Macroeconomics II

9. Saving, Capital Accumulation, and Output

BSc in Economics

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Saving and Investment

- Private saving, S, is given by the difference between disposable income, Y_D, and private consumption, C:

$$S = Y_D - C \Rightarrow S = Y - T - C$$

  where Y is output and T are taxes.

- Given the equation for the equilibrium in the goods market in a closed economy, we have:

$$Y = C + I + G \Leftrightarrow Y - T - C = I + G - T \Leftrightarrow I = S + T - G$$

- If public saving $(T - G) = 0$, we get $I = S$.
- Assuming that $S = sY$, where s is the saving rate (parameter), it is true that $I = sY$.

Investment and Capital Accumulation

- The evolution of the capital stock is given by:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

where δ is the depreciation rate which reflects the proportion of the capital stock becoming useless in a period.

- Using the relationship between investment and output, and dividing both sides by the number of workers in the economy, N (assumed to be constant in time), yields:

$$\frac{K_{t+1}}{N} = (1 - \delta)\frac{K_t}{N} + s\frac{Y_t}{N} \text{ or } \frac{K_{t+1}}{N} - \frac{K_t}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N}$$

Dynamics of Capital and Output

- Given that output *per* worker is an increasing function of capital *per* worker, we have:

$$\underbrace{\frac{K_{t+1}}{N} - \frac{K_t}{N}}_{\text{change in capital from } t \text{ to } t+1} = \underbrace{sf\left(\frac{K_t}{N}\right)}_{\text{investment during } t} - \underbrace{\delta\frac{K_t}{N}}_{\text{depreciation during } t}$$

- If investment *per* worker exceeds depreciation *per* worker, capital *per* worker increases
- If investment *per* worker is less than depreciation *per* worker, capital *per* worker decreases.
- The steady state of the economy implies that which capital and output *per* worker do not change:

$$sf\left(\frac{K^*}{N}\right) = \delta\frac{K^*}{N} \text{ and } \frac{Y^*}{N} = f\left(\frac{K^*}{N}\right)$$

Dynamics of Capital and Output

Graphical representation

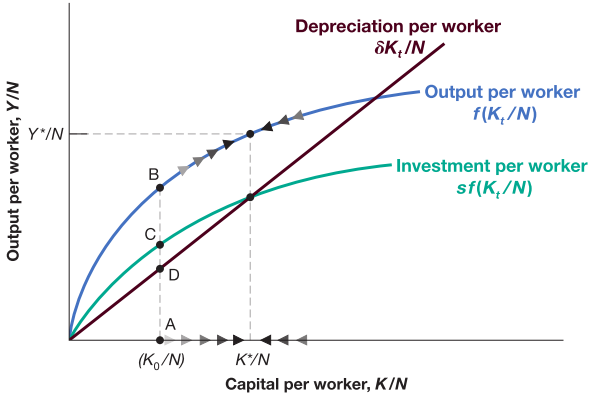

Figura 1: Capital and output dynamics.

Dynamics of Capital and Output

The saving rate and output

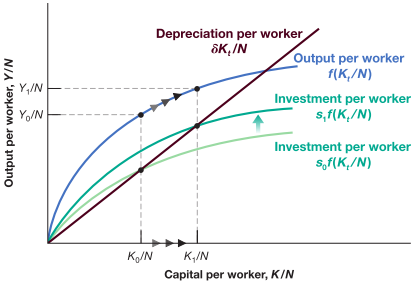

Figura 2: The effects of different saving rates.

- The saving rate does not impact the long-run **growth rate** of output *per* worker which we assumed to be zero.
- The saving rate determines the **level** of output *per* worker in the long run.
- An increase in the saving rate promotes the growth rate of output *per* worker for some time, although not forever.

The saving rate and consumption

- We know that an increase in the saving rate leads to an increase in the level of output *per* worker.
- But it does not mean that consumption necessarily increases in the long-run.
- A saving rate of zero leads to no capital accumulation, zero output and consumption.
- Conversely, a saving rate of one means all income is saved, leading to high capital levels and output initially. But since all income is saved, consumption is equal to zero.
- What happens is that all output is needed to replace depreciated capital, given the excessive amount of capital carried by the economy.
- Thus, while a saving rate of one initially boosts output, it eventually stifles consumption and poses challenges in maintaining excessive capital levels.
- The level of capital associated with the saving rate that maximizes consumption in the steady state is termed the golden-rule level of capital.

The saving rate and consumption

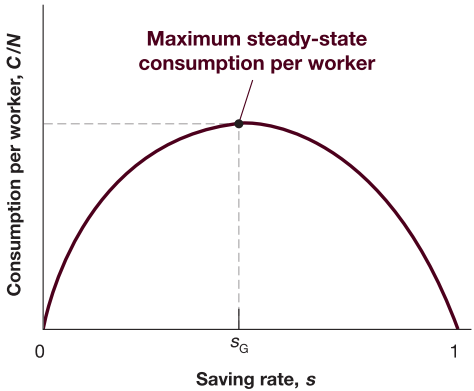

Figura 3: The effects of the saving rate on steady-state consumption *per* worker.

References

- Blanchard, O. (2017). *Macroeconomics. Global Edition.* (7^{th} ed.). Routledge.