Midterm 2 (22nd april 2025)

1 hour

Group 1 (9v/20) Answer the following questions about the link between the economy and climate change:

1.1. (4v) Distinguish adaptation and mitigation measures on the fight against climate change and mention one example of each type of measure.

1.2. (5v) Explain the concept of the social discount rate and the hypotheses on which it rests. Discuss the arguments in favor of, and against, using a low social discount rate.

Answer

1.1. Mitigation measures aim to reduce the impact of climate change by lowering CO2 emissions (examples include promoting the production of renewable energy, encouraging environmentally sustainable means of transportation, reducing the use of private gasoline/diesel vehicles, etc.). Adaptation measures aim to prevent or minimize the impacts of climate change (e.g., building barriers to protect coastal areas, reducing individuals' exposure to heat waves, etc.).

1.2. The social discount rate is an artificial indicator used to assign a present value to costs and benefits that will occur in the future. It is based on two fundamental assumptions: (i) societies become wealthier over time, so €1 in the future is worth less than €1 today; (ii) in general, individuals' intertemporal preferences lead them to assign greater utility to present income than to future benefits.

Using a low social discount rate implies that the future is valued almost as highly as the present. In practice, this means the present value of the economic costs that climate change will cause in the future is higher, which justifies greater investment now to mitigate those costs.

Argument in favor: given the enormous uncertainty surrounding the risks and societal costs of climate change, the precautionary principle suggests using a lower social discount rate and being willing to invest more in the present to reduce future costs.

Argument against: it can be argued that this approach burdens current generations in favor of future ones, as it imposes greater costs on the former.

Group 2 (11v/20)

Consider an economy which behaves according to the hypothesis of the Solow model and which is characterized by the following Cobb-Douglas production function:

$Y = K^{\alpha}.L^{1-\alpha}$

Assume that population (and employment) is constant and equal to L = 100, the depreciation rate is 5%, the savings rate is 20% and the output elasticity with respect to capital is 0.5.

2.1. (3v) Determine the level of capital per worker (k*) and output per worker (y*) at the steady-state, explaining your calculations and conclusions.

Answer

$Y = K^{\alpha}.L^{1-\alpha}$

n=0.00, δ=0.05, s=0.2, α=0.5

We want to determine k*=?

$Y = K^{0.5}.L^{0.5}$

$y = k^{0.5}$

Steady-state: s.y = (n+δ).k

$0.2.(k^{0.5}) = (0.00+0.05)k$

$k=0 \vee 4 = k^{0.5}$

k = 16

$y^* = k^{*0.5} = 16^{0.5} = 4$

2.2. (4v) Suppose the economy is at the steady-state. However, in period t_0, population doubles to L = 200 (and remains constant afterwards). What happens to the stock of capital per worker in t_0? And what happens to the stock of capital per worker at the steady-state?

Answer

In the short run, k and y are reduced. This happens because, in t_0, the economy has a total capital stock (K) which was determined in the previous period (with less population).

$K_0 = k^*_{old} L_{old} = 16 \times 100$

$k_0 = K_0 /200 = 8 < 16$

However, the steady-state value of k (and y*) does not change.*

The steady-state values of k and y* depend on n, s, δ and the (per capita) production function, which are not altered by a one-off population increase (without changing the population growth rate)*

s.y = (n+δ).k

$y = A.k^{\alpha}$

2.3. (4v) Discuss the economic and empirical meaning of the concept of a steady state and, in particular, how this concept can contribute to the analysis of economic growth in modern economies.

Answer

Steady-state concept: In economic growth theories, the concept of a steady state refers to the idea that structural factors may cause market economies to tend toward long-term stagnation. This can be due to trends such as slowing population growth, diminishing returns to scale associated with capital accumulation, or other structural dynamics.

This concept is present in the Solow model, where the assumption of diminishing returns to scale in production factors implies that, in the long run, the economy converges to a state in

which, despite ongoing capital accumulation, there is no change in capital stock per worker (i.e., the capital stock grows in line with the population and labor force, resulting in no per capita growth).

Discussion on the relevance to modern economies:

• May not be relevant: Fundamental innovations have generated productivity gains that have sustained long-term per capita growth. The Solow model does not take technological progress into account.

And/or

• May still be relevant: Challenges such as climate change impose serious constraints on the use of available resources and may hinder the possibility of unlimited growth in productivity and per capita output.