

14.02 – Fall 2001 – QUIZ 3 Answers

PART 1: True, False or Uncertain. (30 points)

- a. TRUE. The natural level of output is defined as the level of output consistent with equilibrium in the labor market when the actual price level is equal to the expected price level. The Aggregate Supply relation is the level of output consistent with equilibrium in the labor market given each level of prices. Therefore, Y_n is simply a point on the AS curve (the one that corresponds to P^e).
- b. FALSE. Changes in fiscal policy will shift Aggregate Demand. As result, prices will change in the short run and the AS will shift over time until it intersects AD at the natural level of output again. In the medium run equilibrium, output is back to the same initial level (Y_n), but the interest rate is now different. Therefore, investment will necessarily have changed. (A fiscal expansion increases the interest rate in the medium run and reduces investment; a fiscal contraction raises investment).
- c. FALSE. An increase in unemployment benefits (z , in terms of the AS-AD model we have seen) will reduce the natural level of output. In the medium run, output will go down to its new natural level –so the increase in z will indeed have permanent effects on output in the medium run.
- d. FALSE. The expectations-augmented Phillips Curve implies that maintaining a rate of unemployment below the natural rate requires increasing (not simply high) inflation. This is because inflation expectations continue to adjust to actual inflation.
- e. UNCERTAIN. An increase in the rate of money growth (a monetary expansion) is likely to lead to a *decrease* in the nominal interest rate in the short run, but to an *increase* in the nominal interest rate in the medium run. (*For the curious:* Initially, an increase in money growth leads to an increase in the real money stock, which in turn causes an increase in output and a decrease in both the nominal and the real interest rate. As long as the real interest rate is below its natural level and output is above its natural level (and hence unemployment is below its natural rate), we know from the Phillips Curve relation that inflation must be increasing. As inflation increases, eventually it becomes higher than nominal money growth, leading to negative real money growth. When real money growth turns negative, the nominal interest rate starts increasing –and given expected inflation, so does the real interest rate. In the medium run, the

real interest rate increases back to its initial value, output is back to its natural level, unemployment is back to its natural rate, and inflation is no longer changing. As the real interest rate converges back to its initial value, the nominal interest rate converges to a new higher value, equal to the real interest rate plus the new higher rate of nominal money growth. *See Figure 14.6 in page 281 in the textbook.*) (5 points)

- f. FALSE. Capital accumulation by itself cannot sustain growth. Because of decreasing returns to capital, sustaining a steady increase in output per capita would require larger and larger increases in the level of capital per capita—in other words, a steady increase in capital per capita will produce smaller and smaller increases in output per capita (increases which, in the long run, will converge to zero). Hence, long-run output per capita growth can only be sustained by steady technological progress.

PART 2: Investment and Monetary Policy

(40 Points)

- a. The natural level of output is Y_n .

Assuming that the economy is initially at its medium run equilibrium, so that output starts at its natural level, at $t = 0$ we will have $Y = Y_n$, $M = M_0$, so: $Y_n = c(M_0 - P_0)$ and hence $P_0 = M_0 - \frac{1}{c}Y_n$. (8 points).

- b. Assuming that price expectations are formed by looking at the level of prices in the previous period ($P_t^e = P_{t-1}$), then $P_1^e = P_0$ and we have:

$$\begin{aligned} Y_1 &= c(2M_0 - P_1) \\ P_1 &= P_0 + d(Y_1 - Y_n) \\ &\rightarrow Y_1 = c[2M_0 - P_0 - d(Y_1 - Y_n)] \\ &\rightarrow Y_1 = \frac{c}{1 + cd}(2M_0 - P_0 + dY_n) \end{aligned}$$

Using $P_0 = M_0 - \frac{1}{c}Y_n$ from (a), we get:

$$\rightarrow Y_1 = \frac{c}{1 + cd} \left[M_0 + \left(\frac{1}{c} + d \right) Y_n \right] = \frac{c}{1 + cd} M_0 + Y_n$$

(8 points)

- c. The monetary expansion reduces the interest rate and raises output (it is straightforward to show this in the IS-LM framework, which is one of the building blocks of the AD-AS). Hence, investment goes up as the interest rate is lower and output is higher (this is, as we move along the IS to the interaction with the new LM). (8 points)

- d. In the medium run, $Y = Y_n$. (8 points)

- e. In the medium run, investment returns to its initial level, because output and the interest rate return to their original levels (*Turn to Figure 1 if you prefer to see this argument graphically*). (8 points)

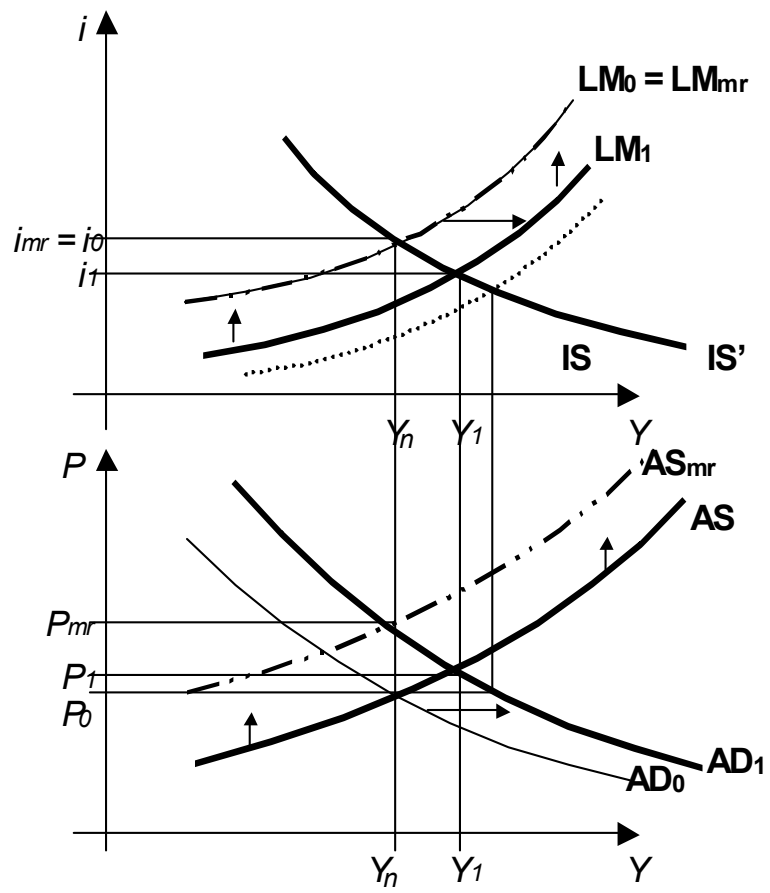


Figure 1:

PART 3: Indexation of Wages (30 points)

- a. $\pi_{2001} = \pi_{2000} + 0.1 - 2u_{2001} = 0.00 + 0.1 - 0.08 = 0.02 = 2\%$
 $\pi_{2002} = \pi_{2001} + 0.1 - 2u_{2002} = 0.02 + 0.1 - 0.08 = 0.04 = 4\%$
 $\pi_{2003} = \pi_{2002} + 0.1 - 2u_{2003} = 0.04 + 0.1 - 0.08 = 0.06 = 6\%$
 $\pi_{2004} = \pi_{2003} + 0.1 - 2u_{2004} = 0.06 + 0.1 - 0.08 = 0.08 = 8\%$

It is even easier to derive these by using the fact that the Phillips Curve can be simplified as: $\pi_t = \pi_{t-1} + 0.1 - 2u_t = \pi_{t-1} + 0.02 = \pi_{t-1} + 2\%$, since $u_t = 0.04$ for all t here. (10 points)

- b. The PC becomes:

$$\pi_t = 0.5\pi_{t-1} + 0.5\pi_t + 0.1 - 2u_t$$

and hence

$$\pi_t - \pi_{t-1} = 0.2 - 4u_t$$

If $u_t = 0.04$ for all t , then:

$$\pi_t = \pi_{t-1} + 0.04 = \pi_{t-1} + 4\%$$

(5 points)

- c. $\pi_{2001} = \pi_{2000} + 0.04 = 0.04 = 4\%$
 $\pi_{2002} = \pi_{2001} + 0.04 = 0.08 = 8\%$
 $\pi_{2003} = \pi_{2002} + 0.04 = 0.12 = 12\%$
 $\pi_{2004} = \pi_{2003} + 0.04 = 0.16 = 16\%$

(5 points)

- d. As indexation increases (this is, as more workers have indexed labor contracts), low unemployment leads to a larger increase in inflation over time. In other words, the impact of u on π becomes stronger. (10 points)