

The Simple Solow Growth Theory

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L3: The Solow Theory

- Main idea of Solow model is to introduce hypothesis of *capital-deepening*: rate of return to investments is lower in richer countries
- Because rich countries have more capital (per head), and there are diminishing returns to capital

The Solow Theory, contd.

- Can reformulate production function in per capita terms:

$$y_t \equiv \frac{Y_t}{P_t} = Af(k_t)$$

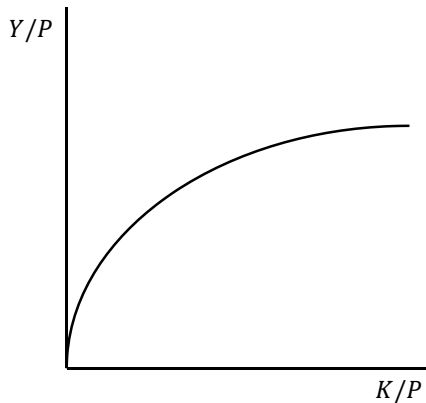
where $k_t \equiv \frac{K_t}{P_t}$, the capital-labor ratio and f is subject to diminishing returns

- e.g. with Cobb-Douglas technology,

$$y_t = Ak_t^\alpha$$

- Reduces to HD theory if $\alpha = 1$

Per-Head Production Function



The Solow Theory, contd.

- What is the correct value of α ? 1 or smaller?
- α equals share of capital in national income
- In most developed countries, this is around $\frac{1}{3}$

Implications of Capital-Deepening

- *A rich country grows slower than a poor country, if they have the same s, n, δ*
- Catch-up phenomenon
- Leads to hypothesis of *Conditional Convergence (CC)*: disparities in p.c.i. between poor and rich countries tend to narrow over time, provided they have the same s, n, δ
- A prediction which can be tested empirically

Conditional versus Unconditional Convergence

- Beware: Solow theory does *not* predict poor countries will inevitably catch up with rich countries, which is the hypothesis of *Unconditional Convergence (UC)*
- If some poor countries fail to catch up, it must be because they have lower savings rates (s), or higher population growth rates (n), or access to poorer technology (A)
- If they are to catch up, their governments have to find ways to raise s , lower n and/or access better technology

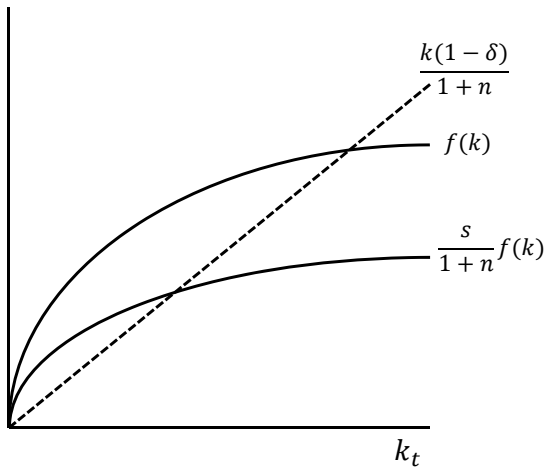
Other Implication of Capital-Deepening Hypothesis

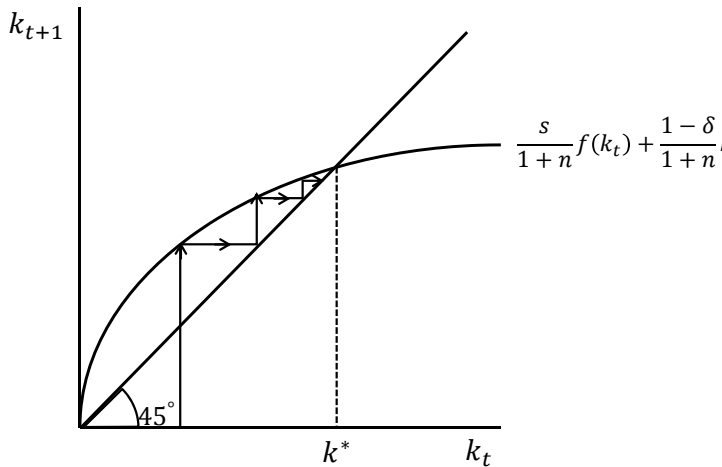
- In any given country with constant s , n , δ , growth tends to slow down over time
- Growth rates in the short-run and long-run differ
- What does the Solow theory predict for the long-run growth rate?

Capital Dynamics in the Solow Model

Key equation:

$$k_{t+1} = \frac{sf(k_t) + (1 - \delta)k_t}{1 + n}$$





Long-Run Predictions of Solow Model

- Assuming absence of technical progress (A constant), p.c.i. will converge to a stationary level in the long-run
- In other words, *long-run growth rate must be zero irrespective of s, n, A, δ*
- Hence raising s or lowering n will raise short-run growth, **but will have no effect on long-run growth**

Does This Mean Raising s or Lowering n Will Not Have Permanent Effects?

- No! not for p.c.i. *levels*
- Steady state capital per head is (in CD case:)

$$k^* = \left[\frac{s}{n + \delta} \right]^{\frac{1}{1-\alpha}}$$

- Distinguish growth effects from level effects, of changes in parameters
- Contrast Solow theory with HD theory in this respect

