14.02 Principles of Macroeconomics
Problem Set 3
Fall 2005
Solution

Posted: Wednesday, October 12, 2005
Due: Wednesday, October 19, 2005

Please write your name AND your TA's name on your problem set. Thanks!

Exercise I. True/False? Explain

1) "Unemployment rate" and "nonemployment rate" are synonyms.

   False.
   The first is the ratio of unemployed to the labor force. The second is the ratio of population minus employment to population.

2) When we formalize the price setting relation as $P = (1 + \mu)W$, we implicitly assume that the reservation wage of the workers is such that

   reservation wage $\leq \dfrac{P}{(1 + \mu)}$.

   True.
   The reservation wage is the wage that would make the workers indifferent between working or being unemployed. The wage paid to the workers
   $W = \dfrac{P}{(1 + \mu)}$ *has to be bigger or equal to the reservation wage.*

3) In an economy where product markets are not perfectly competitive (that is firms can charge prices higher than the marginal cost), it is always optimal for a profit maximizing firm to choose a combination of price P and markup μ such that

   $$\frac{P}{(1 + \mu)} = W = \text{reservation wage.}$$

   False.
   As the efficiency wage theories explain, sometimes firms may want to pay more than the reservation wage in order to motivate workers to be more productive. (There is a nice example of this in the focus box on page 126 in the textbook).

4) An increase in the workers bargaining power leads to an increase in the equilibrium nominal wage; however the equilibrium real wage stays constant.

   True.
   In our setting, the equilibrium real wage is fully determined by the price setters (see page 131 of the textbook). The nominal equilibrium wage increases if workers bargaining power goes up, but the equilibrium price level also increases (the increase in bargaining power would be reflected in an increase in z, which shifts the AS curve up and decreases the natural level of output).

5) The natural level of unemployment determines a natural level of output that always corresponds to the IS-LM equilibrium *Y*.

   False.
   The natural level of output corresponds to the medium run equilibrium in the AS-AD model. The natural level of output is completely determined by institutional variables that affect wage setting (z) and by the degree of competition in the goods markets (which determines the markup μ).
   The IS-LM equilibrium defines a short run equilibrium in the markets of goods and money.

6) The aggregate demand curve represents at the same time the demand for goods, money and labor in the economy.

   False.
   The aggregate demand curve represents the equilibrium points in the market for goods and money only. The demand for labor is automatically determined by equilibrium output due to our assumption that Y=N.

7) In the medium run the paradox of saving disappears.

   True.
   Think in terms of the AS-AD model and imagine the economy in a medium run equilibrium is perturbed by a shock that decreases the consumption parameter c_0.
   The initial decrease in consumption shifts AD to the left. The new equilibrium corresponds to lower levels of price and output. In the medium run, AS shifts down and the price level drops even more which leads to an increase in the real money supply. This lowers the interest rate and investment increases. Output rises back to its natural level and saving increases. Saving is now higher than before the perturbation.

8) In the medium run monetary and fiscal policies are neutral.

False.
Both fiscal and monetary policies do not affect the medium run output equilibrium level. Monetary policy doesn't affect the medium run interest rate either -its effect is just on prices. This phenomenon leads economists to speak about the "neutrality of monetary policy". Fiscal policy affects the medium run interest rate and the medium run level of investment, which implies that it is not neutral.

9) In the AS-AD model, higher competition among producers leads to a medium run equilibrium with higher output, lower interest rate, and lower price level.

True.
The effect of higher competition among producers can be analyzed through a decrease in μ. A decrease in μ leads to a higher natural level of output. The AS curve shifts down initially to a new short run equilibrium with lower output and a lower price level. As long as wage setters update their expectations on prices, the AS curve keeps moving down along the AD curve until it reaches the new medium run natural level of output.
The decrease in the price level leads to an increase of the real money supply. The LM curve keep shifting down along the IS curve as long as the AS curve shifts down along the AD curve. The new medium run equilibrium corresponds to the point defined by the natural level of output and a lower interest rate.

10) In the AS-AD model, lower bargaining power for workers in the market of labor leads to a medium run equilibrium with higher income, lower interest rate, and lower price level.

True.
The effect of a lower bargaining power for workers can be analyzed through a decrease in z. A decrease in z leads to a new higher natural level of output. The price level drops, the interest rate decreases, and the dynamics to the new medium run equilibrium are the same as the ones described in part 9).

Exercise II. AS-AD Model

Assume that the following is true about the economy:

$$C = 70 + 0.1(Y - T)$$
$$I = 40 - 200i + 0.1Y$$
$$G = 100$$
$$T = 100$$
$$M^d = \$Y(0.4 - i)$$
$$M^s = 80$$

Assume the following wage setting relation:

$$W = P^e(z - 30u) \text{ where}$$

$z = \dfrac{140}{13}$ is a parameter that represents the workers bargaining power and u is the

unemployment rate.
The following is the price setting relation
$$P = (1 + \mu)W \text{ where}$$
$\mu = 0.3$ is the markup.
The economy production function is:
$$Y = N$$
The labor force is
$$L = 300.$$

1) Derive the AS relation and graph the AS curve.

The AS relation represents the equilibrium points in the labor market.
$$\begin{cases} P = (1 + \mu)W \\ W = P^e(z - 30u) \end{cases}$$
$$P = P^e(1 + \mu)(z - 30u)$$
Given that
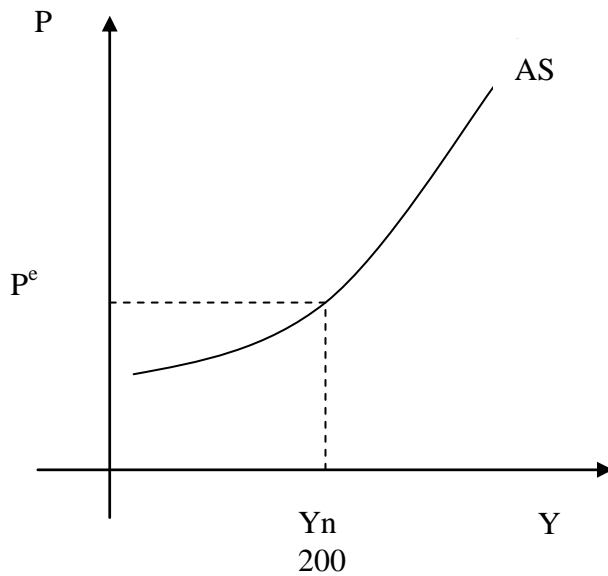$$u = \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{Y}{300}$$
$$\mu = 0.3$$
$$z = \frac{140}{13}$$
we get
$$P = P^e(1 + 0.3)\left(\frac{140}{13} - 30\left(1 - \frac{Y}{300}\right)\right)$$
$$P = P^e\left(\frac{39}{300}Y - 25\right).$$

The AS curve has to pass through the point (P^e, Y) such that
$Y = Y_n = 200$: *the natural level of output.*

2) Derive the AD relation and graph the AD curve.

The AD relation represents the equilibrium points in the goods market and in the money market.

$Y = C + I + G = 70 + 0.1(Y - 100) + 40 - 200i + 0.1Y + 100$

$Y = 200 + 0.2Y - 200i$

$Y = 250 - 250i$ *(IS relation)*
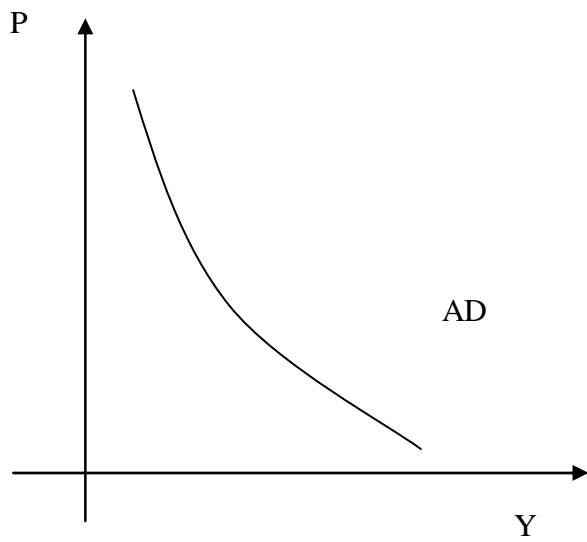
$M^d = \$Y(0.4 - i)$

$M^s = 80$

Given that $\$Y = PY$

$80 = PY(0.4 - i)$

$i = 0.4 - \dfrac{80}{PY}$ *(LM relation)*

Combining the IS and LM relations gives

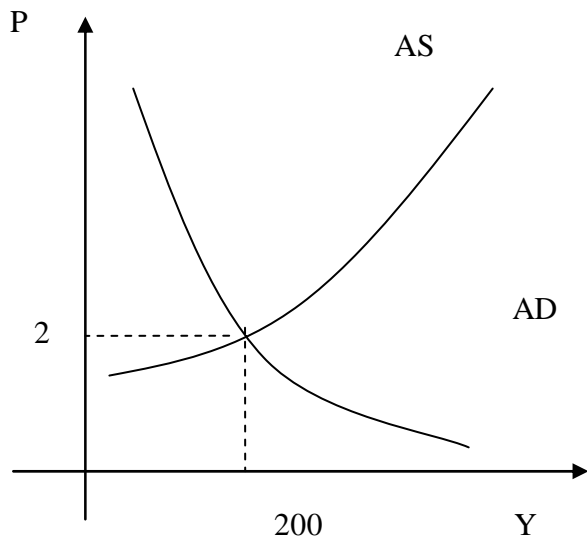$Y = 250 - 100 + \dfrac{20000}{PY}$

$Y^2 - 150Y - \dfrac{20000}{P} = 0$

3) Calculate and graph the medium run equilibrium.

In the medium run equilibrium $P = P^e$ *and* $Y = Y_n = 200$.

$$(200)^2 - 150 * 200 = \frac{20000}{P}$$

$$P = 2$$

4) Imagine an expansionary monetary policy such that $\Delta M^s = 80$, that is the money supply increases by 80, from 80 to 160.
   Assume two different scenarios:
   a) $P^e \neq P$ (Expectations can differ from the actual price level in the short run);
   b) $P^e = P$ (Expectations are always equal to the actual price level).
   Describe the short run equilibriums in both scenarios – you need to do calculations only for b).

   a) *If $P^e \neq P$, the monetary policy can have a real effect in the short run.*
      The increase in the money supply shifts the AD curve to the right. This implies an increase in both price level and output.
      If, at the same time, the expectations of the price level adjust upwards, the AS curve shifts up. This movement can dampen or annihilate the expansionary effect on output (depending on how much P^e increases).

   b) *If $P^e = P$ the AS curve is a vertical line at Y=200.*
      The new equilibrium P is
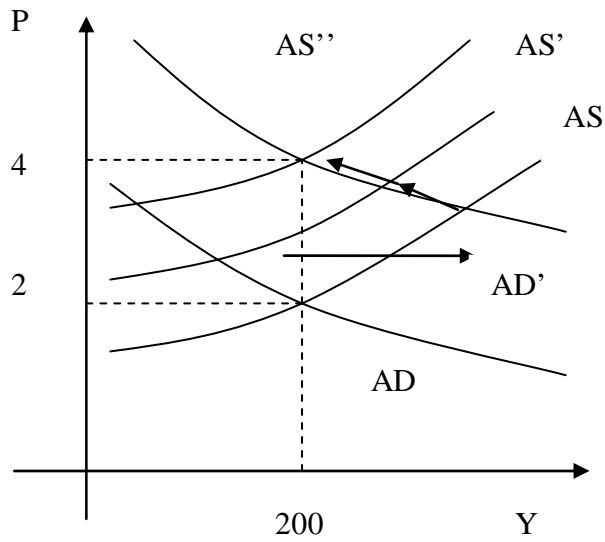 $$160 = PY(0.4 - i)$$
      $$Y^2 - 150Y - \frac{40000}{P} = 0$$
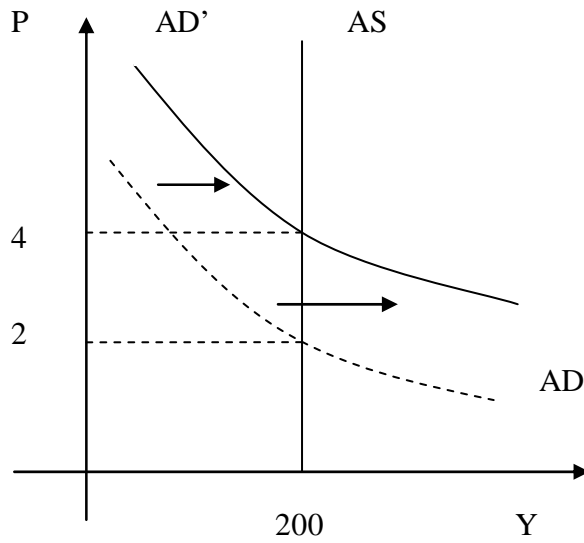 $$(200)^2 - 150 * 200 = \frac{40000}{P}$$
      $$P = 4.$$

5) Show the dynamics to the medium run equilibrium in both scenarios, using diagrams with explanations. Conclude by explaining how the effects of the monetary policy depend on the expectation formation process.

   Starting with $P^e \neq P$ expectations of the price level increase, moving the AS curve up. The economy moves along the AD curve through a sequence of short run equilibrium points. In the dynamics, output keep decreasing and price level keep increasing. In the medium term the AS curve reaches the point corresponding to which $Y = Y_n$ and $P^e = P$.

If $P^e = P$, there are no dynamics towards a medium term equilibrium. The economy immediately settles down to the new equilibrium with a higher price level and the same output level.
The monetary policy is neutral even in the short run.

The real effect of monetary policy on output lasts longer, the slower wage setters update their expectations to the new price level equilibrium.

6) Assume that the medium run equilibrium you calculated in part 3) is perturbed by a shock that dramatically increases μ by 1.3, to a value of 1.6. Calculate the new medium run equilibrium. How can the government and the central bank restore the pre-shock medium run equilibrium you calculated in part 3)?

The new medium run equilibrium is given by

$$P = P^e(1+1.6)\left(\frac{140}{13} - 30\left(1 - \frac{Y}{300}\right)\right)$$

$$\frac{26}{100}Y = 51$$

$$Y = \frac{5100}{26} \approx 196$$

Note that the natural output does not change much given that we are assuming a very inelastic wage setting relation.
In order to restore the previous equilibrium value $Y_n = 200$, we cannot rely on monetary policy since it is neutral in the medium run.
Fiscal policy also does not have a long lasting effect on the equilibrium Y.
The government could intervene by changing the labor market structure (the parameter z in our economy).

$$P = P^e(1+1.6)\left(z - 30\left(1 - \frac{Y}{300}\right)\right)$$

$$1 = 2.6\left(z - 30\left(1 - \frac{200}{300}\right)\right)$$

$$1 = 2.6(z - 10)$$

$$z = \frac{270}{26}$$

This corresponds to decreasing the bargaining power of the workers.