

**EC202C1 – Intermediate Macroeconomic Analysis
Spring 2012, Boston University**

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First Mid-term Exam (Practice #2)

Thursday, February 23, 2012

This is a 50-minute exam. There is a total of 50 points allocated across two questions. Use the number of points allocated to each part as a suggestion for how long to spend on that part. I recommend that you attempt all parts before using more time than is suggested for any one part. If you complete some parts in less than the suggested time, use your extra time to revisit parts you may have had trouble with the first time through and to check your work.

Please read the questions carefully and write your answers in the space provided. You can use the backs of the sheets for scrap paper, but to get full credit you must show all relevant work in the space provided.

Please follow my instructions at all times.

Concentrate and think carefully, but try to relax too!

Student Number: Solutions

(Please do not include your name.)

1. [28 points total, 4 parts] Consider an economy characterized by the following Aggregate Supply and Aggregate Demand relations:

$$P = P^e(0.5 + 0.0005Y) \quad [AS]$$

$$P = 10 - 0.008Y + 0.01G \quad [AD].$$

a) [4 points]

i. Confirm that the natural level of output is 1000.

ii. If the economy starts in medium run equilibrium with government expenditure of $G = 200$, find: the level of output; the actual price level; and the expected price level.

answer:

i. When the economy is in its natural state, the expected price level is equal to the actual price level. Substitute this condition into the AS curve:

$$P = P^e(0.5 + 0.0005Y)$$

$$P = P(0.5 + 0.0005Y)$$

$$1 = 0.5 + 0.0005Y$$

$$0.0005Y = 1 - 0.5$$

$$Y_n = 0.5/0.0005 = 1000.$$

ii. In medium run equilibrium, output will be equal to the natural level (which we just confirmed to be 1000), and the price level (which will, by definition, be equal to the expected price level) will be determined by the height of the AD curve:

$$P = 10 - 0.008Y + 0.01G$$

$$P = 10 - 0.008(1000) + 0.01(200) = 10 - 8 + 2 = 4.$$

And since $P^e = P$ for medium run equilibrium, $P^e = 4$ also.

b) [9 points] Now suppose that government expenditure rises to $G = 400$ and is held at this new level indefinitely.

i. Find the short run equilibrium level of output and the price level that would arise when considering the goods and financial markets only, that is, disregarding any adjustment to the new output level in the labor market.

ii. Find the short run equilibrium level of output and the price level corresponding with simultaneous equilibrium in the goods, financial, and labor markets.

answer:

i. Disregarding any adjustment in the labor market, the price level would stay fixed at the level found above – namely 4 – and output would be determined by the aggregate demand curve alone at this price level:

$$P = 10 - 0.008Y + 0.01G$$

$$4 = 10 - 0.008Y + 0.01(400)$$

$$0.008Y = 10 + 4 - 4$$

$$\hat{Y} = 10/0.008 = 1250.$$

ii. With adjustment in the labor market as well as the goods market and financial markets, the short run equilibrium will be determined by the intersection of the aggregate supply and aggregate demand curves:

$$AS = AD$$

$$P^e(0.5 + 0.0005Y) = 10 - 0.008Y + 0.01G$$

$$4(0.5 + 0.0005Y) = 10 - 0.008Y + 0.01(400)$$

$$2 + 0.002Y = 10 - 0.008Y + 4$$

$$0.01Y = 10 + 4 - 2$$

$$Y' = 12/0.01 = 1200.$$

[because price expectations stay at the initial price level in the short run, and government expenditure is given as 400]

$$P' = 10 - 0.008Y' + 0.01G$$

$$P' = 10 - 0.008(1200) + 0.01(400) = 10 - 9.6 + 4 = 4.4.$$

(The increase in government expenditure shifts IS right and output starts to expand towards 1250. But increasing output draws more workers into employment, thus putting upward pressure on nominal wages and hence the price level. The higher price level causes the real value of the money supply to deteriorate, so LM shifts up slightly. The short run equilibrium output level of 1200 represents the net effect of both the IS shift and the LM shift due to the price response.)

c) [6 points] Start from this short run equilibrium corresponding with simultaneous equilibrium in all markets, and continue to assume that $G = 400$. Now suppose that price expectations adjust, such that P^e becomes equal to the actual price level you found for this short run equilibrium. Find the subsequent new short run equilibrium output and price level. (You can round your answers to one or two decimal places, but you should use four decimal places in your intermediate calculations.)

answer:

$$AS = AD$$

$$P^e(0.5 + 0.0005Y) = 10 - 0.008Y + 0.01G$$

$$4.4(0.5 + 0.0005Y) = 10 - 0.008Y + 0.01(400)$$

$$2.2 + 0.0022Y = 10 - 0.008Y + 4$$

$$0.0102Y = 10 + 4 - 2.2$$

$$Y'' = 11.8/0.0102 = 1156.9.$$

[because price expectations have risen to 4.4 (given), and government expenditure is given as 400 still]

$$P'' = 10 - 0.008Y'' + 0.01G$$

$$P'' = 10 - 0.008(1156.9) + 0.01(400) = 10 - 9.25 + 4 = 4.75.$$

d) [9 points] Continue to assume that $G = 400$. Suppose that the economy has completed its convergence to the new medium run equilibrium.

- i. Find the new medium run equilibrium: output level; price level; and expected price level.
- ii. Compared to the original medium run equilibrium in which the economy started, in what direction and by how much has Investment changed? Explain.

answer:

i. In medium run equilibrium, output will be equal to the natural level (which hasn't changed, so is still 1000), and the price level (which will, by definition, be equal to the expected price level) will be determined by the height of the AD curve:

$$P = 10 - 0.008Y + 0.01G$$

$$P_x = 10 - 0.008(1000) + 0.01(400) = 10 - 8 + 4 = 6 = P_x^e.$$

ii. Investment must have fallen because output is the same (1000 in both cases, i.e. the natural level) and the interest rate is higher. How do we know that the interest rate is higher? Expansionary fiscal policy shifts the IS curve right, which pushes up the interest rate; and a rising price level – due to initial labor market adjustment in the short run then subsequent adjustment of price expectations over the medium run – shifts the LM curve up, also pushing up the interest rate.

We can in fact say that Investment has fallen by exactly 200. Why? That's how much government expenditure has risen by (to 400, from its original level of 200). Consumption is exactly the same as in the original equilibrium because output is the same and taxes are implicitly being held constant so that disposable income must be the same. And $Y = C + I + G$ for goods market equilibrium. The left side of this equation does not change, so neither can the right side. Since C also does not change, the increase in G must be exactly offset by a decrease in I of the same magnitude. (In other words, in the medium run, an increase in government expenditure completely crowds out private investment.)

2. [22 points total, 2 parts] Consider a description of the goods market in which the government imposes a separate income tax and business tax. The income tax T_C is imposed on consumers only, and the business tax T_F is imposed on firms only. The following behavioral equations describe the goods market:

$$C = c_0 + c_1(Y - T_C)$$

$$I = b_0 + b_1Y - b_3T_F.$$

Government expenditure is represented by the exogenous constant G throughout.

a) [11 points]

- i. Derive an expression for output when the goods market is in equilibrium.
- ii. Consider the following statement: "Since the business tax is imposed on firms only, an increase in the business tax will not affect consumption." Is the statement true? Explain your answer briefly.

answer:

i.

$$Y = Z \text{ (for equilibrium, as usual)}$$

$$Y = C + I + G$$

$$Y = (c_0 + c_1(Y - T_C)) + (b_0 + b_1Y - b_3T_F) + G$$

$$Y(1 - c_1 - b_1) = c_0 - c_1T_C + b_0 - b_3T_F + G$$

$$Y^* = [1/(1 - b_1 - c_1)][b_0 + c_0 - b_3T_F - c_1T_C + G].$$

ii. The statement is not true. In short, consumption depends on output, and the expression for equilibrium output just derived clearly depends on business taxes. The underlying mechanism is that an increase in the business tax will decrease investment immediately, which will lower demand and, because demand=production, output. Less output means there is less income in the economy, and so, even though income taxes are held constant implicitly, less disposable income. Since consumption depends positively on disposable income and disposable income has fallen, consumption will fall too. (And this will cause a further decrease in output, and so on until the new equilibrium is reached.)

b) [11 points] Now suppose that the government decides how high to set taxes by establishing a revenue requirement, and that this revenue requirement depends on the state of the economy. Specifically, let the revenue requirement be given by

$$R = a_0 + a_1 Y.$$

Total taxes must be equal to this revenue requirement. Further, suppose that a previous law requires income taxes to be set to zero, i.e. $T_C = 0$.

- i. Derive an expression for the short-run equilibrium output level.
- ii. Explain what will happen following an exogenous increase in consumer confidence (c_0) as the goods market adjusts and converges to its new equilibrium.

answer:

i. This turns out to be similar to the practice problem in which taxes depend positively on output, but the background story is a bit different. Here, the government decides on how much revenue to collect based in part on the state of the economy, and then must set taxes at a level to achieve this revenue target. Mechanically, it ends up being similar to an *IS-LM* model, where equilibrium in the goods market has to be combined with equilibrium in another market. Here, the other condition is that the revenue actually collected by the government has to be in “equilibrium” with how much revenue it wants to collect:

$$\begin{aligned} R &= T \\ a_0 + a_1 Y &= T_C + T_F \\ T_F &= a_0 + a_1 Y \quad (\text{because } T_C = 0). \end{aligned}$$

This gives an “*LM*-type” curve that can be substituted into the equilibrium output condition of the previous part:

$$\begin{aligned} Y &= [1/(1 - b_1 - c_1)][b_0 + c_0 - b_3(a_0 + a_1 Y) - c_1(0) + G] \\ Y(1 + (b_3 a_1)/(1 - b_1 - c_1)) &= [1/(1 - b_1 - c_1)][b_0 + c_0 - b_3 a_0 + G] \\ Y^{**} &= [1/(1 - b_1 - c_1 + b_3 a_1)][b_0 + c_0 - b_3 a_0 + G]. \end{aligned}$$

ii. When consumer confidence increases, the goods market will converge to a new equilibrium with an output level that is higher by the multiplier $(1/(1 - b_1 - c_1 + b_3 a_1))$ times the amount by which c_0 increases. In the very short run, the increase in consumer confidence will increase aggregate demand directly. Since demand equals production in goods market equilibrium, production and hence income will be higher as a result of this direct effect. This higher income will then boost consumption and investment (through the c_1 and b_1 effects), which will lead to further indirect increases in output. However, the higher output is also leading the government to set a higher revenue requirement, and therefore to fulfill it by raising the business tax. As discussed in the previous part, this will decrease investment directly, and hence decrease consumption and output indirectly. The slightly lower output will lead to a lower revenue requirement, necessitating a small business tax cut, pushing up output a bit again, and on and on,

back and forth, until the convergence to the new simultaneous equilibrium is complete. Much as with discussions of the steepness of the LM curve and sensitivity of investment to the interest rate, the degree to which the new equilibrium output level will be higher than the previous one (i.e. how big the multiplier is) will be limited by the interaction of how sensitive investment is to business taxation (b_3) and how aggressively the government increases its revenue requirement as the economy grows (a_1).