1 IS-LM Microfoundations

Explain why each of the following statements is either true or false. If true, discuss the short-run impact of monetary versus fiscal policy in these special cases.

**Solution:** All four statements are true.

a. If investment does not depend on the interest rate, the IS curve is vertical.

**Solution:** For a generic IS curve, \( Y = a - b \cdot r \), \( Y = a \) when \( b = 0 \), i.e., when investment does not depend on the interest rate (assuming that the real interest rate does not enter the consumption function). When the IS curve is vertical, monetary expansions (contractions) shifting in the LM curve will have no short-run impact on real output, but the real interest rate will fall (rise). Fiscal expansion (contraction) shifting the IS curve will still increase (decrease) short run real output, and there is no longer any countervailing investment crowd-out (crowd-in). So monetary policy loses efficacy and fiscal policy gains traction.

Answers for ‘False’ also accepted if you argue that the real interest rate will still enter the IS curve through consumption.

b. If money demand does not depend on the interest rate, the LM curve is vertical.

**Solution:** For a generic LM curve, \( Y = a/P + b \cdot r \), \( Y = a/P \) when \( b = 0 \), i.e., a vertical line for a fixed short-run price level when money demand does not depend on the interest rate. When the LM curve is vertical, fiscal expansions (contractions) will have no short-run impact on real output, but the real interest rate will rise (fall). Monetary policy can still increase or decrease short run real output; the response of the interest will be particularly strong. So monetary policy gains efficacy and fiscal policy loses all traction.

c. If money demand does not depend on income, the LM curve is horizontal.

**Solution:** True. \( M/P = L(r) \) when \( Y \) doesn’t enter the money demand function, yielding a single market clearing real interest rate for a given money supply. When the LM curve is horizontal, monetary expansions or contractions (vertical shifts of the LM curve) will affect both output and the real interest rate. Fiscal policy can still increase or decrease short run real output; there will be no impact on the real interest rate, so fiscal expansion doesn’t produce any countervailing investment crowd-out.

d. If money demand is extremely sensitive to the interest rate, the LM curve is horizontal.

**Solution:** True. If money demand is extremely sensitive to the interest rate, it barely takes any movement of the interest rate to reduce money demand and restore equilibrium, so the LM curve is virtually flat. But an increase in the money supply no longer shifts the LM curve, as the LM curve is essentially tied to a single equilibrium interest rate, regardless of the money supply. As in (1c), fiscal policy is particularly effective because there is no investment crowd-out through the interest rate channel.

2 IS-LM / AS-AD Equilibrium

An economy’s full-employment level of nominal output, \( \bar{Y} \), is 1,000. Government spending, \( G \), is 200 and the nominal money supply, \( M^e \), is 5,000. Expected inflation, \( \pi^e \), is 2%. Desired consumption, desired
investment, real money demand, and government taxes are are given as follows:

\[ C^d = 200 + \frac{2}{3}(Y - T) - 500r \]
\[ I^d = \frac{500}{3} - 500r \]
\[ L = 0.5Y - 250(r + \pi^e) \]
\[ T = 0.25Y - 50 \]

a. Derive the IS curve and the LM curve.

**Solution:**

\[ S^d = Y - C^d - G \]
\[ = Y - (200 + \frac{2}{3}(Y - (0.25Y - 50)) - 500r) - 200 \]
\[ = Y - 400 - \frac{Y}{2} - \frac{100}{3} - 500r \]
\[ = \frac{Y}{2} - \frac{1300}{3} - 500r \]
\[ I^d = \frac{500}{3} - 500r \]

\[ S^d = I^d \iff \frac{Y}{2} = \frac{1800}{3} - 1000r \]

**IS:** \[ Y = 1200 - 2000r \]

**LM:** \[ \frac{M^s}{P} = L \iff \frac{5000}{P} = 0.5(Y) - 250r - 5 \]

b. What are the general equilibrium values of the real interest rate, price level, consumption, and investment?

**Solution:** Plugging \( \bar{Y} \) into the IS curve:

\[ 1000 = 1200 - 2000r \]
\[ \iff r = 0.10 \]

Plugging \( \bar{Y} \) and \( r = 0.1 \) into the LM curve:

\[ \frac{5000}{P} = 0.5(1000) - 250(0.1) - 5 \]
\[ P \approx 10.64 \]

\[ I = \frac{500}{3} - 500(0.1) = 116.67 \]
\[ C = 200 + \frac{2}{3}(1000 - (0.25(1000) - 50)) - 500(0.1) = 683.33 \]

c. If the government raises spending to 250, what will be the new equilibrium values of the real interest rate, price level, consumption, and investment? What happens to the government’s fiscal balance?
Solution:

\[ S^d = Y - C^d - G \]
\[ = Y - (200 + \frac{2}{3}(Y - (0.25Y - 50)) - 500r) - 250 \]
\[ = Y - 450 - \frac{Y}{2} - \frac{100}{3} - 500r \]
\[ = \frac{Y}{2} - \frac{1450}{3} - 500r \]

\[ S^d = I^d \Leftrightarrow Y \]
\[ \frac{Y}{2} = \frac{1950}{3} - 1000r \]

\[ IS : \quad Y = 1300 - 2000r \]
\[ 1000 = 1300 - 200r \Leftrightarrow r = 0.15 \]

\[ LM : \quad \frac{5000}{P} = 0.5(1000) - 250(0.15) - 5 \Leftrightarrow P \approx 10.93 \]

\[ I = \frac{500}{1} - 500(0.15) = 91.67 \]
\[ C = 200 + \frac{2}{3}(1000 - (0.25(1000) - 50)) - 500(0.15) = 658.33 \]

When \( G = 200, S^g = T - G = (0.25(1000) - 50) - 200 = 0 \)

When \( G = 250, S^g = T - G = (0.25(1000) - 50) - 250 = -50 \)

**d.** Calculate the “Keynesian” government spending multiplier for this economy and compare it with the long-run government spending multiplier implied by this AS-AD model.

**Solution:** The “Keynesian Cross” government spending multiplier is derived from the marginal propensity to consume (MPC), \( \frac{\Delta Y}{\Delta G} = \frac{1}{1 - MPC} \), where MPC is implicitly defined as \( C = C^a + MPC(Y - T) \). See ISLM slides.

\[ C = 200 + \frac{2}{3}(Y - (0.25Y - 50)) - 500r \]
\[ = C^a + 0.5Y + br \]

So \( MPC = 0.5 \), \( \frac{\Delta Y}{\Delta G} = \frac{1}{1 - 0.5} = 2 \).

The long-run government spending multiplier in the AS-AD model is zero, as output is determined by the vertical long-run aggregate supply curve, where output is at full employment levels.

### 3 Neutrality of Money

**a.** What does it mean for money to be neutral?

**Solution:** Money is neutral if a change in the money supply only affects nominal variables (e.g., prices, nominal wages), having no effect on real variables (e.g., real GDP).

**b.** What are the policy implications of the neutrality of money?

**Solution:** If money is neutral, expansionary monetary policy cannot be used to increase real GDP.

**c.** What empirical evidence do we have for or against the neutrality of money?

**Solution:** Reductions in money supply growth is almost always correlated with short-run increase in unemployment and decreases in real GDP. Romer and Romer have documented episodes of monetary non-neutrality (e.g., the recessions of 1980 and 1981 following monetary tightening, and the monetary expansion of 1982 being followed by a boom). See RBC slides.
4 U.S. Monetary and Fiscal Policy in the 1980s

In the early 1980s, the U.S. federal government cut taxes and increased budget deficits while the Federal Reserve pursued a tight monetary policy.

What is the short-run impact of this policy mix suggested by the IS-LM / AS-AD framework? Explain and depict your answer graphically. What about the long-run impact?

**Solution:** Expansionary fiscal policy and contractionary monetary policy will shift out the IS curve (to the right) and shift in the LM curve (to the left) in the short-run. The real interest rate will unequivocally rise, while the net impact on real GDP depends on the relative magnitude of the two policy shifts. In the long run, prices adjust and real output return to the level determined by long run aggregate supply. The change in prices depends on whether the aggregate demand curve has shifted upwards or downwards as the net result of the countervailing policy changes.