8. The Romer model

**8.1** Indicate which variables influence technical progress in the Romer model and explain what each of those variables consists of.

**8.2** Consideran economy which behaves according to the Romer model, in which λ=1, φ=0.5 and the labour force grows at a constant annual rate of 1.5%. Assuming that the economy is already in its balanced growth path, compute the growth rate of GDP per capita.

**8.3** Consideran economy which behaves according to the Romer model, in which, starting from an initial balanced growth path, there is a sudden one-off increase in the number of researchers due to a new policy to attract foreign researchers. Explain the short- and long-run impacts of that increase on the growth rate of GDP per capita and the mechanisms that account for those impacts.

**8.4** Consider an economy which behaves as per the Romer model and whose production function for new ideas (technical progress) is given by the following expression:

r(A) = θ . LAλ/A1-Φ

, in which the variables have their usual meaning.

Currently, the number of workers involved in R&D activities is growing at an annual rate of 4% and the stock of ideas is growing at an annual rate of 3.5%. It is further known that λ = 0.7 and Φ = 0.2.

Indicate whether or not this economy is currently on its balanced growth path. Justify your answer.

**8.5** Discuss the following statement, and if necessary correct it: "Unlike what is the case in the Solow model, in the Romer model faster population growth is associated with slower economic growth."

**8.6** Discuss the following statement, and if necessary correct it: “Unlike what is the case in the Solow model, in the Romer model technical progress is endogenous”.

**8.7** Consider the following equation from the Romer model, in which *A* stands for the stock of ideas and *LA* stands for the number of researchers.

dA/dt = θ . *LA*λ . AΦ

Interpret the economic meaning of λ > 1 and φ < 0.

**8.8** Consider an economy which behaves as per the Romer model, with regard to which it is known that the number of researchers is growing at an annual rate of 5% and the stock of ideas is growing at 3% per year. We also know that λ = 0.8 and φ = 0.2. Show that this economy is not on its balanced growth path.

**8.9** Consider the following information for the Portuguese economy in the 30-year period between 1992 and 2022:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **L** | **LA** | **A** | **Y** |
| **1992** | 4 307 | 8 553 | 1 084 | 82 151 |
| **2022** | 5 495 | 56 192 | 16 715 | 155 717 |

L = Labour force (thousands); LA = Number of researchers (FTE in R&D); A = Number of patents + Scientific publications; Y= GDP (millions of euros) at 2006 constant prices.

With a view to characterising the Portuguese economy in its balanced growth path:

a) Estimate the value of [λ/(1-φ)], assuming the average annual growth rates of researchers (LA) and of the stock of ideas (A) indicated in the table above.

b) Using the above estimate, the average annual growth rate of the active population (L) obtained from the data in the table, and assuming that there is no unemployment, calculate the average annual growth rate of the Portuguese economy which corresponds to the balanced growth path of this economy.

c) Calculate the average annual growth rate of the Portuguese economy in this 30-year period and compare it to the findings in (a) and (b) above. Comment on the differences.

**8.10** Consider the following information: Eurostat expects the population of the European Union to keep growing until the year 2045, reaching a maximum of 529 million in that year and decreasing thereafter. In light of the Romer model, discuss what might the consequences of this expected trajectory be for the growth of GDP per capita in the European Union, and what factors might counteract that tendency.