

Professor Christiano  
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## Solutions for Howework #6

### Question #2

a) An increase in consumer confidence.

*Short Run.* Because of the increase in  $c_0$ , the  $IS$  and  $AD$  curve shift to the right. The right shift of the  $AD$  implies that the price level increases to guarantee market clearing in the labor market (we're on the  $AS!$ ). The increase in the price level reduces real money supply and so the  $LM$  shifts upward. Output, price level, and the interest rate are higher in the short run.

*Medium run.* Expectations adjust causing the price level to increase further. To see this note that the price level in the short run is:  $P' > P = P^e$ , where  $P$  denotes the price level in the initial equilibrium. As  $P^e < P'$ ,  $P^e$  will raise. When does the adjustment in expectations end? We know that price expectations equal the actual price level when  $Y = Y^n$ ; so the adjustment ends when the output level is at its natural level. Given that the increase in consumer confidence does not affect the medium run equilibrium in the labor market, the natural level of unemployment, and so the natural level of output, are equal to their initial levels. So in the medium run, output is equal to the initial level  $Y^n$ . In terms of our curves: the  $AS$  shifts upward to the point where the *new*  $AD$  intersects the vertical line  $Y = Y^n$ . The price level increases and so the  $LM$  shifts upward to the point where the *new*  $IS$  intersects the vertical line  $Y = Y^n$ . In the medium run: price level and the interest rate increase and output decreases.

b) An increase in taxes.

*Short run.* Because of the increase in  $T$ , the  $IS$  and  $AD$  curve shift to the left. The left shift of the  $AD$  implies that the price level decreases to guarantee market clearing in the labor market. The decrease in the price level increases real money supply and so the  $LM$  shifts downward. Output, price level, and the interest rate are lower in the short run.

Medium Run. Expectations adjust causing the price level to decrease further. Again the natural level of unemployment is unaffected by the fall in  $T$ , and so in the medium run  $Y$  returns to  $Y^n$ . In terms of our curves: the  $AS$  shifts downward to the point where the *new*  $AD$  intersects the vertical line  $Y = Y^n$ . The price level decreases and so the  $LM$  shifts downward to the point where the *new*  $IS$  intersects the vertical line  $Y = Y^n$ . So in the medium run: the price level and the interest rate decrease and output increases.

### Question #3

An increase in unemployment benefits is measured as an increase in  $z$  in the wage setting equation.

*Short run.* In the short run as  $z$  increases, the  $AS$ :  $P = P^e(1 + \mu)F\left(1 - \frac{Y}{L}, z\right)$ , shifts upward. The position of the  $AD$  curve does not change. As the  $AS$  slides upward along the  $AD$ , the output level decreases and the price level increases. As the price level increases real money supply falls, shifting the  $LM$  upward. Hence in the short run: the interest rate and the price level are higher, while the output level is lower.

*Medium Run.* Expectations adjust causing a further increase in the price level. In the short run we're at a  $P' > P = P^e$ , and so price expectations increase, moving the  $AS$  further up. When does the adjustment end? We know that price expectations are equal to the actual price level when  $Y = Y^n$ , however now the natural level of output has changed. To see this, we need to solve for new medium run equilibrium in the labor market, found as the intersection between the price setting curve and the *new* medium run wage setting equation—i.e., the wage setting equation in which  $P = P^e$  (we're in the medium run!). The wage setting equation moves upward as  $z$  increases, and so the natural level of unemployment is higher. As  $u^n \equiv 1 - \frac{Y^n}{L}$ , the natural level of output is lower. Call this new natural level of output:  $Y^{n'}$ . Now we know where the expectation adjustment process stops. The  $AS$  continues to shift upward to the point where the original  $AD$  and the vertical line  $Y = Y^{n'}$  intersect. As the price level continues to increase, the  $LM$  also shifts upward to the point where the original  $IS$  and the vertical line  $Y = Y^{n'}$  intersect. Hence in the medium run: output is lower, and both the interest rate and the price level are higher.

#### Question #4

a) Money is neutral in the sense that nominal money supply has no effect on output or the interest rate in the medium run (Exercise: verify that this is true). In fact the output level and the interest rate are determined by the natural level of output and by the *IS*. Despite the neutrality of money in the medium run, monetary policy affects the interest rate and the output level in the short run. So monetary policy is a useful policy instrument in the short run.

b) Because in the medium run, investment and the interest rate both change with fiscal policy, it is not neutral in the medium run.

c) The statement is false. Labor market policies, such as unemployment insurance, affect the natural level of output.

#### Question #5

a) Firms might be so pessimistic about the returns of their projects, that no matter how low the interest rate is, they choose not to borrow and invest.

b) If investment is independent of the interest rate then the *IS* curve is vertical

c) The *LM* curve is unaffected.

d) The *AD* curve is vertical. The *AD* curve is obtained by sliding the *LM* along the *IS* for different price levels. As the *IS* is vertical, the output level is constant for any price level, and so the *AD* curve is vertical.

e) As  $z$  increases, the *AS* shifts upward (see the discussion in question #3). So in the short run the price level is higher, but the output level is constant at the initial level because the vertical *AD* curve.

f) As the short run price level is higher than the initial equilibrium price level, price expectations increase shifting the *AS* upward. From the medium run equilibrium in the labor market, the natural level of output is lower than the initial level. However the economy can't converge to this new level. Because the *AD* is vertical the economy is "stuck" at the initial natural level and cannot move: in the medium run the output level is permanently higher than the natural level. What does this imply in terms of the price level? We can rewrite the *AS* as:  $\frac{P}{P^e} = (1 + \mu)F\left(1 - \frac{Y}{L}, z\right)$ . From the definition of the natural level of output, we know that when  $Y = Y^n$ , then  $P = P^e$ ; so as  $F$  is decreasing in its first argument  $\left(1 - \frac{Y}{L}\right)$ , if  $Y > Y^n$ , then it must

be that  $P > P^e$ . So the price level is permanently higher than price expectations in the medium run, so price expectations continue to increase forever. As expectations increases, the  $AS$  continues to shift upward and so the price level continues to increase.