Nelson's Low Level Equilibrium Trap Model

A number of economists starting from Professor Nurkse are of the view that an underdeveloped country in a vicious circle of poverty. Professor Nurkse explain this vicious circle in a particular way whereas Nelson and Leibenstein explain this vicious circle in another way. They point out that the LDCs are in equilibrium position at or near the subsistence level.

Nelson develops this concept of stable equilibrium at low per capita income level with the help of three functional relations relating to population growth, rate of growth of capital and rate of growth of income.

First, Nelson assumes that rate of growth of population is an increasing function of per capita income. But if per capita income is less than the subsistence level of income, then the rate of growth of population will be negative, when per capita income is greater than the subsistence level, then there will be a positive rate of growth of population. However, this rate of growth of

population will reach maximum level, say $\left(\frac{dP}{P}\right)^*$ at a particular level of per capita income, say

 $\left(\frac{Y}{P}\right)^*$. Beyond this level of per capita income, the population growth will be stable and the stable rate of growth of population will continue up to a very high level of per capita income beyond which the rate of growth of population may fall. Symbolically, this type of rate of growth of population function may be written as,

$$\left(\frac{dP}{P}\right) = f\left(\frac{Y}{P} - S\right) \rightarrow \left(\frac{dP}{P}\right)^* \text{at} \left(\frac{Y}{P}\right)^*$$

where S represents subsistence level of per capita income. This type of function and relation between population growth and per capita income is based partly on the Malthusian theory of population and partly on the experiences of developed countries in the 18th and 19th centuries.

In the adjoining figure are capita income $\left(\frac{Y}{P}\right)$ is measured along the horizontal axis and rate of growth of population $\left(\frac{dP}{P}\right)$ and rate of growth of income $\left(\frac{dY}{Y}\right)$ are measured along the vertical

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axis. S represents the subsistence level of $\left(\frac{Y}{P}\right)$. The rate of growth of population function as

explained above is represented by the $\left(\frac{dP}{P}\right)$ curve.

Secondly, Nelson introduces a rate of growth of capital function. Here a sort of Keynesian equilibrium condition in terms of saving investment equality is assumed. If S represents total savings and Y represents national income then the saving ratio is $\left(\frac{S}{Y}\right)$. Putting S = I we get

 $\left(\frac{S}{Y}\right) = \left(\frac{I}{Y}\right)$ at equilibrium. Again *I* represents increase in capital stock i.e. dK. Therefore, $\left(\frac{S}{Y}\right) = \left(\frac{dK}{Y}\right)$. As $\left(\frac{S}{Y}\right)$ is a function of per capita income, $\left(\frac{dK}{Y}\right)$ is also a function of per capita income. So, Nelson writes the rate of growth of capital fuction as,

 $\left(\frac{dK}{Y}\right) = \phi\left(\frac{Y}{P} - X\right)$ where X is a minimum income beyond which capital growth can occur and hence X is greater than S.

Thirdly, from these population growth function and rate of growth of capital function Nelson relates rate of growth of income to per capita income. However, in order to make this relation very precise, Nelson assumes constant returns to scale in the production process i.e. the aggregate production function is homogeneous function of degree one. Mathematically, the

functional relation between $\left(\frac{dY}{Y}\right)$ and $\left(\frac{Y}{P}\right)$ may be established in the following way.

Let us write the aggregate production function as,

$$Y = f(P, K)$$

As this is a homogeneous function of degree one,

$$\left(\frac{Y}{P}\right) = h\left(\frac{K}{P}\right)$$

Again, taking total differential and with some adjustment we can write,

 $dY = \frac{\partial Y}{\partial P} dP + \frac{\partial Y}{\partial K} dK$ $\Rightarrow \frac{dY}{Y} = \frac{\partial Y}{\partial P} \frac{dP}{P} \frac{P}{Y} + \frac{\partial Y}{\partial K} \frac{dK}{Y}$ Here $\frac{\partial Y}{\partial P}$ and $\frac{\partial Y}{\partial K}$ are functions of $\left(\frac{K}{P}\right)$ which is again function of $\left(\frac{Y}{P}\right)$. Hence, $\frac{\partial Y}{\partial P}$ and $\frac{\partial Y}{\partial K}$ are functions of $\left(\frac{Y}{P}\right)$. We already know $\left(\frac{dP}{P}\right)$ is a function of $\left(\frac{Y}{P}\right)$. After deriving this functional relation between $\left(\frac{dY}{Y}\right)$ and $\left(\frac{Y}{P}\right)$ Nelson makes the most crucial assumption relating to the relation between $\left(\frac{dY}{Y}\right)$ and $\left(\frac{dP}{P}\right)$. He assumes that at per capita income levels below OS (i.e. subsistence level) $\left(\frac{dY}{Y}\right)$ is greater than $\left(\frac{dP}{P}\right)$. But after OS level of per capita income, $\left(\frac{dY}{Y}\right)$ is less than $\left(\frac{dP}{P}\right)$ and this will continue up to a certain level of $\left(\frac{Y}{P}\right)$ (OM in our figure). After OM level of $\left(\frac{Y}{P}\right)$, $\left(\frac{dY}{Y}\right)$ is greater than $\left(\frac{dP}{P}\right)$ and this will continue upto a very high level of $\left(\frac{Y}{P}\right)$. This assumption is crucial because Nelson's conclusion rests on this assumption. He points out that if per capita income is less than OS then $\left(\frac{Y}{P}\right)$ will increase because $\left(\frac{dY}{Y}\right)$ is greater than $\left(\frac{dP}{P}\right)$. But if per capita income is greater than OS but less than OM, then per capita income will fall to OS as $\left(\frac{dP}{P}\right)$ is greater than $\left(\frac{dY}{Y}\right)$ at such income levels. Therefore, a stable equilibrium is established at OS level of per capita income.



For this reason Nelson concludes that the LDCs are caught in a low level equilibrium trap. Their attempts at raising per capita income at slow rate are futile because such attempts will lead them to low level of per capita income. The policy prescription which emerges from this model is the following:

The LDCs must have to undertake a very large amount of investment which can lead them to a very high level of per capita income (beyond OM in our diagram) so that a self sustained process of economic growth can be initiated. It may not be possible for the LDCs to undertake such large dose of investment because of scarcity of domestic resources. So foreign aid can play an effective role by supplementing domestic savings so that the rate of investment can be increased to a very high rate.

Though Nelson's main conclusions are more or less correct, theoretically the model has been criticized because of the main assumptions of this model. First, as pointed out above, Nelson establishes a functional relation between rate of population growth and per capita income on the basis of Malthusian theory of population. In this type of assumption the cause of growth of population is assumed to be mainly due to the growth in the birthrate. But it is known that the growth of population in a country occurs due to interaction between the birth rate and the death rate. In most of the countries from the late 19th century, the growth of population has been due to the fall in death rate which has been due to the development of medical benefits and control of epidemics. If growth of population is due to fall in death rate, it has no functional relationship

with per capita income, it is solely due to development of medical science and other facilities provided by the government.

Secondly, Nelson relates the rate of growth of income with increasing rate of savings only. In other words, he assumes that if rate of savings increases with increase in per capita income, investment and capital formation will increase automatically. But, that does not occur always. Unless institutional structure particularly financial institutions and other institutions for investment developed in a country, rate of growth of income does not increase automatically. The experience of many LDCs indicate that even when foreign aid is supplied for supplementing domestic savings, rate of growth of income does not occur at the desired rate because of the absence of infrastructural facilities and financial institutions.

Thirdly, Nelson does not give any emphasis on the role of technological progress in accelerating the rate of economic growth. The experiences of many developed countries indicate that when population growth occurred in their countries in the 19th century, by changing the method of production increasing amount of human resources was employed in a productive way to increase the rate of economic growth. In other words, growth retarding forces like population growth can be offset through technological progress and innovations.