Applicability and Significance of Harrod–Domar Model in Economic Growth

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Abstract—*Although, the Harrod–Domar model was initially created to help and analyse the business cycle, it was later adapted to explain economic growth. Its implications were that growth depends on the quantity of labour and capital; more investment leads to capital accumulation, which generates economic growth. The model carries implications for less economically developed countries, where labour is in plentiful supply in these countries but physical capital is not, slowing down economic progress. The model explains economic boom and bust by the assumption that investors are only influenced by output. Thus, the purpose of this study is to analyse the Harrod-Domar Growth model and find out its applicability and significance.*

Keywords: *Business cycle, Economic growth, Physical capital, Economic boom.*

1. INTRODUCTION

The Harrod–Domar model is an early post-Keynesian model of economic growth. It is used in development economics to explain an economy's growth rate in terms of the level of saving and productivity of capital. It suggests that there is no natural reason for an economy to have balanced growth. Roy F. Harrod in 1939 and Evsey Domar developed the model independently in 1946, although Gustav Cassel had proposed a similar model in 1924. The Harrod–Domar model was the precursor to the exogenous growth model.

Neoclassical economists claimed shortcomings in the Harrod–Domar model in particular the instability of its solution, and, by the late 1950s, started an academic dialogue that led to the development of the Solow–Swan model.

According to the Harrod–Domar model, there are three kinds of growth: warranted growth, actual growth, and natural rate of growth.

Warranted growth rate is the rate of growth at which the economy does not expand indefinitely or go into recession. Actual growth is the real rate increase in a country's GDP per year.

2. MATHEMATICAL FORMALISM

Let Y represent output, which equals income, and let K equal the capital stock. S is total saving, s is the savings rate, and I is investment. δ stands for the rate of depreciation of the capital stock. The Harrod–Domar model makes the following a priori assumptions:

$$Y = f(K)$$
$$\frac{dY}{dK} = c \Rightarrow \frac{dY}{dK} = \frac{Y}{K}$$
$$f(0) = 0$$
$$sY = S = I$$
$$\Delta K = I - \delta K$$

1: Output is a function of capital stock

2: The marginal product of capital is constant; the production function exhibits constant returns to scale. This implies capital's marginal and average products are equal.

3: Capital is necessary for output.

4: The product of the savings rate and output equals saving, which equals investment

5: The change in the capital stock equals investment less the depreciation of the capital stock

Derivation of output growth rate:

$$c = \frac{dY}{dK} = \frac{Y(t+1) - Y(t)}{K(t) + sY(t) - \delta K(t) - K(t)}$$

$$c = \frac{Y(t+1) - Y(t)}{sY(t) - \delta \frac{dK}{dY} Y(t)}$$

$$c\left(sY(t) - \delta \frac{dK}{dY}Y(t)\right) = Y(t+1) - Y(t)$$

$$cY(t)\left(s - \delta \frac{dK}{dY}\right) = Y(t+1) - Y(t)$$

$$cs - c\delta \frac{dK}{dY} = \frac{Y(t+1) - Y(t)}{Y(t)}$$

$$s\frac{dY}{dK} - \delta \frac{dY}{dK}\frac{dK}{dY} = \frac{Y(t+1) - Y(t)}{Y(t)}$$

$$sc - \delta = \frac{\Delta Y}{Y}$$

A derivation with calculus is as follows, using dot notation for the derivative of a variable with respect to time.

First, assumptions (1)–(3) imply that output and capital are linearly related (for readers with an economics background, this proportionality implies a capital-elasticity of output equal to unity). These assumptions thus generate equal growth rates between the two variables. That is,

$$Y = cK \Rightarrow log(Y) = log(c) + log(K).$$

Since the marginal product of capital, c, is a constant, we have:

$$\frac{d\log(Y)}{dt} = \frac{d\log(K)}{dt} \Rightarrow \frac{\dot{Y}}{Y} = \frac{\dot{K}}{K}.$$

Next, with assumptions (4) and (5), we can find capital's growth rate as,

$$\frac{\dot{K}}{K} = \frac{I}{K} - \delta = s\frac{Y}{K} - \delta$$

$$\Rightarrow \frac{\dot{Y}}{Y} = sc - \delta$$

In summation, the savings rate times the marginal product of capital minus the depreciation rate equals the output growth rate. Increasing the savings rate, increasing the marginal product of capital, or decreasing the depreciation rate will increase the growth rate of output; these are the means to achieve growth in the Harrod–Domar model.

3. SIGNIFICANCE

Although the Harrod–Domar model was initially created to help analyse the business cycle, it was later adapted to explain economic growth. Its implications were that growth depends on the quantity of labour and capital; more investment leads to capital accumulation, which generates economic growth. The model carries implications for less economically developed countries, where labour is in plentiful supply in these countries but physical capital is not, slowing down economic progress. Less Developed Countries do not have sufficiently high incomes to enable sufficient rates of saving; therefore, accumulation of physical-capital stock through investment is low.

The model implies that economic growth depends on policies to increase investment, by increasing saving, and using that investment more efficiently through technological advances.

The model concludes that an economy does not "naturally" find full employment and stable growth rates.

4. CRITICISMS OF THE MODEL

The main criticism of the model is the level of assumption, one being that there is no reason for growth to be sufficient to maintain full employment; this is based on the belief that the relative price of labour and capital is fixed, and that they are used in equal proportions. The model explains economic boom and bust by the assumption that investors are only influenced by output (known as the accelerator principle); this is now believed to be correct.

In terms of development, critics claim that the model sees economic growth and development as the same; in reality, economic growth is only a subset of development. Another criticism is that the model implies poor countries should borrow to finance investment in capital to trigger economic growth; however, history has shown that this often causes repayment problems later.

The Endogeneity of Savings: Perhaps the most important parameter in the Harrod–Domar model is the rate of savings. Can it be treated as a parameter that can be manipulated easily by policy? That depends on how much control the policy maker has over the economy. In fact, there are several reasons to believe that the overall level of per capita income in the society may itself influence the rate of savings, not to mention the distribution of that income among the population.

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