# Assignment 3: IS-LM and Econ Growth 2

**Question 1**

Suppose an economy described by the Solow model has the following production function:

$$Y = K^{1/2}(L \times E)^{1/2}$$

**a.** For this economy, what is $f(k)$?

**b.** Use your answer in part **a** to solve for the steady-state value of y as a function of $s$, $n$, $g$, and $\delta$.

**c.** Two neighboring economies have the above production function, but they have different paramter values. Atlantis has a saving rate of 28 percent and a population growth rate of 1 percent per year. Xanadu has a saving rate of 10 percent and a population growth rate of 4 percent per year. In both countries, \$g=\$0.02 and $\delta = 0.04$. Find the steady-state value of $y$ for each country.

**Question 2**

An economy has a Cobb-Douglas production function:

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

The economy has a capital share of a third, 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?

**b.** Solve for capital per effective worker, output per effective worker, and the marginal product of capital.

**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?

**Question 3**

In the U.S. the capital share of GDP is about 30 percent, the average growth in output is about 3 percent per year, the depreciation rate is about 4 percent per year, and the capital-output ratio is about 2.5. Suppose that the production function is Cobb-Douglas and that the U.S. has been in a steady state.

**a.** What must the saving rate be in the initial steady state?[Use the relationship, $sy = (\delta + n + g)k$]

**b.** What is the marginal product of capital in the initial steady state?

**c.** Suppose that public policy alters the saving rate so that the economy reaches the Golden Rule level of capital. What will the marginal product of capital be at the Golden Rule steady state. Compare the marginal product at the Golden Rule steady state to the marginal product in the initial steady state. Explain.

**d.** What will the capital-output ratio be at the Golden-Rule steady state? (For the Cobb-Douglas production function, the capital-output ratio is related to the marginal product of capital.)

**e.** What must the saving rate be to reach the Golden Rule steady state?

**Question 4**

Use the Keynsian cross model to predict the impact on equilibrium GDP of the following. In each case, state the direction of the change and give a formula for the size of the impact.

**a.** An increase in government purchases

**b.** An increase in taxes

**c.** Equal-sized increase in both government purchases and taxes

**Question 5**

In the Keynsian cross model, assume that consumption is given by

$$C = 120 + 0.8(Y - T)$$

Planned investment is 200; government purchases and taxes are both 400.

**a.** Graph planned expenditure as a function of income.

**b.** What is the equilibrium level of income?

**c.** If government purchases increase to 420, what is the new equilibrium income? What is the multiplier for government purchases?

**d.** What level of government purchases is needed to achieve an income of 2400?(Taxes remain at 400.)

**e.** What level of taxes is needed to achieve an income of 2,400(Government purchases remain at 400.)

**Question 6**

Suppose that the money demand function is

$$(M/P)^d = 800 - 50r$$

where $r$ is the interest rate in percent. The money supply $M$ is 2,000 and the price level $P$ is fixed at 5.

**a.** Graph the supply and demand for real money balances.

**b.** What is the equilibrium interest rate?

**c.** What happens to the equilibrium interest rate if the supply of money is reduced from 2,000 to 1,500?

**d.** If the central bank wants the interest rate to be 4 percent, what money supply should it set.

**Question 7**

According to the IS-LM model, what happens in the short run to the interest rate, income, consumption, and investment under the following circumstances? Be sure your answer includes an appropriate graph.

**a.** The central bank increases the money supply.

**b.** The government increases government purchases.

**c.** The government increases taxes.

**d.** The government increases government purchases and taxes by equal amounts.

**Question 8**

Consider the economy of Hicksonia.

**a.** The consumption function is given by

$$C = 300 + 0.6(Y - T)$$

The investment function is

$$I = 700 - 80r$$

Government purchases and taxes are both 500. For this economy graph the IS curve for $r$ ranging from 0 to 8.

**b.** The money demand function in Hicksonia is

$$(M/P)^d = Y - 200r$$

The money supply is 3,000 and the price level P is 3. Graph the LM curve for $r$ ranging from 0 to 8.

**c.** Find the equilibrium interest rate $r$ and the equilibrium level of income $Y$.

**d.** Suppose that government purchases are increased from 500 to 700. How does the IS curve shift? What are the new equilibrium interest rate and level of income?

**e.** Suppose instead that the money supply is increased from 3,000 to 4,500. How does the LM curve shift? What are the new equilibrium interest rate and level of income?

**f.** With the initial values for monetary and fiscal policy, suppose that the price level rises from 3 to 5. What happens? What are the new equilibrium interest rate and level of income?

**g.** For the initial values of monetary and fiscal policy, derive and graph an equation for the aggregate demand curve. What happens to this aggregate demand curve if fiscal or monetary policy changes, as in parts **d** and **e**?

**Question 9**

An economy is initially described by the following equations:

$$\begin{aligned} C &= 500 + 0.75(Y - T) \\ I &= 1,000 - 50r \\ M/P &= Y - 200r \\ G &= 1,000 \\ T &= 1,000 \\ M &= 6,000 \\ P &= 2 \end{aligned}$$

**a.** Derive and graph the IS curve and the LM curve. Calculate the equilibrium interest rate and level of income. Label that point A on your graph.

**b.** Suppose that a newly elected president cuts taxes by 20 percent. Assuming the money supply is held constant, what are the new equilibrium interest rate and level of income. What is the tax multiplier?

**c.** Now assume the central bank adjusts the money supply to hold the interest rate constant. What is the new level of income? What must the new money supply be? What is the tax multiplier?

**d.** Now assume that the central bank adjusts the money supply to hold income constant. What is the new equilibrium interest rate? What must the money supply be? What is the tax multiplier?

**e.** Show the equilibria you calculated in parts **b**, **c**, and **d** on the graph you drew in part **a**. Label them points B, C, D.