Answers, homework 14

1. Consider a traditional IS curve: output, Y, is the sum of investment, I, consumption, C, and government expenditures, G. Consumption is assumed to be a linear function of disposable income, $Y - T$: $C = a + b(Y - T)$, where $a > 0$, $0 < b < 1$, and T is current taxes. Investment is assumed to be linear function of the real interest rate, r_+: $I = d - er_+$, where $d > 0$ and $e < 0$. Government spending is just a constant. In the following cases, suppose that the interest rate, $r+$, remains constant.

   (a) The IS curve is given by $Y = a + b(Y - T) + d - er_+ + G$, or

   $$Y = \frac{1}{1-b}(a - bT + d - er_+ + G).$$

   Case 1. $\Delta T = 0$.

   $$Y + \Delta Y = \frac{1}{1-b}(a - bT + d - er_+ + G + \Delta G).$$

   Solve for ΔY (subtract the first equation from the second) to obtain

   $$\Delta Y = \frac{1}{1-b}\Delta G,$$

   i.e., $\Delta Y > \Delta G$, a "multiplier" effect.
   Case 2: $\Delta T = \Delta G$. Now we have

   $$Y + \Delta Y = \frac{1}{1-b}(a - b(T + \Delta G) + d - er_+ + G + \Delta G).$$

   Again subtract equations to find $\Delta Y = \Delta G$: no multiplier effect (the tax increase lowers consumption, exactly cancelling the increase in consumption due to increased income—in fact, disposable income now remains unchanged).
   Case 3. $\Delta T = 0.5\Delta G$. Now

   $$Y + \Delta Y = \frac{1}{1-b}(a - b(T + 0.5\Delta G) + d - er_+ + G + \Delta G)$$

   so

   $$\Delta Y = \frac{1 - 0.5b}{1-b}\Delta G,$$

   which is an in-between case: there is a (smaller) multiplier effect.

   (b) We have

   $$Y = \frac{1}{1-b}(a - bT + d - er_+ + G).$$

   and

   $$Y + \Delta Y = \frac{1}{1-b}(a - bT + d + \Delta d - er_+ + G + \Delta G),$$

   so we obtain

   $$\Delta Y = \frac{1}{1-b}\Delta d > \Delta d,$$

   i.e., we have a multiplier effect.

(c) In country 1, we have (from a)

$$\Delta Y = \frac{1 - b_1\phi}{1 - b_1}\Delta G,$$

where ϕ is the fraction of the G increase financed by taxes, and in country 2 we have

$$\Delta Y = \frac{1 - b_2\phi}{1 - b_2}\Delta G.$$

Because $\frac{1-b\phi}{1-b} = \frac{1-b\phi-b+b}{1-b} = \frac{1-b+b(1-\phi)}{1-b} = 1 + \frac{b}{1-b}$ is clearly increasing in b, country 1 has a higher increase in output. This is because the multiplier effects are stronger there: out of every extra dollar of increase in government expenditure, the resulting income consumers get translates into higher consumption demand, and thus a higher additional increase in output, and so on.

(d) The IS curve is given by $Y = a + b(Y - f - gY) + d - er_+ + G$, or

$$Y = \frac{1}{1 - b(1-g)}(a - bf + d - er_+ + G).$$

You now have

$$Y + \Delta Y = \frac{1}{1 - b(1-g)}(a - bf + d - er_+ + G + \Delta G),$$

and subtracting the first equation from the second we get

$$\Delta Y = \frac{1}{1 - b(1-g)}\Delta G,$$

Since the new level of taxes are equal to $T + \Delta T = f + g(Y + \Delta Y)$, using the previous result we have

$$\Delta T = g\frac{1}{1 - b(1-g)}\Delta G,$$

which means that the borrowing which must now be done to finance the increase in government expenditure is smaller by this amount:

$$\Delta B = -g\frac{1}{1 - b(1-g)}\Delta G,$$

where B stands for borrowing.

(e) We have, before the change,

$$Y = a + b(Y - T) + d - er_+ + G$$

and after the change

$$Y + \Delta Y = a + b(Y - T - \Delta G) + d - er_+ + G + \Delta G,$$

where in case (i) $T + \Delta G = f + \Delta f + g(Y + \Delta Y)$ and in case (ii) $T + \Delta G = f + (g + \Delta g)(Y + \Delta Y)$.

Clearly, it does not matter how the tax schedule is changed: the first two equations imply that $\Delta Y = \Delta G$ (i.e., no multiplier effect), for the same reason as in question 1(b). In case (i) we get $\Delta f + g\Delta Y = \Delta G$, which gives

$$\Delta f = (1 - g)\Delta G.$$

In case (ii), we have $(g + \Delta g)(Y + \Delta Y) - gY = \Delta G$, so

$$\Delta g = \frac{\Delta G + gY}{\Delta G + y} - g,$$

which is in between g and 1, i.e., tax rates increase.

2. Use graphical analysis: just apply the curve shifting in the book (together with MPL= W/P from the firm's profit-maximization condition). In case (i), the LM curve first shifts right, and then back, because as output increases, the real wage must fall, which can only be accomplished with a rise in prices, and this is what makes the LM curve shift left. Output increases, interest rates fall, and prices rise. In case (ii), the initial impulse is that the IS curve shifts left, and then the LM curve shifts right. Output falls, interest rates fall, and prices fall.

3. The Phillips curve is a negative relation between inflation and unemployment. If monetary policy manages to surprise the economy with a higher than expected rate of money growth, inflation will rise and unemployment fall, using the AS/AD analysis from the book. However, it is hard to imagine that the government could systematically surprise private agents, so on average it is likely not possible to attain a lowered unemployment rate.

4. In a real business cycle model, if a positive technology shock hits, output goes up, and some of this output increase is consumed whereas the rest is invested/saved to be consumed later (if consumption at different dates are "normal goods"). That is, if these kinds of shocks drive cycles, C and I move together.

   In a model of the IS/LM type, if an increase in animal spirits of investors raises investment, output increases with an associated increase in disposable income, so consumption increases as well. That is, this model can also give a positive association between C and I. However, if an increase in consumer confidence increases output, the IS curve shifts right so the real interest rate rises, which lowers investment. I.e., this kind of shock implies that consumption and investment move in opposite directions. Finally, if it is the money stock that causes an output increase, then consumption rises as above and, due to the rightward shift in the LM curve, real interest rates fall which increases investment, thus again leading to a positive comovement of C and I.