

PROBLEM SET 3
14.02 Macroeconomics
March 15, 2006
Due March 22, 2006

I. Answer each as True, False, or Uncertain, and explain your choice.

1. Wages are usually below the reservation wage in Europe because the unemployment rate in Europe is so high.

Ans:

False. Wages must always be equal to or greater than reservation wages. Otherwise, people would not want to work, nor would they be looking for work.

2. Powerful labor unions will decrease the natural rate of unemployment.

Ans:

Uncertain/False. If labor unions use their power to increase the wage of their members at a given unemployment rate, then this will lead to an increase in the natural rate.

3. The aggregate supply curve is upward sloping because firms produce more goods at higher prices.

Ans:

False. The AS curve is upward sloping because higher output means a lower unemployment rate, which enhances workers' bargaining power and results in a higher real wage for a given expected price level, and prices go up in response to an increase in wage.

4. The US unemployment rate will not increase as long as there is positive output growth.

Ans:

False. According to Okun's law, the unemployment rate will increase if the growth rate of output is below the normal rate. The normal growth rate roughly equals 3% per year on average in the US.

5. If Lucas and Sargent were right, it would be possible to decrease inflation without an increase in unemployment.

Ans:

Uncertain. This depends on the credibility of the central bank. If the central bank were credible, then it would indeed be able to reduce inflation at no cost in unemployment.

6. Taylor's analysis of staggered wage contracts makes the case for a slow approach to disinflation, but the traditional Phillips curve analysis implies the opposite.

Ans:

False. Both agree on a slow approach to disinflation. The traditional Phillips curve analysis implies a constant sacrifice ratio and therefore suggests the central bank should achieve disinflation slowly to avoid costly sharp drop in output.

II. Short Questions

1. The AS-AD Model

Suppose that the interest rate has no effect on investment.

- a. Can you think of a situation where this may happen?

Ans:

If for example, financial markets function poorly, and firms cannot borrow and have to finance investment through profits (retained earnings), then the interest rate will have no effect on investment. This is admittedly an extreme case.

- b. What does this imply for the slope of the IS curve?

Ans:

The IS curve becomes vertical, i.e. $\frac{dY}{di} = 0$.

- c. What does this imply for the slope of the LM curve?

Ans:

The slope of the LM curve remains the same.

- d. What does this imply for the slope of the AD curve?

Ans:

The AD curve also becomes vertical, i.e. $\frac{dY}{dP} = 0$. An increase in P shifts the LM curve up. However, given a vertical IS curve, the shift of the LM curve has no effect on output. In other words, the increase in the price level increases the interest rate. But the increase in the interest rate does not affect investment and so does not affect demand.

Continue to assume that the interest rate has no effect on investment. Assume that the economy starts at the natural level of output. Suppose there is an increase in z , so that the AS curve shifts up.

- e. What is the short-run effect on the price level and output? Explain in words.

Ans:

The price level goes up and output stays unchanged in the short run. The increase in price reduces the real money supply and thus shifts up the LM curve, which leads to a higher interest rate. However, since the interest rate has no effect on investment, investment and output remain unchanged.

- f. What happens to output and the price level over time? Explain in words. (Hint: Show that the price level keeps increasing forever.) (This is clearly an extreme case, due to the assumption that the interest rate has no effect on investment.)

Ans:

As price goes up, the expected price level goes up also. However, as long as the interest rate has no effect on investment, output will stay unchanged at its original natural level. Since output cannot adjust to its new lower natural level after the shock to z , price continues rising and so does the expected price level. As a result, the real money supply keeps shrinking, and the interest rate keeps rising. Clearly, such dynamics cannot be sustainable, and we need to reconsider our assumptions.

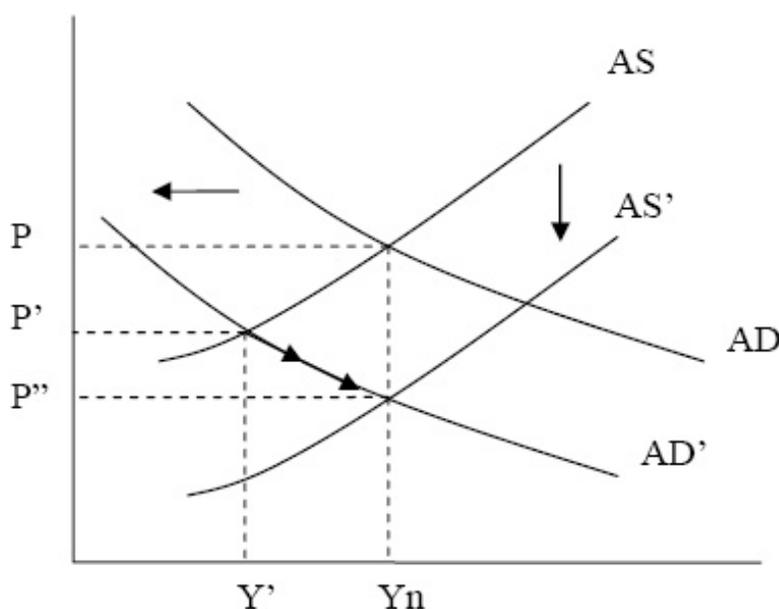
2. Demand Shocks and Demand Management

Assume that the economy starts at the natural level of output. Now suppose there is a decline in business confidence, so that investment demand falls for a given interest rate.

- a. In an AD-AS diagram, show what happens to output and the price level in the short run and the medium run.

Ans:

In the short run, a decline in business confidence shifts in the AD curve. Output drops to a lower level Y' left to the natural level Y_n . The price level falls from P to P' . The expected price level falls with the price level and shifts down the AS curve over time, and at the same time the short-run equilibrium moves along the new AD curve (AD'), until output returns to its natural level. In the medium run, output moves back to Y_n and the price level declines to a lower level P'' .



- b. What happens to the unemployment rate in the short run? In the medium run?

Ans:

The unemployment rate moves in the opposite direction of the level of output. u increases in the short run after a negative shock to investment, but gradually returns to the natural rate as the price level decreases over time.

Suppose that the Federal Reserve decides to respond immediately to the decline in business confidence in the short run. In particular, suppose that the Fed wants to prevent the unemployment rate from changing in the short run after the decline in business confidence.

- c. What should the Fed do? Show how the Fed's action, combined with decline in business confidence, affects the AD-AS diagram in the short and medium run.

Ans:

The Fed should use monetary expansion to prevent a short-run deviation from the natural rate of unemployment. A monetary expansion of the proper size can exactly offset the effect of the investment demand shock on the AD curve. As a result, no change occurs in the AD-AS diagram in either the short or the medium run, though the interest rate is now lower in the new equilibrium.

- d. How do short-run output and the short-run price level compare to your answers from part (a)?

Ans:

Under the policy option in part (c), output and the price level are higher in the short run. In the medium run, output is the same in parts (a) and (c), but the price level is higher in part (c).

- e. How do the short-run and medium-run unemployment rates compare to your answers from part (b)?

Ans:

The unemployment rate is lower in the short run in part (c). In the medium run, the unemployment rate is the same in parts (b) and (c).

III. Long Question: the Effects of Change in Oil Price

Suppose firms produce goods using labor and oil. Suppose the technology is such that to produce one unit of output requires one unit of labor and one barrel of oil. Suppose the nominal wage is equal to W . Suppose the nominal price of a barrel is equal to P_o , where $P_o = Px$ (Equivalently, the price of a barrel in terms of goods is $\frac{P_o}{P} = x$.) An increase in the (real) price of oil is an increase in x .

1. What is the nominal cost of producing one unit of output?

Ans:

$$W + P_o = W + Px$$

2. Assume that the markup is zero, and that firms set prices equal to nominal cost (i.e. in terms of the textbook formulation, assume that $\mu = 0$) Derive the price level as a function of W and x . (Assume $x < 1$: this assumption just says that the price of one of the inputs, oil, is less than the price of the product, a reasonable condition.) What happens to P as x increases?

Ans:

$$\begin{aligned} P &= W + Px \\ &= \frac{W}{1 - x} \end{aligned}$$

P increases with the real cost of oil.

3. Derive the real wage implied by price setting. Discuss: “An increase in the price of oil necessarily implies a decrease in the real wage.”

Ans:

$$\frac{W}{P} = 1 - x$$

The nominal wage is set independently of the oil price, but the goods price is set to adjust for any change in P_o . Therefore, an increase in the price of oil

increases the price of goods but not the nominal wage, which necessarily results in a decrease in the real wage.

4. Assume wage setting is given by $W = P^e F\left(1 - \frac{Y}{L}, z\right)$. Derive the aggregate supply equation. Characterize the natural level of output Y_n .

Ans:

Plug the wage setting equation into the price setting equation, to eliminate the nominal wage W ,

$$AS : P = \frac{P^e F\left(1 - \frac{Y}{L}, z\right)}{1 - x}$$

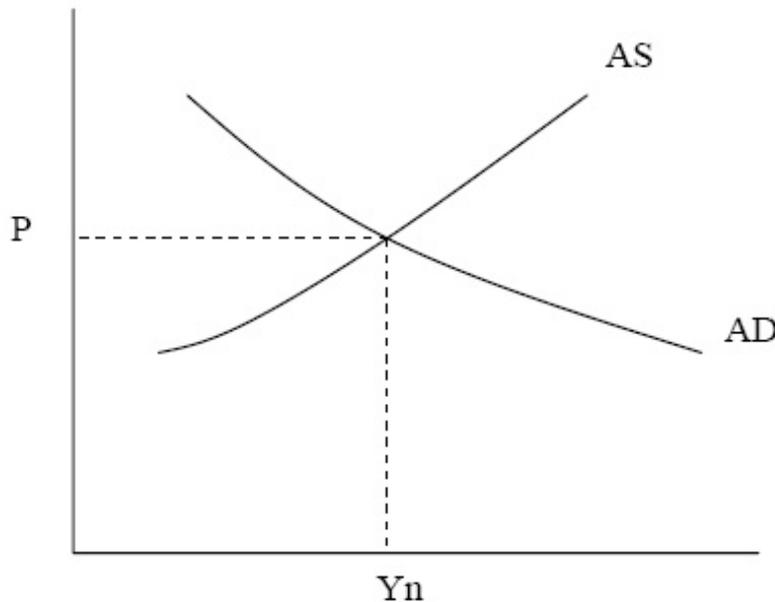
By definition, Y_n is the natural level of output such that $P = P^e$, i.e.

$$F\left(1 - \frac{Y_n}{L}, z\right) = 1 - x.$$

Y_n increases as x decreases.

5. Assume the aggregate demand equation is given by $Y = Y\left(\frac{M}{P}, G, T\right)$. Draw the aggregate demand and aggregate supply curves. Characterize the equilibrium.

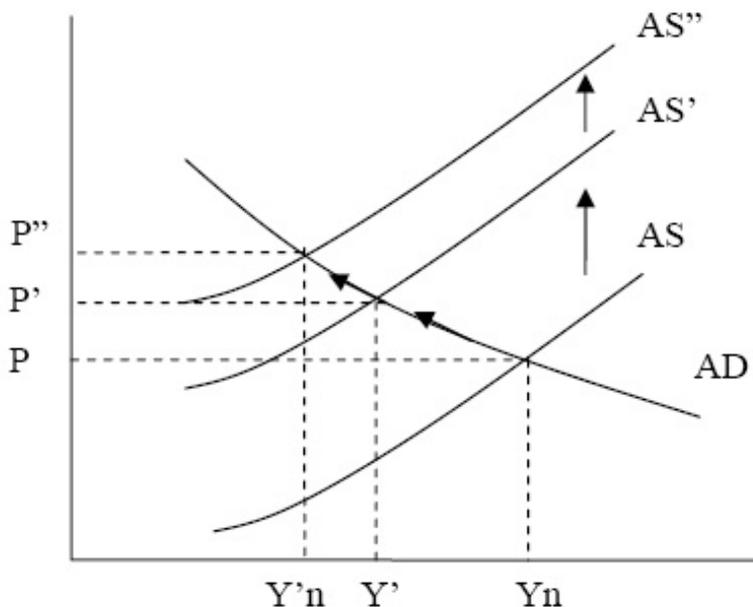
Ans:



In equilibrium, $P = P^e$, so $Y = Y_n$ which is a function of z and x .

6. Assume that the economy is at the medium-run equilibrium Y_n . Consider an increase in the price of oil, i.e. an increase in x . Show, graphically, the short-run and the medium-run effects of the increase on output and the price level. Show how the economy adjusts over time. Explain in words.

Ans:



Firms respond to the increase in the price of oil by setting the price higher, which shifts up the AS curve and leads to a short-run decrease in output and a short-run increase in the price level. As the price level goes up, the expected price level rises and workers demand for a higher wage, which shifts the AS curve further up. Over time, P and P^e keep increasing and Y keeps decreasing, until the economy reaches the medium-run equilibrium in which output arrives at its new natural level Y'_n and the expected price level equals to the actual price level P'' .

7. Discuss: “An increase in the price of oil is bad in two dimensions. It leads to an increase in prices (and so higher inflation for some time), and it leads to lower output, both in the short and the medium run.”

Ans:

An increase in the price of oil does lead to lower output (and a higher unemployment rate) and higher prices, both in the short and the medium run. The inflation rate increases in the short run and may stay high during the transition from the short run to the medium run, but it returns to zero in the medium run though the price level is higher. Note that inflation rate refers to the rate at which the price level increases.

8. Extra credit: What happened to the (nominal, and real) price of oil in 2005? What happened to inflation? What happened to output growth? (Hint: The effects were not as bad as the model above predicts, and not as bad as most economists fear.)

Ans:

The domestic first purchase price of crude oil increased by 36.69% from 36.77 dollars per barrel in 2004 to 50.26 dollars per barrel in 2005. (Data source: <http://www.eia.doe.gov/>) Both the nominal and the real price of oil have increased significantly. In contrast to the model prediction, inflation (computed using the CPI) remained mild around 3%, and real GDP grew by 3.4%.