# MA Economics, Semester IV, Paper III- Development Economics

## Topic: AK Model

**E-Content Prepared by**
**Amulya Tiwari**
**Assistant Professor, Dept. Of Economics**
**SJNPG College, Lucknow**

## Endogenous Growth:

In the mid-1980s, a group of economists led by Paul Romer (1986) became almost totally dissatisfied with exogenously driven explanations of long-run productivity growth. They developed a different class of models in which the key determinants of growth were endogenous to the model. The name 'endogenous growth' carries the significance that the long-run growth rate is determined from within the model rather than by some exogenously growing variables like unexplained technological progress.

The simplest version of the endogenous growth model, called the AK model (based on the AK type of production first introduced by von Neumann in 1937) is based on the assumption of a constant saving ratio. This model shows how the elimination of diminishing returns can lead to endogenous growth.

**The AK Model:**

The main property of endogenous growth models is the absence of diminishing returns to capital. The production function without diminishing returns is expressed as

$Y = AK$ … (i)

where A is a positive constant (like the one in the Cobb Douglas production function), that is, an index of the level of technology. Here K may be treated in a broad sense to include both physical and human capital so as to assume away the absence of diminishing returns to capital in the AK production function. Output per capita is $y = Y/L = A. K/L= Ak$ and the $AP_L$ and $MP_K$ are constant at the level $A > 0$.

In the Solow model the growth rate of capital is given by

Yk k/k = s$f$(k)/k –n-δ ……(ii)
Here we use the symbol y to denote the growth rate of any variable, s is MPS, k = K/L capital per capita, n is the rate of population growth and δ is the rate of depreciation.

If we substitute f(k)/k A is equation (ii), then we get

$Y_k$ = sA = (n + δ) … (iii)
It is now possible to show that per capita growth can now occur in the long run even without exogenous technological change. Now in case of the AK model the downward-sloping curve, s$f$(k)/k is replaced by the horizontal line at the level sA as shown in Fig .5.
This means that $Y_k$ is the vertical distance between the two lines sA and n + δ. If the technology is AK, then the saving curve s$f$(k)/k is a horizontal line at the level sA. If sA >n + δ then k grows in perpetuity, i.e., $Y_k$ > 0′ even in the absence of technological progress.

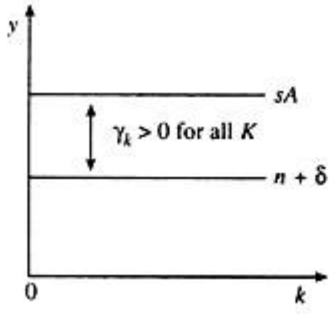

Fig. 5: The AK model

Since the two lines are parallel, $Y_k$ is constant. To be more specific, it has no functional relation to k. Alternatively stated, k always grows at the steady-state rate, = sA – (n + δ).
Since y = Ak, $y_y$ also equals $Y^*_k$ at every point in time. Furthermore since per capita consumption c = (1 – s) y, where 5 is the saving rate, the growth rate of consumption equals $Y_k$. This means that all the per capita variables in the model grow at the same rate, given by
Y = Y*= sA-(n + δ) …. (iv)

Thus an economy characterised by the AK technology can display positive long-run per capita growth even in the absence of exogenous technological change. Furthermore, the per capita growth rate in equation (iv) depends on the behavioural parameters of the model, such as the savings rate and the rate of population growth. For example, unlike the neo-classical model, a higher saving rate, 5, leads to a higher rate of long-run per capita growth, Y*.

Alternatively, if the level of technology, A, improves once and for all or if the elimination of a governmental distortion effectively raises A, then the long-run growth rate is higher. Changes in the rate of depreciation, 5 and population growth, n also have permanent effects.

**Comparison with Solow Model:**

Unlike the Solow model, the AK formulation does not produce absolute or conditional convergence, that is $dY_y/dy = 0$ for all levels of y. This is a major defect of the AK model because conditional convergence is empirically verified almost regularly.

Let us suppose some economies are structurally similar in the sense that the parameters A, n and δ are the same. The economies differ only in terms of their initial capital stocks per person, K (0) and, hence, in Y (0) and C (0). Since the model predicts that each economy grows at the same per capita rate, Y*, regardless of its initial position, all the economies are supposed to grow at the same per capita rate. This conclusion emerges due to the absence of diminishing returns.

Another central idea of the endogenous growth theory is that the level of the technology can be advanced by purposeful activity, such as R & D expenditures.

**As R. Barro and X.S.I Martin put it:**

"This potential for endogenous technological progress may allow an escape from diminishing returns at the aggregate level, especially if the improvements in technique can be shared in a non-rival manner by all producers. This non-rivalry is plausible for advances in knowledge, that is, for new ideas."

## Study material reference

**http://www.economicsdiscussion.net/economic-growth/models-economic-growth/models-of-economic-growth-with-diagram-macroeconomics/26622**