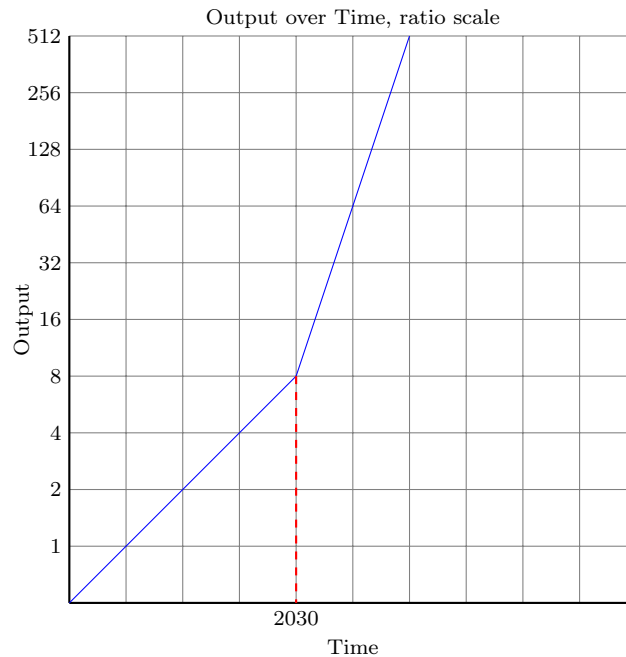## An Increase in Research Productivity

Suppose that the economy is on a balanced growth path in the Romer model. Then, in 2030, research productivity $\bar{z}$ rises immediately and permanently to $\bar{z}'$.

(a) Make a graph of y_t over time using a ratio scale.

(b) Why might research productivity increase in an economy?

Solution

(a)

Output over Time, ratio scale

(b)

Research productivity might increase in an economy if the government undertakes large scale investments in education or increases the prizes or patents that it provides to new research that entices different types of innovations.

Numbers in the Romer Model

Suppose the parameters in the Romer model are as follows: $\overline{A}_0 = 100$, $\bar{\ell} = 0.1$, $\bar{z} = 1/500$, and $\overline{L} = 100$.

(a) What is the growth rate of output per person in this economy?

(b) What is the initial level of output per person? What is the level of output per person after 100 years?

(c) Suppose research share were to double. How would you answer parts (a) and (b)?

Solution

(a)

The growth rate of output is equal to the growth rate of A, which is equal to:

$$g_a = \overline{z}\overline{\ell}L$$
$$= \boxed{0.02}$$

(b)

The initial level of output per person is equal to:

$$y_0 = \overline{A}_0(1 - \overline{\ell})$$
$$= \boxed{90}$$

$$y_{100} = \overline{A}_0(1 - \overline{\ell})(1 + \overline{z}\overline{\ell}L)^{100}$$
$$= \boxed{652}$$

(c)

If research share were to double, we would get the following results:

$$g_a = \overline{z}\overline{\ell}L$$
$$= 0.04$$

$$y_0 = \overline{A}_0(1 - \overline{\ell})$$
$$= 80$$

$$y_{100} = \overline{A}_0(1 - \overline{\ell})(1 + \overline{z}\overline{\ell}L)^{100}$$
$$= 4041$$

A Variation of the Romer Model

Consider the following variation:

$$Y_t = A_t^{1/2} L_{yt}$$
$$\Delta A_t = \overline{z} A_t L_{at}$$
$$L_{yt} + L_{at} = \overline{L}$$
$$L_{at} = \overline{\ell}\overline{L}$$

There is only a single difference: we have changed the exponent on A_t in the production of the output good so there is now a diminishing product to new ideas in that sector.

(a) Provide an economic interpretation for each equation.

(b) What is the growth rate of knowledge in this economy?

(c) Solve for the level of output per person at each point in time.

(d) What is the growth rate of output per person in this economy?