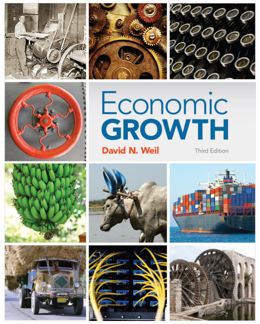
Chapter 3

PHYSICAL CAPITAL



A few things before starting

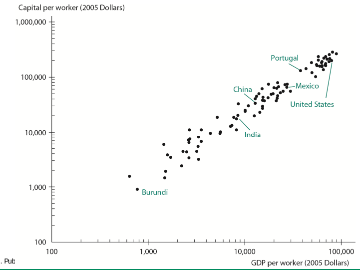
Database on WB indicators

http://data.worldbank.org/products/wdi

Nature of capital

- Capital is productive
- But it is has been produced itself...through investments. In other words capital is accumulated. Distinction between flows and stocks
- Capital depreciates
- Capital stock is made of machinery, tools, buildings, roads....
- It can private or public (mainly infrastructures)

An interesting stylised fact: GDP and Capital per Worker, 2009



Source: Calculations based on Heston et al. (2010).

Early models of economic growth

- Harrod-Domar model
- Solow model

Capital's role in production

- Production function:
  - Y=F(K,L)
  - y=F(K/L, 1)
  - y= f(k)

SOLOW model: Cobb-Douglas PF

  - $Y=F(K,L) = AK^{\alpha}L^{\beta}$
  - Usually $\alpha+\beta=1$, in this case we can rewrite the function above as follows: $y = A\,k^{\alpha}$

in a competitive environment alpha is the capital factor share. in a Cobb-Douglas model this is constant.

Solow model: A Production Function with Diminishing Marginal Product of Capital

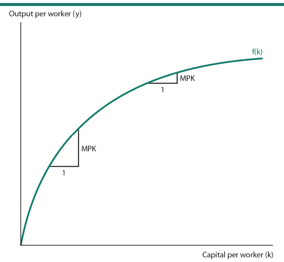


Figure 3.3 Capital's Share of Income **(which is equal to α)** in a Cross-Section of Countries

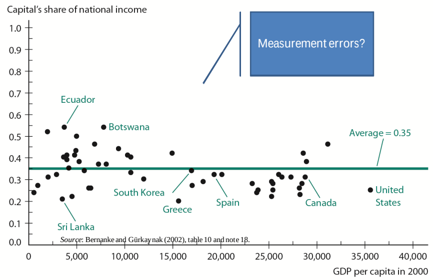


Figure 3.4 The Steady State of the Solow Model (with no population dynamics)

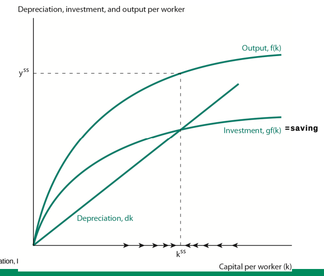


Figure 3.10 Speed of Convergence to the Steady State

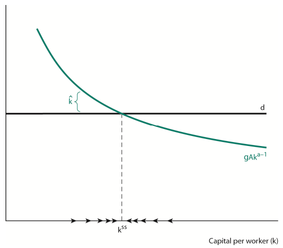


Figure 3.5 A non economic example: Determination of Steady-State Weight

Think also about changes in the position of the two lines

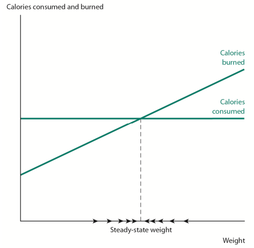
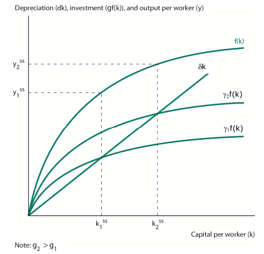


Figure 3.6 Effect of Increasing the Investment Rate on the Steady State



Solow model calibration

Using $y = A k^{\alpha}$

- $\Delta k = \gamma A k^{\alpha} - \delta k$

In steady state Δk is equal to zero, that is

- $0 = \gamma A k_{ss}^{\alpha} - \delta k_{ss}$

Which implies that

- $\gamma A k_{ss}^{\alpha} = \delta k_{ss}$
- $k_{ss}^{\alpha} = (\gamma A/\delta)^{1/(1-\alpha)}$

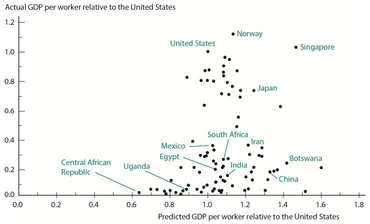
Solow model calibration

- $y_{ss} = A k_{ss}^{\alpha} = A^{1/(1-\alpha)} (\gamma/\delta)^{\alpha/(1-\alpha)}$
- If we take the value of y of steady state for country i and country j, we can compare them in the following way
- $y^{i}_{ss} / y^{j}_{ss} = (\gamma^{i}/\gamma^{j})^{\alpha/(1-\alpha)}$
- Now let us assume that country i has an investment rate of 20% and country j of 5%

Solow model calibration

- With alpha equal to 0.3 the previous formula gives a value of 2….
- … do you remember the example of Silvania and Freedonia?

Figure 3.7 Predicted versus Actual GDP per Worker



Source: Author's calculations using data from Heston, Summers, and Aten (2011).

The Solow model as a theory of relative growth rates (difference btwn s.r. and l.r.)

The key is to think about countries which are not in s.s.

- *If two countries have the same rate of investment but different levels of income, the country with lower income will have higher growth*
- *If two countries have the same level of income but different rates of investment, then the country with a higher rate of investment will have higher growth*
- *A country that raises its level of investment will experience an increase in its rate of income growth*

Figure 3.8 Saving Rate by Decile of Income per Capita

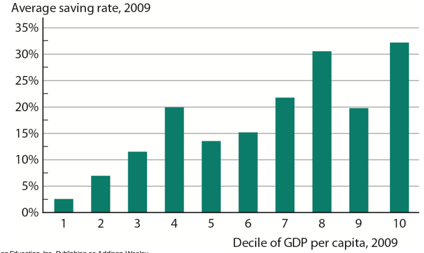
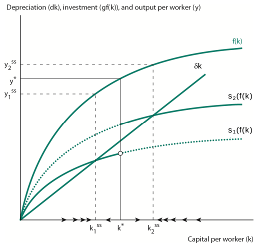


Figure 3.9 Solow Model with Saving Dependent on Income Level

Multiple equilibria = Poverty traps



The rise and fall of capital revisited

- The belief that capital accumulation is the key ingredient for economic growth reached its peak after WWII (see Arthur Lewis and Soviet Union’s success)
- Policies were designed accordingly
- Now economist have discarded the idea that development depends mainly on capital accumulation