

Econ 101b: First Midterm: September 25, 2003

Do all four questions: all four questions have equal weight

Question 1: Suppose that we have a standard Solow economic growth model, with the rate of labor force growth $n=1\%$ per year, the rate of labor-efficiency growth $g=3\%$ per year, the rate of depreciation $\delta=4\%$ per year, and the economy's savings rate $s=24\%$ of GDP, consisting of private saving $s_p=24\%$ of GDP and a balanced budget so that net government saving $s_g=0$. Suppose further that the diminishing-returns-to-investment parameter α is $1/2$ and that the current level of the efficiency of labor E_0 is \$20,000 per year.

- Assuming all these parameters are stable, what is the economy's balanced-growth capital-output ratio? What is the balanced-growth path level of output per worker?
- Suppose the economy remains on its balanced-growth path. How fast is output per worker growing?
- Suppose that the government shifts rapidly and permanently to a massive deficit, so that $s_g=-4\%$ of GDP. Now what is the balanced-growth level of output per worker?
- Suppose the economy was on its balanced-growth path at time 0 before the shift to a policy of high deficits. Using the fact that the capital-output ratio follows the law of motion:

$$\frac{K_t}{Y_t} = \left(\frac{K_0}{Y_0} - \frac{s}{n+g+\delta} \right) e^{-(1-\alpha)(n+g+\delta)t} + \frac{s}{n+g+\delta}$$

write down what (approximately) will be the value of K/Y a year after the shift to the high-deficit policy.

- Using the fact that one form of the production function is:

$$\frac{Y_t}{L_t} = \left(\frac{K_t}{Y_t} \right)^{\frac{\alpha}{1-\alpha}} E_t$$

what (approximately) will be the value of Y/L a year after the shift to the high-deficit policy.

Question 2: Suppose that we have a standard Solow economic growth model with one difference. Instead of the capital accumulation equation being:

$$\frac{dK_t}{dt} = sY_t - \delta K_t$$

it is instead:

$$\frac{dK_t}{dt} = \frac{sY_t}{p_k} - \delta K_t$$

Where p_k is the relative price of capital goods: machine tools, buildings, roads, computers, et cetera. Suppose further that the economy's savings rate $s = 20\%$ of GDP, that the labor force growth rate $n=1\%$ per year, that the depreciation rate $\delta=3\%$ per year, that the efficiency-of-labor growth rate $g=1\%$ per year, that the efficiency of labor E_0 is \$20,000 per year, and that the diminishing returns to investment parameter α is $1/2$.

- Suppose that the price of capital goods $p_k=1$. What is the economy's balanced-growth capital-output ratio?
- Suppose that a revolution in information technology reduces p_k by half, so that the new $p_k=0.5$. What is the effect of such a reduction in the price of capital on the economy's balanced-growth capital-output ratio?
- Suppose that the economy had been on its balanced-growth path before the sudden drop in the price of capital. What is the growth rate of output per worker in the first year after the sudden drop in the price of capital?
- Suppose that the national income accountants don't notice that the relative price of capital has declined so much. What are they likely to conclude has happened to the parameters of the growth model as they watch the economy in the first year or two after the fall in the price of capital goods p_k ?
- Over the long run, even if you couldn't measure the price of capital goods reliably, can you think of any way to tell whether the shift in the economy's growth rate was due to a one-time fall in the price of capital goods as opposed to some other cause?

Question 3: Suppose that we have a standard Solow growth model, with labor force growth $n=1\%$ per year, efficiency of labor growth $g=1\%$ per year, and depreciation $\delta=3\%$ per year. Suppose further that the diminishing-returns to investment parameter $\alpha=1/4$, and that the current level of the efficiency of labor E_0 is \$20,000 per year. And I should also tell you that the cube root of 4 is 1.59, the cube root of 5 is 1.71, and the cube root of 6 is 1.82.

- a. Suppose that the economy's savings rate $s=20\%$ of GDP. What is the economy's balanced-growth path capital-output ratio? What is its balanced-growth path level of not output per worker but of consumption spending per worker--where consumption spending is equal to output minus savings? (And the
- b. Suppose that the economy's savings rate $s=25\%$ of GDP. What is the economy's balanced-growth path capital-output ratio? What is its balanced-growth path level of not output per worker but of consumption spending per worker--where consumption spending is equal to output minus savings?
- c. Suppose that the economy's savings rate $s=30\%$ of GDP. What is the economy's balanced-growth path capital-output ratio? What is its balanced-growth path level of not output per worker but of consumption spending per worker--where consumption spending is equal to output minus savings?
- d. If you could choose to start the economy with one of the capital-output ratios and corresponding savings rates of parts (a), (b), and (c), which would you choose? Why?
- e. If you were a benevolent central planner starting out with a relatively poor economy--one with a current capital-output ratio of one--and you wanted to maximize social welfare, would you choose the savings rate corresponding to (a), (b), or (c)? Why? What do you think social welfare is, and how does it relate to the time path of output per worker that comes out of the growth model?

Question 4: Suppose that you have twenty minutes to write and need to teach somebody who has taken neither macroeconomics nor economic history why those of us lucky enough to live in the world economy's industrial core are so rich today, relative both to our geographic predecessors several centuries ago and to the billions living in poorer economies in the world. What do you write?