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→ In the Barro article, we saw that one of the most important determinants of growth of GDP/N was education

→ Solow model not capable of explaining cross-country differences in GDP/N

→ For example: According to Penn World Tables in 2000:

GDP/L in US $64,437

in Nigeria $1,479

so if US + Nigeria both share some technology, then $A_{US} = A_{Nigeria}$ and

$$y = k^{\alpha} \Rightarrow \frac{y_{US}}{y_{Nigeria}} = \left(\frac{k_{US}}{k_{Nigeria}}\right)^{\alpha} \Rightarrow \left(\frac{y_{US}}{y_{Nigeria}}\right)^{1/\alpha} = \frac{k_{US}}{k_{Nigeria}}$$

$$\frac{y_{US}}{y_{Nigeria}} = \frac{Y_{US}/A_{US}L_{US}}{Y_N/A_N L_N} = \frac{Y_{US}/L_{US}}{Y_N/L_N} \quad \text{because } A_{US} = A_N$$

$$\left(\frac{y_{US}}{y_N}\right)^{1/\alpha} = \left(\frac{\$64437}{\$1479}\right)^{1/\alpha} = \begin{cases} 82{,}700 & \text{when } \alpha = 1/3 \\ 288 & \text{when } \alpha = 2/3 \end{cases}$$

→ Perhaps the US has 288 times more capital per worker than Nigeria, but there's no way it has 82,700 times more

→ In practice however $\alpha = \frac{1}{3}$

$$Y = K^{\alpha}(AL)^{1-\alpha}$$

$$w = p\,MPL = p(1-\alpha)\frac{Y}{L} \quad \Big\| \quad \text{if economic profit} = 0$$

$$r = p\,MPK = p\alpha\frac{Y}{K} \quad \Big\| \quad pY = rK + wL$$

$$pY = p\alpha\frac{Y}{K}\cdot K + p(1-\alpha)\frac{Y}{L}\cdot L$$

$$= \alpha pY + (1-\alpha)pY$$

↑ capital's share of income ← labor's share of income

→ In practice, we know that capital's share of income is about $\frac{1}{3}$ which implies $\alpha \approx \frac{1}{3}$

→ But how can we reconcile that result with Nigeria having 82,700 times less capital per worker than US?

## EDUCATION and HUMAN CAPITAL

→ Suppose that:

$$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta}$$

$$y = k^{\alpha} h^{\beta}$$

→ Suppose that $\alpha = \beta = \frac{1}{3}$

→ Suppose that US has 288 times more capital per worker and 288 times more human capital per worker, then

$$\frac{y_{US}}{y_N} = \left(\frac{k_{US}}{k_N}\right)^{\alpha}\left(\frac{h_{US}}{h_N}\right)^{\beta}$$

assume $A_{US} = A_{Nigeria}$

$$\frac{\$64437}{\$1479} = 288^{1/3} \cdot 288^{1/3}$$

$$43{,}6 = 43{,}6$$

→ Now I don't think the US has 288 times more human capital than Nigeria, but we're getting closer to something reasonable

→ In practice, $A_{US} > A_{Nigeria}$

→ so if $\rho(k, h) > 0$ and large

then incorporating human capital into the model helps explain cross-country differences in GDP/L