

Problem Set 1

(I) In the Solow Model with no population growth and no technological change, how does the savings rate affect the growth rate of output per worker along the Balanced Growth Path (BGP)? Justify fully using a diagram and/or a precise explanation.

(II) Problem 1 from Problems and Applications, page 109 from Mankiw (reproduced below). Country A and Country B both have the production function:

$$Y = F(K, L) = K^{1/2} L^{1/2}.$$

(a) Does this production function have constant returns to scale? Explain.

(b) What is the per-worker production function, $y = f(k)$? (where $y = Y/L$, $k = K/L$)

(c) Assume that neither country has population growth or technological progress and that 5% of capital depreciates each year. Assume further that country A saves 10% of output each year and country B saves 20% of output each year. Use your answer from part (b) above and the Balanced Growth Path (BGP) condition that $\Delta k = 0$ to find the level of capital per worker for each country at the BGP. Then find the levels of income per worker and consumption per worker at the BGP.

(d) Suppose that both countries start off with a capital stock per worker of 2. What are the levels of income per worker and consumption per worker at the initial period?

Remembering that the change in the capital stock is investment less depreciation, use a calculator to show how the capital stock per worker will evolve over time in both countries. For each year, calculate income per worker and consumption per worker.

How many years will it be before the consumption in country B is higher than the consumption in country A?

(III) Consider a country that has the production function:

$$Y = F(K, L) = K^{2/3} L^{1/3}.$$

(a) Does this production function have constant returns to scale? Explain.

(b) What is the per-worker production function, $y = f(k)$?

(c) Assume that the country has no population growth or technological progress and that 10% of capital depreciates each year. Assume further that the country saves 30% of output each year. Use your answer from part (b) above and the Balanced Growth Path (BGP) condition that $\Delta k = 0$ to find the level of capital per worker for this country at the BGP. Then find the levels of income per worker and consumption per worker at the BGP.

(d) Suppose that the country starts off with a capital stock per worker of 20.

What are the levels of income per worker and consumption per worker at the initial period? Calculate the growth rates of capital per worker and income per worker during that first period.

(IV) Problem 1, part b, from More Problems and Applications, page 117 from Mankiw (reproduced below).

In the economy of Solovia, the owners of capital get 2/3 of national income, and the workers receive 1/3.

(b) In year 1, the capital stock was 6, the labor input was 3, and output was 12. In year 2, the capital stock was 7, the labor input was 4 and output was 14. What happened to total factor productivity between the two years?