

Problem Set 8
Due: Wednesday, November 17.

Answers

True, False or Uncertain (each worth 10 points)

1) **False.** The important point here is that the unemployment rate and participation rate don't give a complete (or near complete) description of the labor market. A look at the flows into and out of unemployment, employment, and the labor force provide a better idea of whether the job market is dynamic or sclerotic. In these statistics the US and France differ a lot, the first one having larger flows. In particular this makes unemployment duration to be much lower in the US.

2) **False.** What matters is that there are reasons why a firm might decide to offer a wage about workers reservation wage, *even if* workers lack bargaining power. These reasons are grouped under what is known as "efficiency wage" theories, and their basic idea is that if a firm cares about the productivity of its workers and monitoring their work effort is costly then it will pay wages over workers reservation wages to provide an incentive for workers to work hard, the incentive being that if they get caught shirking (not working) they would be fired and lose the high wage.

3) **Uncertain.** While a higher minimum wage definitely benefits young workers when they get a job (because we can think of young workers as being paid basically the minimum wage), firms will reduce their hiring of young workers if they now have to pay higher wages for them. Therefore young unemployment duration will increase and this hurts young unemployed. Since there are two effects and one benefits and the other hurts young workers looking for a job, the overall effect is ambiguous.

4) **False.** The adjustment mechanism works the other way round basically. When the economy is working above its natural rate there is a pressure to increase prices (resulting from the tighter labor market leading to higher wages). Inflation will erode real money balances in the economy ($\frac{M}{P}$) which will increase the interest rate (effect that can be seen clearly in the (Y,i) space of the IS-LM determination of the AD relation). This increase in the interest rate will depress demand and thus lead to a reduction in output. As output decreases, employment decreases and workers are laid off.

Question 2

a) (5 points) The equilibrium in the labor market results from the simultaneous satisfaction of the price setting and wage setting equations. The real wage is derived directly from the price setting equation as

$$\frac{W}{P} = \frac{1}{1 + \mu}$$

The equilibrium unemployment rate results from replacing this real wage in the wage setting equation

$$\frac{1-u}{u} = \frac{1}{1+\mu}$$

$$u = \frac{1+\mu}{2+\mu}$$

Finally recalling that unemployment is given by the ratio of the unemployed to the labor force and given that output is a linear function of employment we get

$$Y = N = L - U = L - uL = L(1-u) = L \left(\frac{1}{2+\mu} \right)$$

b) (5 points) If z increases to 2 because the government has increased unemployment benefits, then equilibrium real wages are not affected since they were determined by the price setting relation which is not affected by z . But the unemployment benefits increase the bargaining power of workers, something that will result in an upward pressure on wages, given prices. Since we have just stated that real wages don't change, then it must be the case that unemployment goes up to reduce the bargaining power of workers to the original level. Let's write the wage setting equation and derive equilibrium unemployment to see this point.

$$2 \frac{1-u}{u} = \frac{1}{1+\mu}$$

$$u = \frac{1+\mu}{1.5+\mu} > \frac{1+\mu}{2+\mu}$$

Now output is given by

$$Y = L \left(\frac{0.5}{1.5+\mu} \right) < L \left(\frac{1}{2+\mu} \right)$$

c) (15 points) Now we have a mark-up that depends on the unemployment rate in a procyclical way (when the economy is in a boom and output is high, then the mark-up is high, and vice versa when the economy is in a recession). We can rationalize this if competition between firms is strongest in a recession and this reduces the profit margin.

Now to solve for the equilibrium we substitute from the price setting equation into the wage setting equation as before to get

$$\frac{1-u}{u} = \frac{1}{1+\mu} = \frac{1}{1+(0.5(1-u))}$$

Solving for u we get a quadratic equation

$$u^2 - 6u + 3 = 0$$

This equation has two solutions, but only one of these is economically relevant (the unemployment rate must be between zero and one), $u=0.55$. With this we can now substitute to get the real wage and output

$$\frac{W}{P} = \frac{1}{1+(0.5(1-u))} = 0.816$$

$$Y = (1 - u)L = (0.45)L$$

If we now increase unemployment benefits and have $z=2$ we will find that the equilibrium changes, but contrary to point b), now the real wage will change because the mark-up depends on the unemployment rate that changes. Let's solve with the new value of z .

$$2\frac{1-u}{u} = \frac{1}{1+\mu} = \frac{1}{1+(0.5(1-u))} \rightarrow u^2 - 5u + 3 = 0$$

and equilibrium unemployment now is given by $u=0.69$. This in turn leads to a real wage of 0.868 and output given by $Y = (0.31)L$.

The difference between the result here and that found in point b) is due to the fact that when the mark-up is constant, all the adjustment must come in the level of employment as the real wage is fixed. When real wages are flexible part of the adjustment comes through real wages and the unemployment rate doesn't have to increase so much (something that can be seen by calculating the unemployment rate in point b) assuming the mark-up is equal to the value it has in point c) when $z=1$, i.e. 0.225).

Question 3

a) (10 points) The price setting equation tells that the price of a unit of output equals the production cost times one plus the markup. Since the production cost is given by the wage times the amount of labor used in production this gives:

$$P = (1 + \mu)\frac{W}{A}$$

Since when productivity is A , we only need $1/A$ quantity of work to produce one unit of output (we keep A general and later specialize for $A=1$). The natural rate of unemployment is derived as the equilibrium in the labor market when the actual price level equals the expected one and the price setting and wage setting equations are simultaneously satisfied.

$$z\frac{1-u}{u} = \frac{A}{1+\mu} \rightarrow u_n = \frac{z(1+\mu)}{A+z(1+\mu)} = \frac{z(1+\mu)}{1+z(1+\mu)} \text{ (if } A=1\text{)}$$

and this is the natural rate of unemployment. To get the natural output level we proceed as in the previous question and get

$$Y = (1-u)AL = \frac{A^2}{A+z(1+\mu)} = \frac{1}{1+z(1+\mu)} \text{ (if } A=1\text{)}$$

To get actual output and unemployment we have to lift the assumption that $P^e=P$. Replacing the price setting equation into the wage setting one gives us the AS relation,

$$P = P^e(1+\mu)z\frac{(1-u)}{Au} = P^e(1+\mu)\frac{z}{A}\left(\frac{1}{1-\frac{Y}{A}} - 1\right)$$

By inspection we see that its slope is positive,

$$\frac{dP}{dY} = P^e(1+\mu)z\left(\frac{1}{(A-Y)^2}\right) > 0,$$

So actual unemployment is given by

$$u = \frac{z(1+\mu)\frac{P^e}{P}}{A+z(1+\mu)\frac{P^e}{P}}$$

and actual output is given by

$$Y = \frac{A^2}{A + z(1 + \mu)\frac{P^e}{P}}$$

b) (5 points) The AD schedule is derived from the IS-LM framework and it gives us the output level that simultaneously gives equilibrium in the goods and financial markets for each price level. Writing first the IS and LM relations we have,

$$IS : Y^d = C + I + G = c_0 + c_1(Y^d - T) + I_0 - I_1 i + G$$

$$LM : \frac{M}{P} = \frac{Y^d}{i}$$

Replacing the interest rate from the LM into the IS we get

$$Y^d = c_0 + c_1(Y^d - T) + I_0 - I_1 \left(\frac{PY^d}{M} \right) + G$$

and solving for Y^d gives the AD relation:

$$Y^d = \frac{c_0 - c_1 T + I_0 + G}{1 - c_1 + I_1 \frac{P}{M}}$$

and by inspection we see that its slope is negative, since

$$\frac{dY^d}{dP} = -\frac{c_0 - c_1 T + I_0 + G}{(1 - c_1 + I_1 \frac{P}{M})^2} \frac{I_1}{M} < 0$$

c) (5 points) You find these pictures in the textbook, e.g. 16.2 and 16.3.

d) (10 points) If productivity was 1 and now is at a level $A > 1$ to see what happens to the natural unemployment rate and natural level of output we simply have to compare the result of point a) for the cases $A > 1$ and $A = 1$.

$$u_n(A > 1) = \frac{z(1 + \mu)}{A + z(1 + \mu)} < \frac{z(1 + \mu)}{1 + z(1 + \mu)} = u_n(A = 1)$$

$$Y(A > 1) = \frac{A^2}{A + z(1 + \mu)} > \frac{1}{1 + z(1 + \mu)} = Y(A = 1)$$

If expectations are adaptive then in the short run we will have a shift in the AS schedule to the right reflecting that now firms are willing to supply a given level of output at a lower price (given price expectations). This can be seen from the AS equation in point a). Thus in the short run the output goes up and prices go down. In the long run prices will keep decreasing and output will keep increasing until the economy reaches the new natural level of output.

e) (5 points) If the Central Bank is concerned with price stability then it must accommodate money supply in such a way that the AD schedule shifts and intersects the new AS schedule at the old price level. Thus we need an expansionary monetary policy in order not to have deflation as in point d). Since prices don't change the new price level is at the level of expectations and we thus know that the equilibrium is already at the natural level of output and thus the AS curve will no longer shift. There are no further pressures on prices and price stability is maintained in the long run (actually there is no difference between long and short run in this case).