Growth Theory and Growth Models

Readings:

- Michael Todaro and Stephen Smith (2014) Economic Development- Pearson Publishing (Chapter 3, various parts)

Growth theory and growth models:

- Motivated by the question of what drives the process of economic growth and formulating a mathematical growth path based on social and economic parameters
- Modern growth theory starts with the Harrod- Domar model based on a broadly Keynesian formulation (the mid-1940s). Taken up by newly developing countries as a policy-guiding formulation in the 1950s
- Followed by the neoclassical growth model credited to Solow and Swan   (separate papers both published in 1956)
- The modified neoclassical models called endogenous growth models starting from the late 1980s

The basic structure of the model:

- Savings function $S = sY$, & $0 < s < 1$ $\qquad\qquad$ (1)
  Total savings is a proportion of total income
- Investment $I = \Delta K$ $\qquad\qquad$ (2)
  Investment is a change in capital stock (K)
- $K/Y = \Delta K/\Delta Y = c$ $\qquad\qquad$ (3)
  Assuming production to be based on capital only (simplification) with constant returns to scale
- $S = I$ $\qquad\qquad$ (4)
- $sY = c\,\Delta Y$ $\qquad\qquad$ (5)
- $\Delta Y/Y = s/c$ $\qquad\qquad$ (6)
- $g = s/c$ $\qquad\qquad$ (7)
  g being the growth rate of income

Implications of the growth equation:

- The growth rate is a function of s, the savings propensity and $c = K/Y$ or the capital-output ratio.
- $1/c$ can be thought of as the efficiency of capital in producing output.
- A plausible g with s = 15 % and c = 4 is only 3.75 %
- Growth rate can be pushed up from both ends- higher savings rate or higher efficiency of capital use
- However, these are unlikely to be independent channels
- The key implication is the necessity of augmenting savings rates continuously to ensure higher growth rates

Solow-Swan Model or the neoclassical growth model:

Assumptions:

- Production function with two substitutable factors Capital (K) and labour (L), unlike the Harrod-Domar model
- Constant Returns to Scale (CRS) production function
- $Y = F (L, K)$ F_L and $F_K > 0$ and F_{LL} and $F_{KK} < 0$
- Diminishing marginal returns to capital and labour
- There is a constant rate of growth of labour force n (i.e. $dL/dt/L = n$)
- Constant depreciation rate **δ**
- Saving is a fraction of total income, and all savings are invested
- $S = sY$ and $I = \Delta K = S$

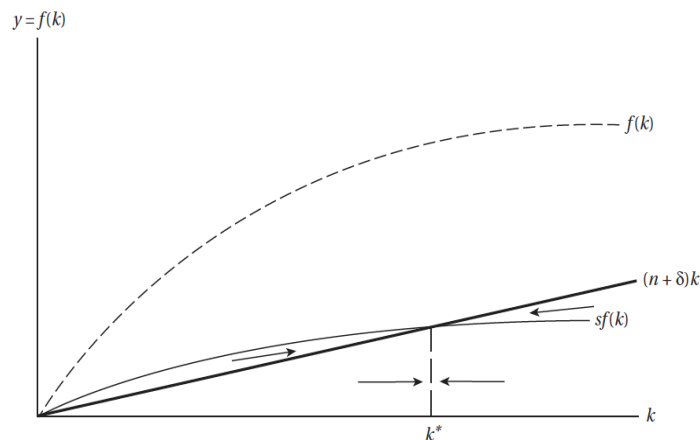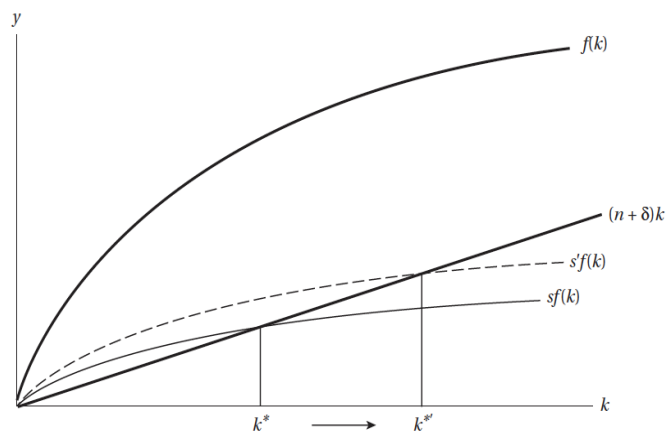**FIGURE A3.2.1 Equilibrium in the Solow Growth Model**

FIGURE A3.2.2   The Long-Run Effect of Changing the Savings Rate in the Solow Model

Some concerns from the Solow model:

- What happens when the population growth rate increases?
- What is the idea of convergence coming out of the Solow model?

Solow residual and the idea of endogenous growth:

- The Solow(neoclassical) model has limited capacity to explain the sources of growth in reality
- Only 50 per cent of historical growth is accounted for adjustments in K and L (or k). The rest is clubbed together as the Solow residual, i.e. not assigned to any explicit source of growth
- The understanding was that the Solow residual is a result of technological progress
- But this progress is not endogenous to the Solow model
- Also, the Solow model has no room to understand long-term growth (which is 0)
- Lastly, the thorny issue of unconditional convergence that the Solow model predicts

Endogenous or new growth theory:

- The source of the 0 growth equilibrium of the Solow model is the diminishing returns to capital which gets reflected in the shape of f(k)
- The challenge for endogenous growth theory was to theorize a different entity of capital that helps in overcoming this property
- The new growth theory focused on different kinds of positive externalities whereby new knowledge creation often led to human capital accumulation even if the knowledge is publicly funded and created (R & D, learning by doing etc.)
- Capital is now conceptualized as a composite good of physical and human capital and does not necessarily yield diminishing returns

Basic endogenous model (Romer, 1986):

Assumptions:

- A constant returns to scale production function with K and L with standard properties. This production function is conceptualized at the firm or the industry level
- At the economic level, there is an additional stock of capital $\bar{K}$ which reflects the collective knowledge about production processes(through R & D etc.) which is a kind of public good
- The firms get to utilize this public good as additional capital and thus escape the diminishing returns trap
- The basic model in formal terms is given in Appendix 3.3 of the textbook.