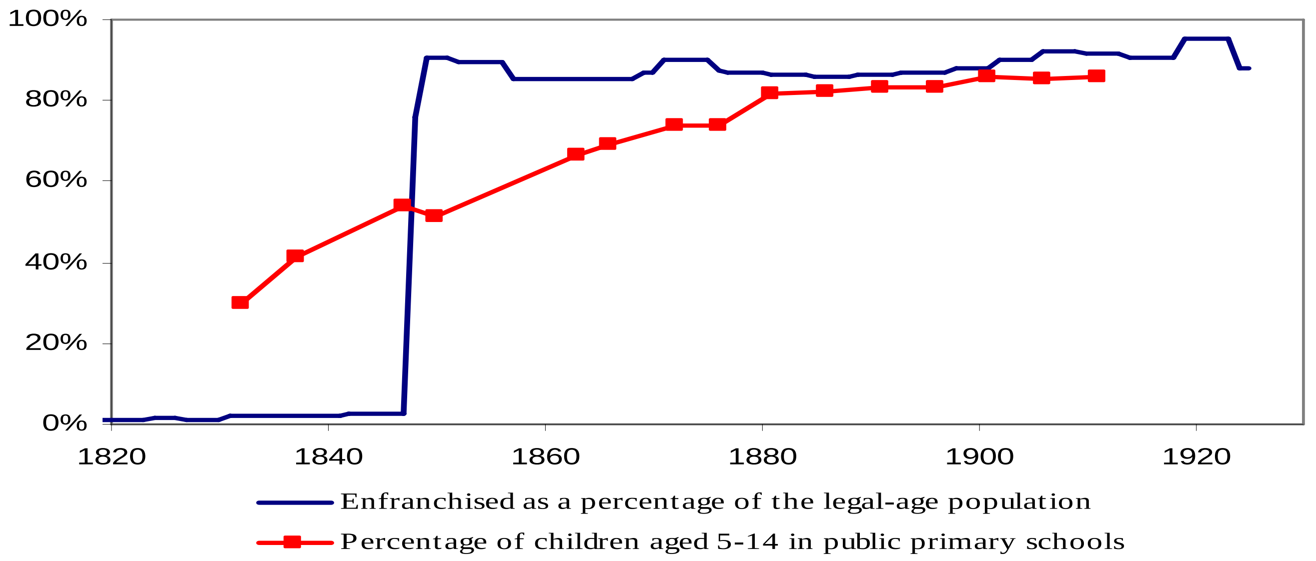


Figure 3(b). The evolution of voting rights and school enrolment: France 1820-1925 Source: Flora et al. (1983)

Table 2. The effect of the weight of the skill-intensive sector on the support for the Balfour Act

Exp Variable	(1) Vote on Balfour Act	(2) Vote on Balfour Act	(3) Vote on Balfour Act	(4) Vote on Balfour Act	(5) Vote on Balfour Act
Income per capita	-0.0011	-0.0030	-0.0033	-0.0118	-0.0120
	(0.12)	(0.33)	(0.36)	(1.33)	(1.33)
% in skill-intensive occupations	5.7298 **	4.1818 **	4.2554 **	2.6177 *	2.6171 *
	(4.49)	(3.09)	(3.20)	(1.93)	(1.94)
% non-conformists		-1.9109 **	-1.4129	0.7349	0.7395
		(3.95)	(1.59)	(0.67)	(0.67)
Scotland dummy			0.0215	-0.1246	-0.1216
			(0.09)	(0.50)	(0.46)
Wales dummy			-0.7289 **	-0.9086 **	-0.9057 **
			(2.01)	(2.01)	(1.99)
Party affiliation				-1.7404 **	-1.7399 **
				(11.44)	(11.46)
% urban					0.0246
					(0.10)
Chi-square p-val	0.0000	0.0000	0.0000	0.0000	0.0000
Total observations	455	455	455	455	455
Method	Oprobit	Oprobit	Oprobit	Oprobit	Oprobit

Absolute values of t-ratios are given in parentheses
** indicates significance at 5%
* indicates significance at 10%

Vote on Balfour: 2=Yes, 1=Abstain, 0=No
Party Affiliation: 1=Liberal, 0=Conservative
Standard errors are adjusted by clustering by county

Table 3. The effect of the weight of the skill-intensive sector on MP's party affiliation

Exp Variable	(1) Party Affiliation	(2) Party Affiliation	(3) Party Affiliation	(4) Party Affiliation
Income per capita	-0.0139	-0.0119	-0.0112	-0.0009
	[-0.00548]	*[-0.00469]*	*[-0.0044]*	*[-0.0035]*
	(1.03)	(1.02)	(0.97)	(0.81)
% in skill-intensive occupations	-7.2551 **	-4.6358 **	-4.3282 **	-4.1988 **
	[-2.8581]	*[-1.8287]*	*[-1.7091]*	*[-1.6587]*
	(3.69)	(2.31)	(2.23)	(2.23)
% non-conformists		3.3908 **	4.1208 **	4.2180 **
		[1.3375]	*[1.6272]*	*[1.6664]*
		(4.66)	(2.78)	(3.01)
Scotland dummy			-0.3227	-0.3936
			[-0.1239]	*[-0.1499]*
			(0.72)	(0.98)
Wales dummy			0.1406	0.0815
			[0.0559]	*[0.03234]*
			(0.28)	(0.17)
% urban				-0.2887
				[-0.11402]
				(0.72)
Chi-square p-val	0.0003	0.0000	0.0000	0.0000
Total observations	455	455	455	455
Method	Probit	Probit	Probit	Probit

Absolute values of t-ratios are given in parentheses
** indicates significance at 5%
* indicates significance at 10%

Marginal effects are reported in square brackets

Vote on Balfour: 2=Yes, 1=Abstain, 0=No
Party affiliation: 1=Liberal, 0=Conservative
Standard errors are adjusted by clustering by county

Lower complementarity between human capital and land

Indirect evidence (US in 1998):

- The return to education is typically lower in the agricultural sector, as evident by the distribution of employment in the agricultural sector.
  - 56.9% of agricultural employment are high school dropouts, (13.7% in the economy as a whole)
  - 16.6% of agricultural employment consists of workers with 13 or more years of schooling, (54.5% in the economy as a whole)

Identification

We control for state unobserved heterogeneity by differencing out the state levels and control for time trends using state fixed effect, that is:

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

Note that the fixed effect model is:

$$\Delta \ln e_{it} - \Delta \ln e_i = \beta_1 (\Delta G_{i,t-1} - \Delta G_i) + \beta_2 (\Delta \ln y_{i,t-1} - \Delta \ln y_i) + \beta_3 (\Delta U_{i,t-1} - \Delta U_i) + \beta_4 (\Delta B_{i,t-1} - \Delta B_i) + (\theta_i - \theta_i) + (\Delta \varepsilon_{it} - \Delta \varepsilon_i)$$

Assuming that:

$$E((\Delta G_{i,t-1} - \Delta G_i)\Delta\varepsilon_{it}) = 0$$
$$E((\Delta \ln y_{i,t-1} - \Delta \ln y_i)\Delta\varepsilon_{it}) = 0$$
$$E((\Delta U_{i,t-1} - \Delta U_i)\Delta\varepsilon_{it}) = 0$$
$$E((\Delta B_{i,t-1} - \Delta B_i)\Delta\varepsilon_{it}) = 0$$

the fixed-effect generates unbiased estimates of the parameter of interest.

Potential problems:

Note that $\Delta G_i = \sum(\Delta G_{i,1} + \ldots + \Delta G_{i,t-1} + \Delta G_{i,t} + \Delta G_{i,t+1} + \ldots + \Delta G_{i,T})/T$. If $\Delta\varepsilon_{it}$ affects $\Delta G_{i,t}$ or $\Delta G_{i,t+1}$ than there is a problem in using fixed effects.

There are two relevant terms: Exogeneity (past and present) and Strict Exogeneity (past, present, and future).

At first glance it looks like using fixed effects requires strict exogeneity assumption. Yet since we have ONLY 2 observations per state this is not the case.

In this paper we have only 2 observations per state. Therefore:

$$\Delta G_i = \sum(\Delta G_{i,t-1} + \Delta G_{i,t})/2$$

Hence, the implicit assumption is:

$$cov((\Delta G_{i,t-1} - \Delta G_{i,t}), \Delta\varepsilon_{it}) = 0$$

Hence, in this case we do not need to impose the strict exogeneity assumption as the identifying assumption is that:

$$cov(\Delta G_{i,t}, \Delta\varepsilon_{it}) = 0$$

$$cov(\Delta G_{i,t-1}, \Delta\varepsilon_{it}) = 0$$