# Chapter 17 Economic Growth in the Closed Economy

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Despite the fact that growth theory has not been the economic mode for almost a decade, the current worldwide trend towards stabilisation of the macroeconomy will bring theories of the growth process back into the forefront of economic thinking. This prospect prompts a review of the fundamentals of growth theory and their application to particular economies.

Much of modern growth theory rests on the idea of equilibrium; not an equilibrium in the static sense of Keynesian analysis, but a long run perpetual equilibrium known as a steady state equilibrium. Such an equilibrium is characterized by a fully employed economy with a fixed capital-labour ratio and where output is growing at the same rate as the labour force. Economics is thus concerned with the determination of Y (equilibrium output) and the process via which an economy can reach this point.

The Harrod-Domar (H-D) model, developed in the 1930's and 1940's, dominated growth theories until the 1960's. The basic assumptions of the model are that (a) savings (= investment) are a constant fraction, a, of output i.e. $S/Y = a$, (b) the labour force grown at a constant rate, $\beta$, (c) the capital-labour ration (K/L) is constant. Thus, the growth equation for the H-D steady state is $a/v = \beta$, where $v = K/L$. The implication of this is that the growth rate of the capital stock must equal the growth rate of the labour force i.e. $\beta_K = \beta_L$ which comes from assumption (c). However, this effectively implies zero substitutibility between labour and capital, i.e. more labour intensive or capital intensive methods of production are ruled out, and is clearly at variance with the facts of growth.

This prompted Sargant, Meade and, in particular, Solow to develop a new theory which would allow for a degree of capital-labour substitutibility. This 'neoclassical' growth synthesis provides the basis for modern growth theories and appears to be more consistent with Kaldor's "stylized facts" of growth. The assumptions underlying this model are essentially as follows:

(a) savings are identically equal to investment (i.e. $S \equiv I$). This follows from the fact that in perfect financial capital markets, the rate of interest, r, will represent society's preference for present, as opposed to future, consumption i.e. the marginal rate of transformation (MRT) will be equal to the marginal rate of substitution. If private savings exceed private investment then the government will have to run a budget deficit to maintain the equality between savings and investment.

(b) savings are a constant fraction of output i.e. $S/Y = a$.

(c) for simplicity, the capital stock does not depreciate.

(d) the labour force grows at a constant rate, g, which can be treated as exogenous.

(e) the technical relationship between inputs and outputs takes the form of a continuous aggregate production function which exhibits constant returns to scale i.e. if $f(K,L) = Q$ then $f(cK, cL) = cQ$ where c is any positive number.

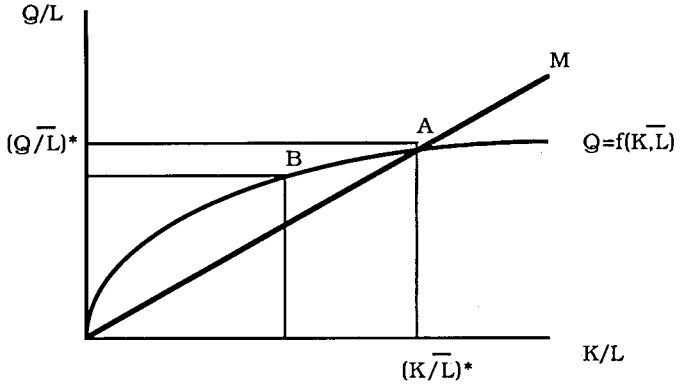


Figure 1

If labour is held constant, it is possible to represent the change in output per worker (Q/L) as a function of capital per worker (K/L) where the marginal product of capital ($MP_K$) is always positive but decreasing i.e. capital experiences diminishing marginal returns. This implies that there is some substitutibility between the two factors.

The line M shown in fig. (i) embodies two pieces of information: (a) the savings rate at any particular level of output and (b) the growth of the labour force. It shows the output per worker that is required to maintain the capital-labour ratio constant, which is a necessary condition for steady state growth. Since a given fraction, a, of output, is saved, it follows that the rate of savings must equal the growth rate of the labour force in order to hold the capital-labour ratio constant. If the savings rate was higher, the capital-labour ratio would be growing and this would push up the output-labour ratio, at a slower pace, until a steady state was attained. So, if the economy was initially at point B in fig. (i), the savings rate, a, exceeds the rate of growth of the labour force, g. The economy will thus move towards point A, a steady state. Conversely, any point to the right of the line M will correspond to a savings rate being less than the rate of growth of the labour force and so the capital-labour ratio will fall until point A is reached.

This analysis has implications for policy makers as there appears to be at least two ways whereby growth can be increased. It must be remembered that such increases can only be temporary as the economy will move back to its long run equilibrium.

The first is to do with 'increases in technology'. Although the neoclassical model does allow for technical progress, it is perhaps the greatest criticism of the model that this technology is 'disembodied'. The model treats increases in technology as increases in universal labour productivity and hence can be regarded as a reduction in the labour input at every level of output. Consequently, the long run rate of growth of output becomes the rate of growth of the labour force plus the rate of growth of productivity. This implies that 'labour-augmented disembodied technical progress' will only lead to a temporary acceleration in output growth until the economy returns to its equilibrium steady state level

where the growth rate will be higher than before. However, the increase in technology will not allow for a permanent increase in the rate of growth over and above its steady state rate over time. Because of this, an incorporation of 'capital-embodied' progress, where the quality of inputs can be increased, into the model would allow even greater consistency with the facts of growth.

The second method of bringing about a rate of growth higher than the steady state rate is through a higher savings rate (but only up to a point). If the savings rate is increased, the ratio of capital to labour will eventually rise and this will lead to a higher ratio of output to labour. The consequence of this is that the line M will pivot to the right implying a higher capital-labour ratio at each level of output per worker.

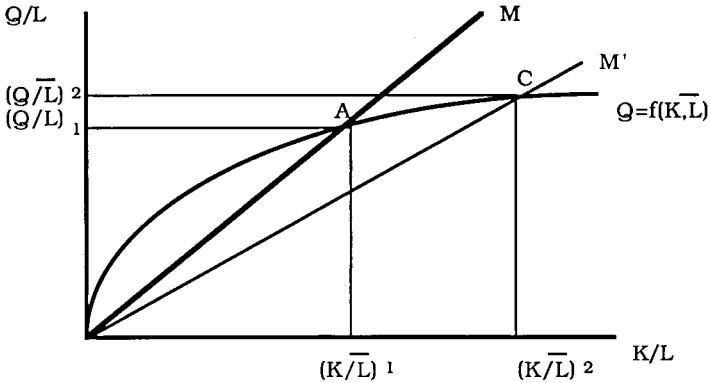


FIGURE 2

The economy will move from A to C and once it reaches C, it will grow at its steady state level again.

Thus, economic policy should be directed towards achieving that rate of savings which will achieve the highest level of output per worker while at the same time maximizing the present value of consumption. As both savings and consumption constitute output, it can be seen that maximum growth could imply a savings rate of 100% which is obviously not a desirable outcome. In an effort to overcome this, economists have developed the 'golden rule of accumulation'.

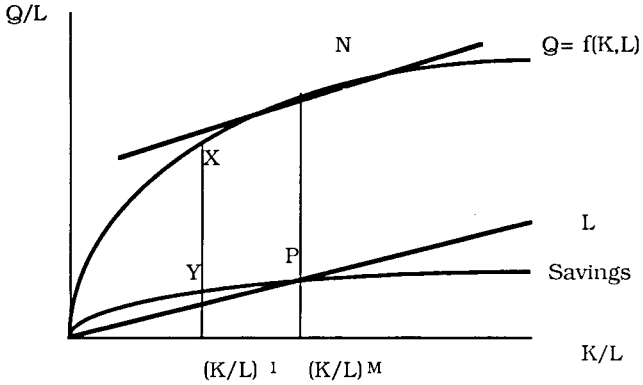


FIGURE 3

The line L in fig. (iii) represents the growth of the labour force, assumed to be exogenous and constant. In equilibrium, the growth rate of the labour force is equal to the rate of savings. The government should then try to ensure that the savings function (where savings are a constant fraction of output) intersects the line L, where potential consumption, the distance between L and the production function, is maximized over all future years. This occurs where the marginal product of capital equals the rate of growth of the labour force which is at the point P. The distance NP represents consumption while $P(K/L)^{m}$ represents the savings rate. Given the above, it remains only to examine what policy makers should understand about growth in a closed economy.

Since this is a discussion concerning an equilibrium where there is full employment, it is effectively dealing with the growth of potential output. This will not be unrealistic if policy makers have sufficient tools to maintain equilibrium in the goods and financial markets while output increases.

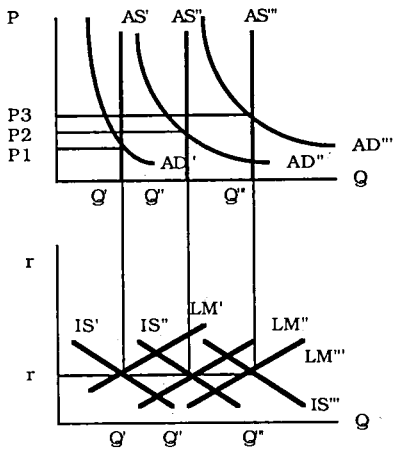


FIGURE 4

The role of the government is to ensure that the aggregate demand curve does intersect a shifting aggregate supply curve at a particular set of prices and it can attempt to do this by using short run stabilisation policy instruments. If the interest rate is changing then investment would not be stable and so the economy would not be in a steady state equilibrium. The government must ensure that the money supply expounds at a rate equal to the growth rate of aggregate demand plus the rate of inflation. The type of monetary expansion that this entails necessitates an examination of the demand for money relationship.

Prices will be rising only if the growth of wages (wage inflation at full employment) is greater than the growth of labour productivity (the determinant of the wage level in neoclassical microeconomics). Hence, in long run steady state equilibrium, output must be rising at a rate equal to the growth of the labour force plus the growth in labour productivity. Prices must be rising at a rate of wage inflation (a Phillips curve relation) less the growth of labour productivity, and the money supply must be expanding at a rate equal to the growth of aggregate demand plus price inflation.

This analysis shows how the economy moves when steady state equilibrium has been achieved. However, two methods have been outlined in which growth may be increased temporarily: increasing technology and a rise in the savings rate. In neoclassical analysis, the two are closely linked so that one may stimulate the other.

As regards investment, three important components are (a) investment in physical capital, (b) investment in human capital and (c) investment in research and development. The effect of each of these is basically the same. They can be analysed in terms of their impact on labour productivity which is essentially a reduction in labour input. The level of investment in each of these is dependent upon the rate of return viz-à-viz the cost of the investment (the rate of interest). Therefore, the role of policy makers should be to ensure that the interest rate is sufficiently low to encourage such investment while still maximizing the present value of consumption (the golden rule). In particular, policy makers should be concerned with types (b) and (c) due to the level of risk and uncertainty that surrounds them. For example, an increase in the availability of funds to finance greater investment in human capital through education, together with a patent system to ensure high rates of return on successful R and D projects, would be acceptable to the vast majority.

Lastly, it is important to remember that the analysis has been based on the neoclassical idea of perfect markets and hence is an ideal. Even one of the world's most closed economies (the United Stated) can diverge from the theory. The present budget deficit ($169 billion for federal government) would imply that there is a private sector surplus of savings over investment. However, as can be seen from the calls for still greater savings, the level of economic growth implies that investment is sufficient while savings are too low. Notwithstanding this, the neo-synthesis does, in general, fit the facts of growth. The rates of growth of output and the labour force have been fairly steady although the former has tended to exceed the latter (take the U.S. for example). The capital stock is growing at a fairly steady rate and is close to the rate of growth of output suggesting an approximately constant capital-output ratio. However, Solow did point out that "this is a temporary excuse and not a permanent licence". The analysis of economic growth is not over!