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

Comments by Omar Licandro
European Uuniversity Institute

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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 κ

- Output per worker

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

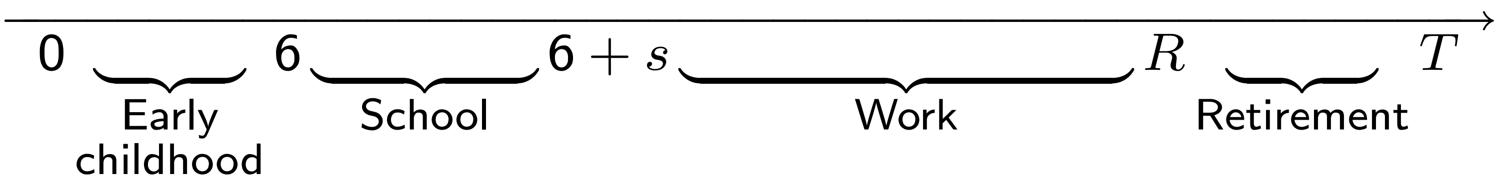
- Human capital per worker $\bar{h}$ is a complex function of z

- The simulation results: US and the poorest decile

$$\underbrace{\frac{\bar{y}_{us}}{\bar{y}_p}}_{19.2} = \underbrace{\frac{z_{us}}{z_p}}_{1.4} \underbrace{\frac{F\left(\kappa_{us},1\right)}{F\left(\kappa_p,1\right)}}_{1.1} \underbrace{\frac{\bar{h}_{us}}{\bar{h}_p}}_{12.5}$$

- 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)

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

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 $h\,(6) = h_E$ 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

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

  - $\tilde{n}(a)$ 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

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

  - The optimal input ratio

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

- The *quality* of schooling $h(6+s)$
  - At the interior solution

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

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

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

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 η_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 γ_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 π of the training costs
  - The steady state distribution of population in (14) is an assumption

    At a constant B, the initial conditions replicate forever