

# Human Capital and the Wealth on Nations by R. Manuelli and A. Seshadri

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## Main Objective

- Why are some countries richer than others?

## Strategy

- A growth model of human capital accumulation
- Calibrated to the US economy
- Cross-country study:
  - Demographic variables are taken from the data (fertility rate and retirement age)
  - TFP is computed to match observed output per worker

## Main Findings

- Cross-country differences in human capital are large
- Differences in TFP are small (at most 27%)
  - Removed by differences in the price of capital
- A substantial impact of demographics on development
- Consistent with the Mincerian approach and the evidence on earnings of immigrants

## Development accounting

- Aggregate technology is Cobb-Douglas
- Countries share the same interest rate, but different TFP

$$r + \delta_k = zF_k(\kappa, 1)$$

have different capital to human capital ratios  $\kappa$

- Output per worker

$$\bar{y} = zF(\kappa, 1)\bar{h}$$

- Human capital per worker  $\bar{h}$  is a complex function of  $z$

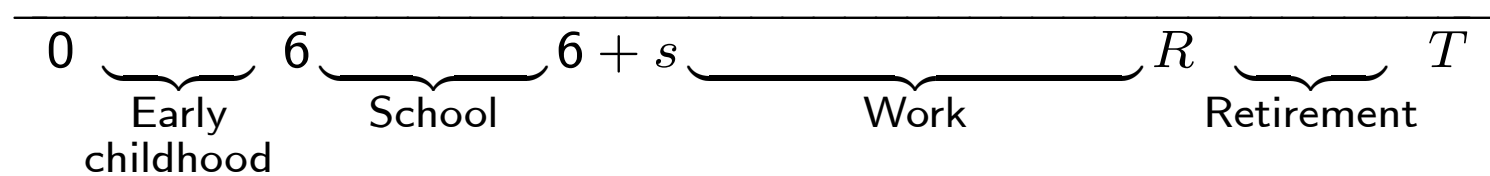
- The simulation results: US and the poorest decile

$$\frac{\bar{y}_{us}}{\bar{y}_p} = \frac{z_{us}}{z_p} \underbrace{F(\kappa_{us}, 1)}_{1.1} \frac{\bar{h}_{us}}{\bar{h}_p}$$

19.2
1.4
1.1
12.5

- The economic mechanism: The elasticity of human capital to TFP is around 9

## Human capital technology



- Early childhood

$$\boxed{h(6) = h_B (x_E)^\nu} \quad h_B > 0, \nu \in (0, 1)$$

- Education and Training (where the action is)

$$\boxed{\dot{h} = z_h (nh)^{\gamma_1} x^{\gamma_2}} \quad z_h > 0, \gamma_i \in (0, 1)$$
$$\gamma \equiv \gamma_1 + \gamma_2 < 1$$

## Individual problem (human capital formation)

- First order conditions are a ODE system
- Variables:  $h, q$ , two controls  $n, x$
- Equations: two differential equations  $\dot{h}, \dot{q}$  and two static equations  $n, x$
- Initial condition  $h(0) = h_E$  and a terminal condition  $q(R) = 0$
- The inequality constraint  $n \leq 1$  may be binding

## Main results and definitions

- The optimal allocation of the labor to human capital formation

$$n(a) = \begin{cases} 1 & a \in [6, 6 + s] \\ \tilde{n}(a) \leq 1 & a \in [6 + s, R] \end{cases} \quad \begin{array}{l} \text{Schooling} \\ \text{Training} \end{array} \quad \text{with } \tilde{n}'(a) < 0$$

–  $\tilde{n}(a)$  is the interior solution

– The return on human capital decreases with age (retirement)

- The *quantity* of human capital

The schooling time  $s$ :  $\tilde{n}(6 + s) = 1$



- At the interior solution,  $a \in [6 + s, R]$

- The marginal value of human capital

$$q(a) = w \underbrace{\mathcal{R}(R - a)}_{\text{discounted value of a unit flow up to } R}$$

- The optimal input ratio

$$\frac{x}{n} = \text{cst } wh$$

- The *quality* of schooling  $h (6 + s)$

- At the interior solution

$$wh = q \text{ cst } h^{\gamma_1} x^{\gamma_2} = q \text{ cst } h^{\gamma} w^{\gamma_2}$$

$$\boxed{h^{1-\gamma} = \text{cst } \mathcal{R}(\cdot) w^{\gamma_2}}$$

- The elasticity of human capital to wages is  $\frac{\gamma_2}{1-\gamma}$

- Key parameters (+ calibration)

- \* decreasing returns to scale  $\gamma < 1$

- \* inputs other than human capital  $\gamma_2 > 0$

- Calibration  $\gamma_2 = 0.3, \gamma = 0.93 \implies \frac{\gamma_2}{1-\gamma} \approx 5$

## Comments

- Are differences in TFP so small? Diffusion of IT, for example
  - Adoption of advanced technologies requires high human capital

## Quality vs quantity of human capital

- Decomposing  $\bar{h}$  into quantity and quality is arbitrary
- In the paper, differences between the US and poorest decile
  - In quantity: 2.7 time (using Mincerian returns)
  - In quality: 4.5 times

- In the model,  $s$  is quantity and  $h(6 + s)$  is quality
  - But, they are complex functions of the same parameters
  - $h(6 + s)$  is computed using a subset of equations
    - \* it's right
    - \* but, the elasticity of wages is arbitrary since  $s$  also depends on  $w$
    - \* it depends on the training technology
  - $h(6 + s)$  may also be solved by using the schooling period
    - \* the elasticity of wages may be different
    - \* it would depend on the education technology

- Formal schooling and training

- The definition of schooling is arbitrary (important for calibration):

- $n(a) < 1$  may be very close to one

- Technologies to produce education and training are identical

- \* Earning profiles are used to calibrate the training technology

- Do the main results depend on the training technology only?

- There must be large differences in education and training technologies across countries

- The relevant technology is not the US technology

$$\frac{h_{us}}{h_p} \propto \frac{z_{us}^{\eta_{us}}}{z_p^{\eta_p}}$$

since  $z_{us} = 1$ , then only  $\eta_p$  matters

– Are earning profiles similar across countries?

- Earning profiles

- Hypothesis: Life cycle earning profiles are steeper than cross-section earning profiles

Increasing initial human capital of new generations (Boucekkine et al, JET, 2002)

- \* Human knowledge improves
- \* Years of schooling increase
- Using cross-section earnings to estimate the training technology overestimates the  $\gamma_i$ , and the elasticity of the quality of human capital to TFP
- Using longitudinal earning overestimate the average human capital

- Some second order comments:

- The capital to human capital ratio is not equal across countries, because it depends on the TFP, from Table 5

$$\frac{F(\kappa_p)}{F(\kappa_{us})} \approx 0.9$$

- In demography, long term is some hundred of years (non stationary data)
- The optimal kids' consumption  $c_k$  is zero (no utility)
- Firms pay a fraction  $\pi$  of the training costs
- The steady state distribution of population in (14) is an assumption  
At a constant  $B$ , the initial conditions replicate forever