

Problem set I¹

I.1 *Short questions* (answering requires only a few well chosen sentences).

- a) Consider an economy where all firms' technology is described by the same neoclassical production function, $Y_i = F(K_i, L_i)$, $i = 1, 2, \dots, N$, with decreasing returns to scale everywhere (standard notation). Suppose there is "free entry and exit" and perfect competition in all markets. Then a paradoxical situation arises in that no equilibrium with a finite number of firms (plants) would exist. Explain.
- b) In the Solow, Ramsey, and Diamond growth models, as in many other macro models, the technology is assumed to have constant returns to scale (CRS) with respect to capital and labour taken together. Often the so-called *replication argument* is put forward as a reason to expect that CRS should hold in the real world. What is the replication argument? Do you think it is valid in the present case? Explain.
- c) Suppose that for a certain historical period there has been something close to constant returns to scale and perfect competition, but then, after a shift to new technologies in the different industries, increasing returns to scale arise. What is likely to happen to the market form? Why?

I.2 In about two decades China has had an average growth rate of real GDP at approximately 9 percent per year.

- a) Supposing China's growth performance continues to be like that, how many years does it take for China's GDP to be doubled? You should explain your method.
- b) What was in 1987 the ratio of China's GDP per capita to that of the US? *Hint*: see the appendix to Chapter 12 in B & S, p. 564.

¹A tilde over a variable generally has the same meaning as the hat in B & S.

- c) Suppose China's GDP per capita growth rate per year continues to be as it was on average 1973-1987 and suppose the GDP per capita growth rate per year in the US continues to be as it was on average in 1970-1990. How long time, reckoned from 1987, will it then take for China to catch up with the US (p. 563)? You should explain your method. *Hint:* The needed data for answering this problem can be found in the appendix to Chapter 12 in B & S.
- d) Do you find it likely that the actual course of events will be (approximately) like that? Why or why not?

I.3 In a popular magazine on science the following data was reported:

World income per capita relative to income per capita in the US: 1952-96

<i>Year</i>	<i>Percent</i>
1952	13.0
1962	13.3
1972	13.0
1982	13.8
1992	15.1
1996	17.7

Source: *Knowledge, Technology, & Policy* 13, no. 4, 2001, p. 52.

Remark. Countries' per capita income are weighted by population as a fraction of the world population.

- a) Briefly, discuss this data relative to concepts of convergence or divergence and relative to your knowledge of the importance of weighting by population size.
- b) What is meant by the terms unconditional (or absolute) convergence and conditional convergence?
- c) Give a short list of mechanisms that could in principle explain the data above.

I.4 In the data appendix of B & S we see that for Denmark GDP per capita in 1950 is 5227 US\$ (1985 prices) and in 1990 it is 14806 US\$ (1985 prices). Calculate the average (compound) growth rate in GDP per capita 1950-1990 (use continuous compounding). How does the result compare with the general tendency for developed countries since 1870?