Lectures on Fertility, Education, Growth, and Sustainability

2a. Private vs Public Education

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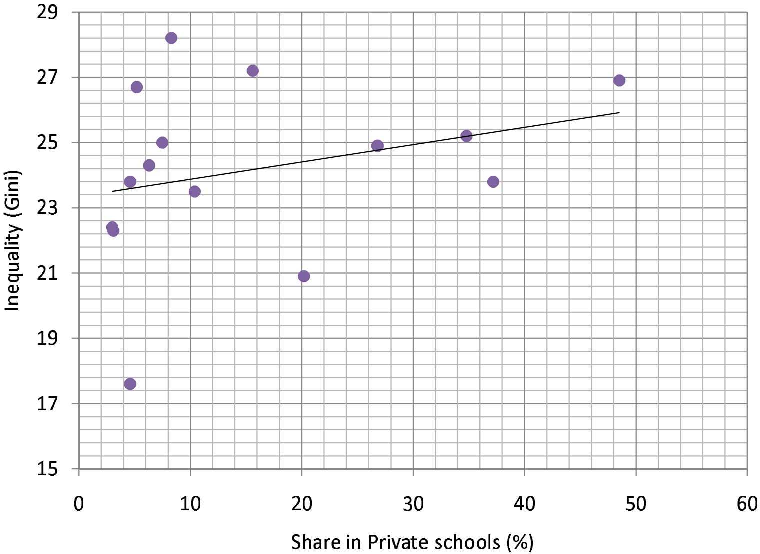
Objective

Usual view of public vs private schooling:
Countries which rely the most on public schools should develop a more equal distribution of income but grow at a slower pace.

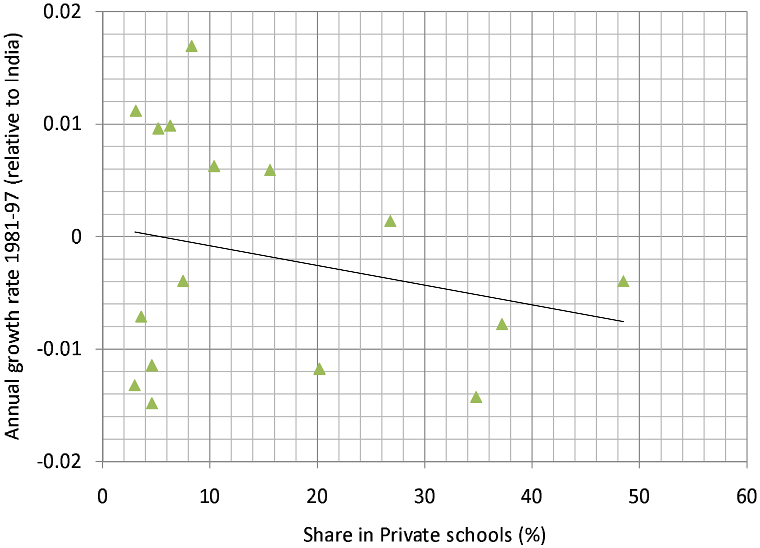
Simple look at data: not obvious it is the case.

In this chapter: we show that endogenous fertility matters for this result

Private education and rural inequality circa 2000 across Indian States



Private education and growth circa 2000 across Indian States



Ideas

Compare the implications of public and private schooling for growth and income distribution with endogenous fertility.

Two Ideas:

Fertility differentials between rich and poor related to private investment in quality; it may disappear with (free) public schooling. That can be good for growth.

Differential fertility → centrifugal force: higher reproduction by low-skilled people increase the relative number of the poor. Public education offsets this centrifugal force.

What we do

A simple model with no physical capital and only two groups of households.

The private education regime corresponds to the one described previously.

A new public regime is introduced: same education for all financed by an income tax.

In this presentation: I show the model and the main results (no detailed calculations)

Common elements (1)

Population sizes (no social mobility):

$$P^i_{t+1} = P^i_t n^i_t. \tag{1}$$

Relative size:

$$z_t = \frac{P^A_t}{P^B_t}. \tag{2}$$

Aggregate production function:

$$Y_t = L_t,$$

Common elements (2)

Utility:

$$\ln(c_t^i) + \gamma \ln(n_t^i h_{t+1}^i).$$

The human capital of the children depends on human capital of the parents, average or teacher's human capital, and education:

$$h_{t+1}^i = \mu(\theta + e_t^i)^\eta (h_t^i)^\tau (\bar{h}_t)^{1-\tau}. \quad (3)$$

Average human capital:

$$\bar{h}_t = \frac{P_t^A h_t^A + P_t^B h_t^B}{P_t^A + P_t^B}. \quad (4)$$

Setup with Private Education

Households'constraint:

$$c_t^i + n_t^i e_t^i \bar{h}_t = h_t^i (1 - \phi n_t^i). \tag{5}$$

Labor supply:

$$L_t = P_t^A \left(h_t^A (1 - \phi n_t^A) \ - e_t^A n_t^A \bar{h}_t \right) + P_t^B \left(h_t^B (1 - \phi n_t^B) \ - e_t^B n_t^B \bar{h}_t \right). \tag{6}$$

Setup with Private Education

Definition (Private-Education Inter-temporal Equilibrium)

Given initial human capital endowments (h_0^A, h_0^B) and group sizes $(P_0^A,\ P_0^B)$, an equilibrium with private education consists of sequences of aggregate quantities $\{z_t,\ \bar{h}_t,\ L_t\}$, group sizes $\{P_{t+1}^i\}_{i=A,B}$, and decision rules $\{c_t^i,\ n_t^i,\ e_t^i,\ h_{t+1}^i\}_{i=A,B}$ such that:

1. the households' decision rules c_t^i, n_t^i, e_t^i, h_{t+1}^i maximize utility subject to the constraints (5) and (3);
2. the group populations evolve according to (1);
3. aggregate variables z_t, $\bar{h}_t$, and L_t are given by (2), (4), and (6).

Setup with Public Education

Households' budget constraint:

$$c_t^i = (1 - v_t)h_t^i(1 - \phi n_t^i). \tag{7}$$

The government spends $\bar{e}_t \bar{h}_t$ on each child. Budget:

$$\bar{e}_t \bar{h}_t (P_t^A n_t^A + P_t^B n_t^B) = v_t (P_t^A h_t^A (1 - \phi n_t^A) + P_t^B h_t^B (1 - \phi n_t^B)). \tag{8}$$

Human capital:

$$h_{t+1}^i = \mu(\theta + \bar{e}_t)^\eta (h_t^i)^\tau (\bar{h}_t)^{1-\tau}. \tag{9}$$

Setup with Public Education

Definition (Public-Education Inter-temporal Equilibrium)

Given initial human capital endowments (h_0^A, h_0^B) and group sizes $(P_0^A,\ P_0^B)$, an equilibrium with public education consists of sequences of aggregate quantities $\{z_t,\ \bar{h}_t,\ L_t\ \}$, group sizes $\{P_{t+1}^i\}_{i=A,B}$, private decision rules $\{c_t^i,\ n_t^i,\ \ h_{t+1}^i\}_{i=A,B}$, and policy variables $\{v_t, \bar{e}_t\}$, such that:

1. the households' decision rules c_t^i, n_t^i, h_{t+1}^i maximize utility subject to the constraints (7) and (9);
2. the government's budget constraint (8) is satisfied;
3. given decision rules, the policy variables maximize the utility of adult households;
4. the group populations evolve according to (1);
5. aggregates z_t, $\bar{h}_t$, and L_t are given by (2), (4), and (6).

Fertility and Policy Choices Under Public Education

The first-order condition for n_t implies that everyone chooses the same number of children:

$$n_t = \frac{\gamma}{\phi(1+\gamma)}. \tag{10}$$

The adults choose the tax v_t to maximize utility. The first-order condition for a maximum leads to:

$$v_t = \frac{\gamma(\phi\eta - \theta)}{\phi(1+\gamma\eta)},$$

and the resulting choice for public education is:

$$\bar{e}_t = \frac{\eta\phi - \theta}{1+\gamma\eta}. \tag{11}$$

Long-Run Dynamics

Growth rate g_t of average human capital (along the balanced growth path, = growth rate of GDP per capita):

$$g_t = \frac{\bar{h}_{t+1}}{\bar{h}_t}.$$

Proposition (Balanced Growth Path with Private Education)

There is a balanced growth path with private education such as:

$$\begin{aligned} x_t^A &= 1 = x_t^B \\ g^\star &= \mu \left(\frac{\eta(\phi - \theta)}{1-\eta} \right)^\eta > 0. \end{aligned}$$

This balanced growth path is locally stable if: $\tau < 1 - \frac{\eta\phi}{\phi-\theta}$.

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This balanced growth path is globally stable.

Both under private and public education there exists a balanced growth path in which all inequality has vanished.

The stability properties of the two education regimes, however, are different.

Comparing growth in the long-run

Along a balanced growth path, education and growth are lower under public education than under private education, while fertility is higher.

Why? in the public regime, parents do not internalize the negative effect of having many children on the education resources per child.

Comparing growth in the short-run

For group A, the private regime yields higher education only if x_t^A is large enough:

$$x_t^A \geq \frac{\phi(1-\eta)+\theta(1+\gamma)}{\phi(1+\gamma\eta)}. \tag{12}$$

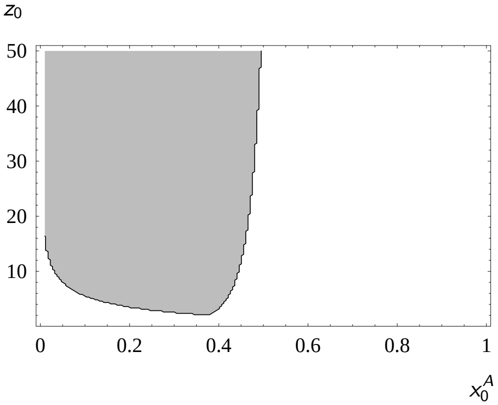
Proposition (Comparison of Public and Private Regime)

Assume that parameters satisfy $\eta + \tau < 1$. Then for a given x_t^A sufficiently low to violate (12)*, there exists a threshold for z_t above which the public education regime yields higher growth than the private education regime.*

If there is enough inequality (x_t^A low enough) and if group A makes up a large fraction of the population, the public regime yields higher growth in the short-run.

Initial Conditions for which Growth is Higher with Public Education

$\gamma = 0.169$, $\tau = 0.1$, $\eta = 0.6$, $\phi = .075$, $\theta = 0.017$ (calibration procedure similar to 1b.)



Conclusion

1. Public schooling distorts the fertility and education choice of parents: parents increase fertility once education is provided for free.
This leads to lower growth in the long-run.

2. When there is inequality, the comparison of growth rates can switch in favor of public education, because of differential fertility.

3. With private education, differential-fertility can result in a diverging income distribution. This divergence can be prevented by a public education.