

## 14.02 Quiz # 2

### Solutions

#### Question 1

1) **True.** An increase in the price of oil leads to an increase in  $\mu$ . For any given wage, firms must charge a higher price for output because the cost of oil has risen. The PS curve shifts down in  $(W/P, U^n)$  space. This results in an increase in  $U^n$ .

2) **False.** The natural rate of unemployment is unaffected by the level of inflation in any of our models. What is true is that if inflation is rising then actual unemployment must be less than the natural rate.

3) **False.** A decrease in  $G$  causes the AD curve to shift to the left in  $(P, Y)$  space. This will lead to output below its natural level and unemployment above its natural level. This will cause workers to demand lower wages, which, in turn causes the AS to shift to the right. The new long run equilibrium will be at the same (natural) level of output. The long run price level will be lower.

4) **True** If the dollar depreciates, then US goods become cheaper abroad and foreign goods become more expensive here. Thus exports will increase and imports decrease. The net result is that production of goods in the US will increase. Hence employment will rise. Strictly speaking all that is true only if it is the real exchange rate that depreciates. However, in the short run you can assume that price level in the US does not change in response to a change in the nominal exchange rate. Therefore if the nominal exchange rate ( $E$ ) depreciates so will the real exchange rate ( $\varepsilon = EP^*/P$ ).

5) **Uncertain.** The increase in taxes will shift the IS curve to the left next year. This will result in lower interest rates and output next year. People know this, so this year they will in anticipation of lower interest rates they will tend to increase investment shifting this year's IS curve to the right. However, they also know that future income will be lower, so they will tend to reduce consumption today in order to save more to make up the lower income next period. This effect will shift the IS curve to the left. Thus we cannot tell what happens to output or employment today. If the first effect dominates output and interest rates will rise today. If the second effect is stronger they will both fall today.

6) **False** Investors must also take into account the fact that the dollar will probably appreciate ( $E$  falls) against the Lira. Only if the Italian interest rates are higher than US interest rates by an amount greater than the

expected appreciation of the dollar, will it make sense to invest in Italy.

$$i_{us} = i_{it} + \frac{E_{t+1}^e - E_t}{E_t}$$

7) **Uncertain.** If the boom is the result of a demand shock, the statement is false. If the boom is the result of a supply shock the statement is true. Consider the demand shock first. Suppose there is an increase in G or anything that causes a shift in the AD curve to the right. This will increase output above the natural level. Firms will demand more labor in order to produce this extra output. Thus unemployment will fall below the natural rate. But note that the natural rate itself has not changed. We know in the long run the economy will return to this same natural rate because workers require higher wages shifting the AS curve to the left. Thus the statement is false.

Now consider a supply shock, anything that changes  $\mu$  or  $z$ . For example an increase in the capital stock as we had on problem set #6. This causes the PS curve to move up. Firms can now afford to pay workers more because they produce more output working with more and better machines. This results in a new lower natural rate of unemployment. Thus the statement is true in this case.

### Question II

a) This is the wage-price spiral story. A low level of unemployment encourages workers to seek higher wages. In order to pay these wages firms must increase their prices. But as prices rise workers seek even higher wages. This causes firms to increase their prices again, and the cycle repeats itself. The net result is prices will be rising continuously i.e. there will be positive inflation ( $\pi > 0$ ). The lower the unemployment, the faster wages will rise, therefore the higher the rate of inflation.

b)

$$\pi_t = \pi_t^e + (\mu + z) - \alpha u_t$$

$$\pi_t = \pi_t^e - \alpha(u_t - u_t^n)$$

The fundamental difference is that the old version of Phillips curve assumed that  $\pi_t^e = 0$  always. In other words workers based their wage claims on the belief that prices would not change. The modern Phillips curve assumes that workers believe that prices will change in the future at the same rate that they did in the immediate past i.e.  $\pi_t^e = \pi_{t-1}$ . The basic intuition of the new Phillips curve is the same as for the old: Workers push for higher

wages when unemployment is lower. The difference now is that they will push for even higher wages than they would have under the old regime because they expect prices to be rising.

c) The old Phillips curve worked for a while because workers did truly believe that prices would not change i.e.  $\pi_t^e = 0$ . This belief was reasonable up to the late 1960s because actual inflation was equal to zero on average. In the late 1960s as a result of the Vietnam war, actual prices began to increase on a regular basis. Thus actual inflation was positive on average. Workers soon noticed this and revised their expectations. It was no longer reasonable to assume that  $\pi_t^e = 0$ . Workers now adopted  $\pi_t^e = \pi_{t-1}$  and so the old Phillips curve failed to match the data.

d) Assume that unions seek to push up wages. In the WS-PS diagram this will cause the WS curve to shift up. This will lead to a new higher natural rate of unemployment. It takes time for actual unemployment to adjust to this new natural rate i.e. we have to go through the process of expectations adjusting over time. This implies that the actual level of unemployment will be less than new natural rate. This implies that the rate of inflation will increase. The rate of inflation will continue to increase until the economy has reached the new long run equilibrium i.e. where actual unemployment is equal to the new natural rate. Then inflation will be stable at a higher level than before.

$$\pi_t = \pi_{t-1} - \alpha(u_t - u_t^n)$$

### Question III

a) The Federal Reserve contracted the money supply. Graphically, this translates as an upward or leftward shift of the LM curve. In the new equilibrium  $i$  is higher and  $Y$  is lower.

b) The Fed would want to decrease demand in order to decrease the rate of inflation. Some economists believe that the current unemployment rate is below the NAIRU. Thus, at the current unemployment rate, we should expect the rate of inflation to increase. In order to reduce this tendency for the inflation rate to accelerate, policymakers reduce demand (increase unemployment towards the NAIRU).

c) Recall that at the new equilibrium  $i$  increases and  $Y$  decreases. Thus  $C(Y - T)$  decreases,  $G$  does not change (it is exogenous) and  $I$  declines. Unambiguously, demand falls.

d) AD is given by the following relationship. It is derived by finding an expression for  $Y$  in terms of exogenous variables and  $P$  using the IS/LM relationships.  $Y = z[c_0 - c_1T + b_2/a_2(M/P) + G]$  where  $z = 1/(1 - b_1 - c_1 + b_2a_1/a_2)$

The AD curve is downward sloping in  $(P, Y)$  space

The slope is the partial derivative of  $Y$  with respect to  $P$ . This is equal to  $-z(b_2/a_2)(1/P^2) < 0$

The slope reflects the negative relationship between equilibrium income in the goods and financial markets, and the price level,  $P$ . An increase in  $P$ , *cet pari*, leads to a decline in real money balances. This leads to an increase in the interest rate, a decline in investment demand, a decline in aggregate demand and a decline in equilibrium income.

A contraction in the money supply shifts the AD curve downwards or to the left.

For any level of  $P$  a change in  $M$  of  $dM$  units leads to a change in  $Y$  of  $z(b_2/a_2)(dM/P)$  units.

e) AS is given by the following relationship. It is derived by finding an expression for  $P$  in terms of exogenous variables and  $P_e$  using the WS/PS relationships.  $P = P_e F(1 - Y/L, z)(1 + \mu)$

The AS curve is upward sloping in  $(P, Y)$  space

The slope reflects the positive relationship between income and the price level,  $P$ . An increase in income  $Y$  leads to a decline in unemployment; labor market tightness increases the wage which wage earners can bargain from firms, and the increase in wages increase the prices set by firms.

f) Now assume that the initial SR equilibrium is at  $Y^n$ . The monetary contraction shifts the AD curve downwards or to the left. In the SR,  $P$  and  $Y$  both decrease. In the LR  $P$  decreases even more and  $Y$  returns to  $Y^n$ .

g) A decrease in transfers is equivalent to an increase in taxes. This translates to a leftward shift in the AD curve. In the "immediate" run when prices are not allowed to change,  $Y$  falls, and  $P$  does not change.

In the SR, both prices and output decline.

In the LR, prices decline more, and output returns to the original  $Y^n$ .

The economy converges to LR equilibrium by a decrease in price expectations. This leads to a decline in actual prices, and an increase in demand and equilibrium output until  $Y = Y^n$  and price expectations no longer change.

h) If wages are indexed to the actual price level, then WS:  $W/P = F(i - Y/L, z)$ . Thus, the AS curve is VERTICAL, and coincides with the vertical

line  $Y = Y^n$ . Thus, the SR equilibrium is the LR equilibrium and there is no transition from SR to the LR.