

Part 3: Application questions (42 points)

1. (8 points) In a fixed economy, assume that a competitive economy can be described by a constant returns to scale (Cobb–Douglas) production function and all factors of production are fully employed. Holding other factors constant, including the quantity of labor and technology, carefully explain how a one-time, 50-percent decrease in the quantity of capital (perhaps the result of war damage) will change each of the following:

- a. the level of output produced; **(2 points)**
- b. the real wage of labor; **(2 points)**
- c. the real rental price of capital; **(2 points)**
- d. capital's share of total income. **(2 points)**

Answers:

- a. Output decreases by less than 50 percent because of diminishing returns to capital.
- b. The real wage decreases because the average productivity of labor decreases (Y/L decreases, as Y decreases and L is constant), so the MPL , which equals $(1 - \alpha)Y/L$, decreases.
- c. The real rental price of capital increases because the average productivity of capital increases (Y/K increases, as Y decreases proportionally less than K decreases), so the MPK , $\alpha Y/K$ increases.
- d. Capital's share of income is unchanged since it depends only on the parameter (α) from the production function, which does not change.

2. (8 points) An economy has a monetary base of 1,000 \$1 bills. Calculate the money supply in scenarios (a)–(d) and then answer part (e).

- a. All money is held as currency. **(1 points)**
- b. All money is held as demand deposits. Banks hold 100 percent of deposits as reserves. **(1 points)**
- c. All money is held as demand deposits. Banks hold 20 percent of deposits as reserves. **(2 points)**
- d. People hold equal amounts of currency and demand deposits. Banks hold 20 percent of deposits as reserves. **(2 points)**
- e. The central bank decides to increase the money supply by 10 percent. In each of the above four scenarios, how much should it increase the monetary base? **(2 points)**

Answers:

- a. If all money is held as currency, then the money supply is equal to the monetary base. The money supply is \$1,000.
- b. If all money is held as deposits but banks hold 100 percent of deposits in reserve, then there are no loans. The money supply is \$1,000.
- c. If all money is held as deposits and banks hold 20 percent of deposits in reserve, then the reserve–deposit ratio is 0.2, the currency–deposit ratio is 0, and the money multiplier is $1/0.2 = 5$. The money supply is \$5,000.

- d. If people hold an equal amount of currency and deposits, then the currency–deposit ratio is 1, the reserve–deposit ratio is 0.2, and the money multiplier is $(1 + 1)/(1 + 0.2) = 1.67$. The money supply is \$1,666.67.
- e. The money supply is proportional to the monetary base and is given by $M = m \times B$, where M is the money supply, m is the money multiplier, and B is the monetary base. In each scenario, for a given money multiplier, a 10-percent increase in the monetary base B leads to a 10-percent increase in the money supply M . □

3. (8 points) Assume that a series of inflation rates is 1 percent, 2 percent, and 4 percent, while nominal interest rates in the same three periods are 5 percent, 5 percent, and 6 percent, respectively.

- a. What are the ex post real interest rates in the same three periods? **(2 points)**
- b. If the expected inflation rate in each period is the realized inflation rate in the previous period, what are the ex ante real interest rates in periods two and three? **(3 points)**
- c. If someone lends in period two, based on the ex ante inflation expectation in part b, will he or she be pleasantly or unpleasantly surprised in period 3 when the loan is repaid? **(3 points)**

Answers:

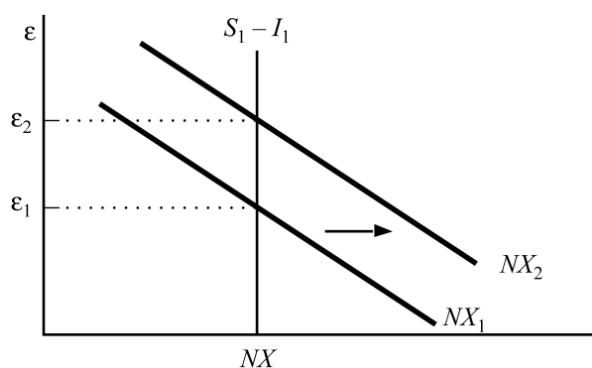
- a. 4 percent; 3 percent; 2 percent
- b. 4 percent; 4 percent
- c. He or she will be unpleasantly surprised.

4. (9 points) The government of a small open economy wishes to promote trade policies that will result in currency appreciation.

- a. Would protectionist policies (higher tariffs and more quotas) or freer trade policies (tariff reductions and quota eliminations) be more effective in generating currency appreciation? **(2 points)**
- b. Illustrate graphically the impact of the trade policy on the exchange rate of the small open economy. **(2 points)**
- c. What will happen to the trade balance of the small open economy as a result of the trade policies, assuming that the country started from a position of free trade? **(2 points)**
- d. What will happen to the quantity of exports and imports as a result of the trade policies? **(3 points)**

Answers:

- a. Protectionist policies will result in currency appreciation
- b. The protectionist policies increase the demand for net exports, and the curve shifts to the right, causing the exchange rate increasing.



- c. The trade balance will remain unchanged and still balanced.
- d. The volume of exports will decrease (as a result of the currency appreciation), and the volume of imports will decrease (as a result of the protectionist policies and currency appreciation).

5. (9 points) An economy has a Cobb–Douglas production function:

$$Y = K^a (LE)^{1-a}$$

The economy has a capital share of a third, a saving rate of 24 percent, a depreciation rate of 3 percent, a rate of population growth of 2 percent, and a rate of labor-augmenting technological change of 1 percent. It is in steady state.

- a. At what rates do total output, output per worker, and output per effective worker grow? **(3 points)**
- b. Solve for capital per effective worker, output per effective worker, and the marginal product of capital. **(3 points)**
- c. Does the economy have more or less capital than at the Golden Rule steady state? How do you know? To achieve the Golden Rule steady state, does the saving rate need to increase or decrease? **(3 points)**

Answers:

- a. total output grows at 3 percent, output per worker grows at 1 percent, and output per effective worker is constant.

b.

$$0.24k^{1/3} = (0.03 + 0.02 + 0.01)k$$

$$k^{2/3} = 4$$

$$k = 8.$$

$$y = k^{1/3} = 2$$

$$MPK = (1/3)k^{-2/3} = 1/12$$

- c. In the Golden Rule steady state, the marginal product of capital is such that $\delta + n + g = 0.06$. In the current steady state, the marginal product of capital is $1/12$, or 0.083 . Since there are diminishing marginal returns to capital, this economy has less capital per effective worker than in the Golden Rule steady state. To increase capital per effective worker, there must be an increase in the saving rate.