

Economics 101b Midterm: Fall 2001

1. **Long-Run Growth (30 points).** Consider the Solow growth model, in which output per worker along the steady-state growth path is given by:

$$\frac{Y_t}{L_t} = (\kappa^*)^\lambda \times E_t$$

where the steady-state capital-output ratio κ^* is given by:

$$\kappa^* = \frac{s}{n + g + \delta}$$

where the growth multiplier λ is a simple function of the diminishing-returns-to-scale parameter α in the production function:

$$\lambda = \frac{\alpha}{1 - \alpha}$$

and where s is the economy's savings-investment rate, n is the labor force growth rate, δ is the depreciation rate, and g is the proportional rate of growth of the efficiency of labor E_t .

- a. Suppose that we have two economies A and B, identical save that in economy A the efficiency of labor is twice that of economy B. What is the ratio of their steady-state output per worker levels?
- b. Suppose that at some point in the past economies A and B had had the same levels of the efficiency of labor, but that labor efficiency in A had then begun growing at 2% points per year faster than in B. About how many years would it take before economy A had twice the labor efficiency of economy B?
- c. Now change the situation slightly. Suppose that in addition to the difference in efficiency of labor levels, economy A has a savings-investment rate 1.5 times as large as economy B because investment goods tend to be cheaper in rich countries. If the diminishing-returns-to-scale parameter $\alpha = 2/3$, what is the ratio of the two economies' steady-state output per worker levels?
- d. Now change the situation slightly. Suppose that in addition to the difference in efficiency of labor levels, economy A has a savings-investment rate 1.5 times as large as economy B because investment goods tend to be cheaper in rich countries. If the diminishing-returns-to-

scale parameter $\alpha = 1/4$, what is the ratio of the two economies' steady-state output per worker levels?

- e. Explain why—using words only—the impact of the difference in efficiency-of-labor levels (and the consequences of that difference) so much bigger in part d. than it was in part c.

2. **Flexible-Price Macro (30 points).** Suppose that we have our standard flexible-price macro model:

$Y = Y^*$	the full-employment assumption
$C = C_0 + C_y \times (1-t) \times Y$	the consumption function
$I = I_0 - I_r \times r$	the investment function
$\epsilon = \epsilon_0 - \epsilon_r \times (r - r^f)$	the exchange rate
$NX = (X_f \times Y^f) + (X_\epsilon \times \epsilon) - (IM_y \times Y)$	net exports
$Y = C + I + G + NX$	the national income identity

and:

$G = G$	government purchases equal to whatever the government chooses
$T = tY$	taxes T are equal to the tax rate t times national income Y.

- a. Start from the national income identity, our way of expressing the circular flow principle. Manipulate the equation by shifting everything save investment over to the left-hand side, and rewrite the left-hand side to arrive at the savings-investment identity: that investment (I) is equal to the sum of private savings (income Y minus consumption C minus taxes T), public savings (taxes T minus government purchases G), and the capital inflow from abroad (minus net exports, - NX).
- b. Suppose that the economy starts from a position of equilibrium, and then that the only shock to economic policy or to the economic environment is an increase in foreign national income Y^f by an amount ΔY^f . Write down an algebraic expression for the change in the equilibrium real interest rate generated by this change in foreign national income.
- c. Write down algebraic expressions for the change in net exports and the change in investment generated by this change in foreign national income.
- d. Explain—in one paragraph (qualitatively only, using words only)—to someone who has not taken intermediate macroeconomics just why it is that an increase in national income

overseas leads to (a) a rise in the real interest rate, (b) a fall in the exchange rate (the value of foreign currency), (c) a rise in net exports, and (d) a fall in investment spending.

- e. If the government asked you what changes in economic policy it should make if it wanted to make sure that investment spending did not fall in the wake of the rise in national income abroad, what policy changes would you recommend?

3. Money and Inflation (10 points). Begin with the quantity equation:

$$M \times V = P \times Y$$

and the further assumption that velocity V is an increasing function of the nominal interest rate i .

- a. What would you expect to happen to the price level if, everything else being fixed, the government doubled the money stock this year and convincingly claimed that this was a once-and-for-all emergency level? Give a quantitative answer, and explain why.
- b. What would you expect to happen to the price level if, everything else being fixed, the government doubled the money stock this year and announced that doubling would be repeated every year? (You shouldn't give a quantitative answer, but you should explain whether the change in the price level this year would be greater or less than in part a., and you should explain why.)

4. Sticky-Price Macro (30 points). Consider the sticky-price macro model:

$C = C_0 + C_y \times (1 - t) \times Y$	the consumption function
$I = I_0 - I_r \times r$	the investment function
$\varepsilon = \varepsilon_0 - \varepsilon_r \times (r - r^f)$	the exchange rate
$NX = (X_f \times Y^f) + (X_\varepsilon \times \varepsilon) - (IM_y \times Y)$	net exports
$Y = C + I + G + NX$	the aggregate demand equation

and:

$G = G$	government purchases equal to whatever the government chooses
$T = tY$	taxes T are equal to the tax rate t times national income Y .

with

r , the real interest rate, set by the central bank.

- a. Start from the aggregate demand equation. Substitute in the equations for consumption and net exports, and derive an algebraic expression for real GDP Y as a function of autonomous spending A :

$$A = C_0 + I + G + (X_f \times Y^f + X_e \times \varepsilon)$$

and of the marginal propensity to expend on domestic products, the MPE:

$$MPE = C_y(1 - t) - IM_y$$

- b. If the marginal propensity to consume out of disposable income C_y is 0.8, the tax rate t is 0.25, and the share of national income spent on imports IM_y is 0.10, what is the multiplier? That is, what is the effect on equilibrium real GDP Y of a \$1 increase in autonomous spending A ?
- c. Suppose total autonomous spending is \$6 trillion, and the other parameter values are as given in part b. What is the equilibrium level of real GDP Y ?
- d. Suppose that the interest sensitivity of investment I_r is 75—so that a one percentage point increase in the real interest rate r lowers investment spending by \$75 billion—and that the product of the sensitivity of exports to the exchange rate X_e and the sensitivity of the exchange rate to the interest rate ε_r is also 75—so that a one percentage point increase in the real interest rate lowers gross exports by \$75 billion. Suppose the central bank raises the real interest rate by two percentage points. By how much does autonomous spending A fall? By how much does equilibrium real GDP Y fall?
- e. What is the slope of the IS curve in this economy?