

Problem Set 3: Aggregate Demand; Aggregate Supply and Expectations

Answer all the parts of the questions separately giving your reasons for your answer.

1. Consider the IS-LM model:

$$\text{IS equation} : Y = \frac{C_0 + I_0 + G - c_1T}{1 - c_1} - \frac{b}{1 - c_1}r \quad (1)$$

$$\text{LM equation} : \frac{M^S}{P} = m_0 + kY - hr \quad (2)$$

- a) The IS equation represents equilibrium in the goods market. What variable is it thought to determine?
- b) The LM equation represents equilibrium in the money market. What variable is it thought to determine?
- c) Suppose that the Federal Reserve increased the money supply through an open market purchase of bonds. Show how that monetary expansion would impact interest rates and output. [Note: here I am looking for you to tell me the mechanism by which an open market purchase has an impact on the money and goods markets. Use the equations above to help you describe the effect.]
- d) Suppose that the government decides to pursue expansionary fiscal policy by cutting taxes. Describe what happens in the goods and money markets as a result of the fiscal expansion. What is the analytical expression for the tax multiplier from the equations above?

2. Suppose that expectations of inflation are not zero, and instead they play a part.

- a) What is the key link between nominal and real interest rates called? What is the equation which describes this link?
- b) How would you incorporate expectations of inflation in equations (1) & (2) above?
- c) Sketch the new IS-LM curves in *nominal* interest rate - output space, i.e. (i, Y) space. What do they look like?

- d) Suppose that expectations of inflation increase. What happens to the IS-LM curves in this space?
- e) What happens to nominal interest rates, real interest rates and output in part (d)? What is the name of this effect?

3. Recall that the IS and LM curves give us aggregate demand, AD, curve:

$$Y = \frac{C_0 + I_0 + G - c_1T - \frac{b}{h}m_0 + \frac{bM^S}{hP}}{1 - c_1 + \frac{bk}{h}} \quad (3)$$

where the slope of the AD curve can be shown to be:

$$\frac{\Delta P}{\Delta Y} = -\frac{P^2h(1 - c_1 + \frac{bk}{h})}{bM^S} \quad (4)$$

- a) Draw the AD curve in price-output, (P,Y), space.
- b) What are the key parameters that would influence the slope of the AD curve?
- c) What variables cause a shift of the AD curve? What variables cause a movement along the AD curve?
- d) Suppose there is an increase in G. What happens to the AD curve? Describe your intuition for what happens as well.
- e). Suppose as is question (1d), that the government cuts taxes. Using equation (3), write down the analytical expression for the tax multiplier. How does the expression you wrote here compare to your answer in question (1d)? Which multiplier is bigger?

4. Consider the supply side and in particular the labor market.

- a) What is the firm's objective? Write down this objective function?
- b) What does the Labor Demand schedule represent? What determines how much labor a firm hires, i.e. how does a firm decide how many workers to hire?
- c) What does the Labor Supply schedule represent? What determines how much labor is supplied, i.e. how does a worker decide how much to work?

d) The labor market equilibrium condition requires labor demand to be equal to the supply of labor. Explain why in the long run, the long run aggregate supply is independent of prices?

5. This question is about the sticky wage model. Consider the equations below for aggregate supply in the labor market:

$$Y = F(\bar{K}, L, Z) = Z\bar{K}^{\frac{1}{2}}L^{\frac{1}{2}} \quad (5)$$

$$L^S = 75 + \omega \quad (6)$$

$$L^d = 200 - 4\omega \quad (7)$$

where \bar{K} is the fixed supply of capital in the long run, Z represents technology, ω represents the **real** wage, and Y is real GDP. You may assume that $Z = 1$.

a) Calculate the value of full employment, L^* , and the equilibrium (anticipated) value of the **real** wage, ω^* .

b) Suppose that the equilibrium value of capital that clears the market for capital, $K^* = 100$. Calculate potential GDP.

c) Suppose that workers had set their **nominal** wage, $W = 3000$. Using your answer for the anticipated real wage ω^* from part (a), calculate the average price that people were expecting to occur, i.e. calculate the value of the price index that people were expecting, P^e . [Hint: Recall that workers had to form expectations about the price level, P^e , before observing P , when setting the contract - they needed this in order to be able to pick a (nominal) wage.]

d) Suppose that the equation for the SRAS curve is given by:

$$P = 80 + 0.4Y^S \quad (8)$$

If the actual price level that occurred was 140, calculate the value of actual real GDP.

e) How does actual GDP compare to potential (i.e. is it higher, lower or the same)? Why? (- just describe the intuition for how output relates to the full employment level of output).

6. Consider the expectations augmented Phillips Curve studied in the lectures.

$$\pi_t = \pi_{t+1}^e + \frac{1}{\alpha}(Y_t - \bar{Y}) + \nu_t$$

- a) How are the Phillips Curve and the Aggregate Supply Curve related?
- b) What is the slope of the Long Run Phillips Curve?
- c) Consider Okun's Law used in the derivation of the Phillips Curve. What does it state? What is the intuition behind it?
- d) What is meant by Rational Expectations? (Note: Here, describe in general what is meant by Rational Expectations, and then give an expression for $\pi^e = \dots$)

For the following parts, I am not expecting you to get a numerical result. Just give some intuition for the general levels of the variables and how they compare to π_{t+1}^e and \bar{Y} .

- e) Suppose that we assume Adaptive Expectations, e.g. $\pi_{t+1}^e = \pi_{t-1}$. How would you expect (on average) inflation to be related to π_{t+1}^e ? What would output (on average) be at?
- f) Now suppose we assume Rational Expectations. How would you expect (on average) inflation to be related to π_{t+1}^e ? What would output (on average) be at?