rate. Even if one accepts the stability of the U.S. natural rate since the 1970s, conventional techniques do not estimate it with much precision.

In sum, the natural rate hypothesis provides a powerful, unifying conceptual framework, but economists' understanding of labour market equilibrium remains limited.

VI. Extensions

Instructors may wish to discuss the scope for monetary policy to maintain full employment in the *AD–AS* framework. For *AD* shocks, countercyclical monetary policy can be used to restore the natural rate of unemployment relatively quickly (as compared to waiting for the economy to adjust on its own). Essentially, a change in the money supply substitutes for a medium-run change in *P*, so that *M/P* adjusts as needed to restore the natural rate of output. For AS shocks, countercyclical monetary policy moves the economy further away from the natural rate. For example, consider an adverse AS shock, which increases the natural rate of unemployment and reduces the short-run output. An increase in M would serve to buffer some of the output fall in the short run, but at the expense of a higher price level in the medium run. A decrease in *M*, however, would move the economy to its new natural rate of output more quickly and with a lower medium-run price level (than would have occurred without the fall in M), but at the expense of an additional decline in the *short-run* output.

VII. Observations

In the medium run, the interest rate is determined by the intersection of the IS curve and the natural level of output. Effectively, conditional on the natural level of output, the interest rate is determined by fiscal policy. Regardless of the value of the money supply, the price level will adjust so that the LM curve intersects the IS curve at the natural level of output. Thus, monetary policy has no effect on the interest rate in the medium run. Once money growth is introduced, this conclusion will be refined. In the medium run, monetary policy (defined as the choice of the growth rate of money) will have no effect on the real interest rate, but will affect the nominal interest rate through the Fisher effect (Chapter 11).

Questions and Problems

1.

a. True. See Figure 9.1.

b. True. $Y = Y_n$ when $P = P^e$, so Y_n can be determined from equation $P = P^e(1-\mu)F\left(1-\frac{Y}{L}, Z\right)$ assuming $P = P^e$.

c. False. If *P* is higher, $\frac{M}{P}$ (real money supply) is lower, so *LM* shifts up. From *IS–LM* relation, when *LM* shifts up, *i* increases and *Y* decreases. This is why *Y* is lower when *P* is higher.

d. False. Fiscal and monetary policy only shift *AD* curve. The shifts in *AS* curve are given by changes in the labour market (increase of z or μ), so also without changes in monetary policy or fiscal policy there can be shifts from the natural level of output.

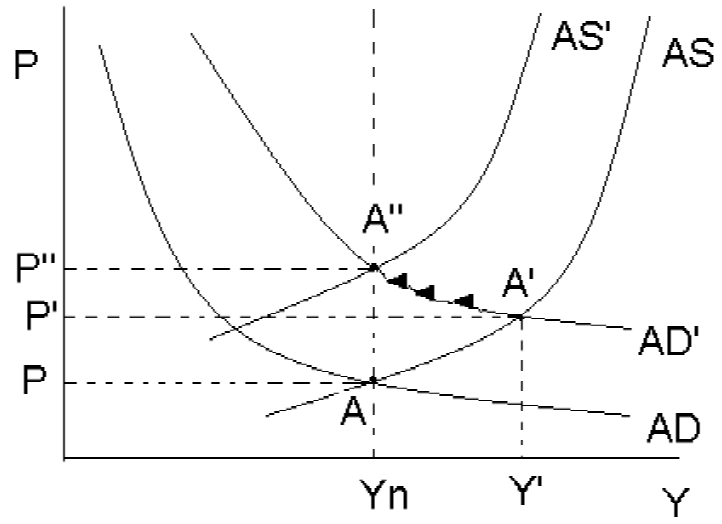
e. True. In the medium run $Y = Y_n$ and $P = P^e$. The monetary policy is effective only in the short run.

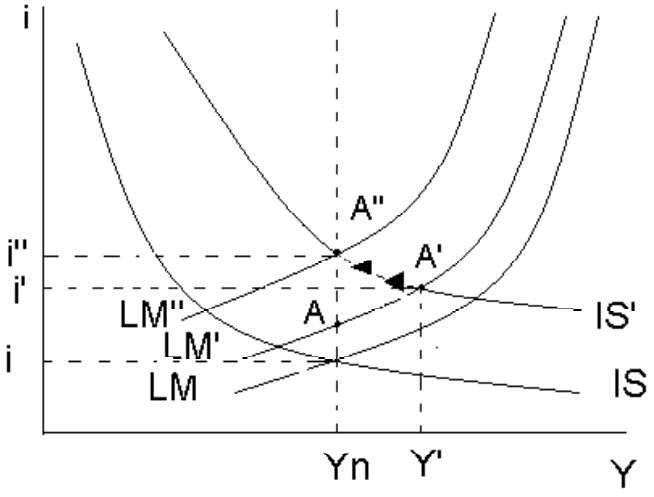
f. False. Although the output will be always equal to its natural level in the medium run, its composition can change. A decrease in government spending without any other policy interventions increases the investment in the medium run.

g. False. *Y* returns always to the natural level, but the natural level remains the same only if there are no shifts in the *AS* curve. Effective prices in the medium run are equal to expected prices, but expectations aren't fixed, they can increase or decrease.

2.

a.





b. If *T* decreases, in the short-run consumption increases, so *AD* shifts right and *Y* increases. *P* increases only a bit. Looking at the *IS–LM* model, an increase in C causes the shift to the right of the *IS* curve and the increase of *Y* and *i*. In the medium run P^e increases because $P > P^e$: prices increased after the increase of *Y*. The *AS* curve shifts up. *P* increases, so *M*/*P* decreases. *LM* curve shifts up, *Y* and *i* decrease. *Y* goes back to Y_n in the medium run. In the new medium run equilibrium with lower taxes *i* is higher, and *P* is higher, *Y* does not change.

3.

a. See Figures 8.11and 9.15 in the text.

b. An increase in unemployment benefits increases the variable *z*. The wage-setting relation curve shifts to the right. In the short run, real wage increases but in the medium run $\frac{W}{P}$ will decrease due to the increase in prices to the new equilibrium point, where u_n is higher and the real wage is $\frac{1}{1+\mu}$.

The increase in *z* affects the *AS* curve, which shifts up. In the short run the natural level of output Y_n. Effective prices increase and so the expected prices P^e. In the medium run, the prices increases until $P = P^e$ and the natural level of output decreases more, until the new level of equilibrium. In the new equilibrium, Y_n is lower than before the increase in unemployment benefits and *P* is higher.

4.

a. Money is neutral in the medium run because the effects of the monetary policy are effective only in the short run. Monetary policy is useful in the short run to counterbalance fiscal policy or negative exogenous shocks. In the medium run the only effect of monetary policy is to create inflation (in the case of an increase in money supply) or deflation (after a decrease in money supply), without effects on real output. In the medium run equal to Y_n, its level does not depend on monetary policy.

b. Fiscal policy can affect the composition of GDP: if *G* decreases, in the medium run the investment will rise.

c. This is not true. Fiscal policy is not the only possible government policy. Some government policies affect *AS* curve, not AD, and in this way they can change the natural level of output in the medium run. Such policies are those which affect the labour market: the increase of unemployment benefits, labour protection and antitrust policy are all policies that affect *z* or μ.

5.

a, b. See Figure 9.11. The effect of a decrease in consumption on *AS–AD* curves is the same as a decrease in the budget deficit.

In *AS–AD* graph: the decrease in consumer's confidence causes a decrease in consumption, the *AD* shifts left and the output decreases. Also the price decreases a bit, so the *AD* decreases less than it could. Effective price *P* is lower than expected price P^e. In the medium run the *AS* curve shifts down until $P = P^e$. *Y* returns to Y_n. The prices are lower in the medium run after a fall in consumer's confidence.

In *IS*–*LM* graph: in the short run the decrease in consumption shifts the *IS* curve to the left, *Y* decreases and *i* decreases. When *P* decreases, the real money supply $\frac{M}{P}$ increases and *LM* shifts up. *Y* goes back to Y_n. The interest rate decreases even more.

c. In the short run the output decreases, the interest rate and the price level decrease. Consumption decreases, investment does not change, private saving does not change. In the short run it is not possible that a fall in consumption leads to an increase in saving because the prices are fixed. The fall in consumption leads only to a decrease in output.

d. No, there is no paradox of saving. In the medium run *Y* is fixed at Y_n. The decrease in consumption is counterbalanced by an increase in investment, because the interest rate is lower while the output does not change.

6.

a. If financial markets function poorly and firms cannot borrow and have to finance investment through profits the interest rate will have no effect on investment.

b. The *IS* curve is vertical.

c. The *LM* curve remains the same.

d. The *AD* curve is vertical and fixed on the value $Y = Y_n$.

e. The *AS* curve is vertical as the *IS* curve, so the short-run effect on the price level of an increase of *LM* is an increase to the new expected price level. There is no short-run effect of the output or investment. *Y* remains fixed to the natural level.

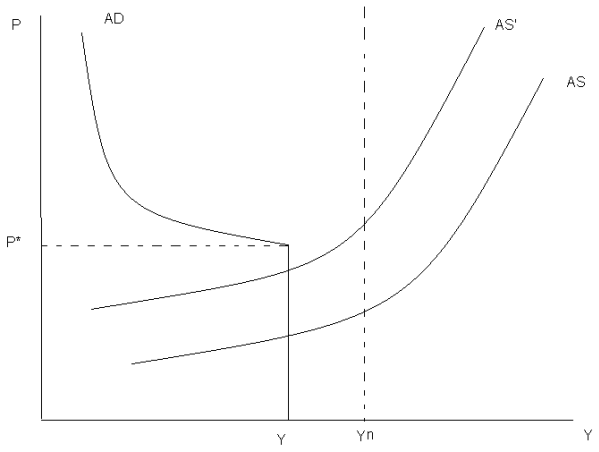
f. As price goes up, the expected price level goes up too. The interest rate has no effect on the investment, so output will stay unchanged at the original natural level. Price continues to rise and so does the expected price level. The real money supply keeps shrinking, and the interest rate keeps rising.

7.

a. See Figure 5.11. During a liquidity trap the interest rate is equal to 0 and the *LM* curve is flat.

b. Also the *IS* curve is flat when the interest rate falls below zero.

c.



The *AD* curve becomes vertical after the price level *P** where the interest rate are equal to zero.

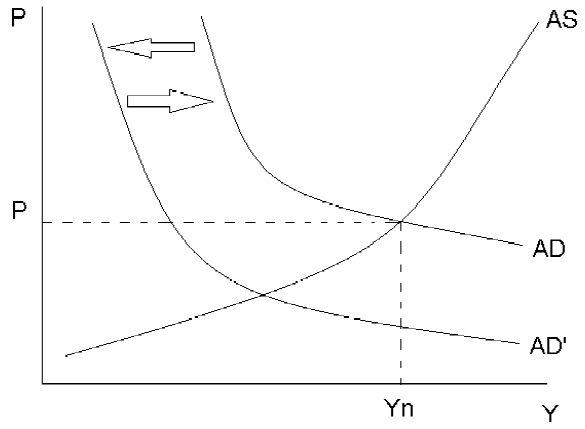
d. The effects on output in the short run will be zero, because in a liquidity trap *Y* cannot be increased by increasing the money supply. In the medium run output cannot be increased by an intervention of the Central Bank, only the fiscal policy can intervene.

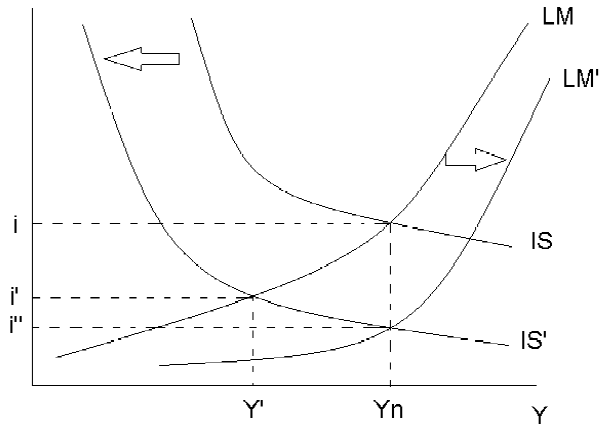
8.

a. See Figure 9.11.

b. The unemployment rate *u* in the short run increases because the output decreases but in the medium run *u* returns to u_n because *Y* increases to Y_n.

c.





In the short run the business confidence decreases, the investment decreases and *AD* shifts to the left. The *IS* shifts to the left, *Y* decreases and *i* decreases too. If the ECB wants to respond perfectly, it should increase the supply of money, so the interest rate can decrease and output can increase to Y_n. In this way the investment would remain to the same level.

d. The short-run price with the ECB policy is higher than the price in a. The short-run output with the policy is equal to Y_n, so it is higher than *Y* in the case without policy.

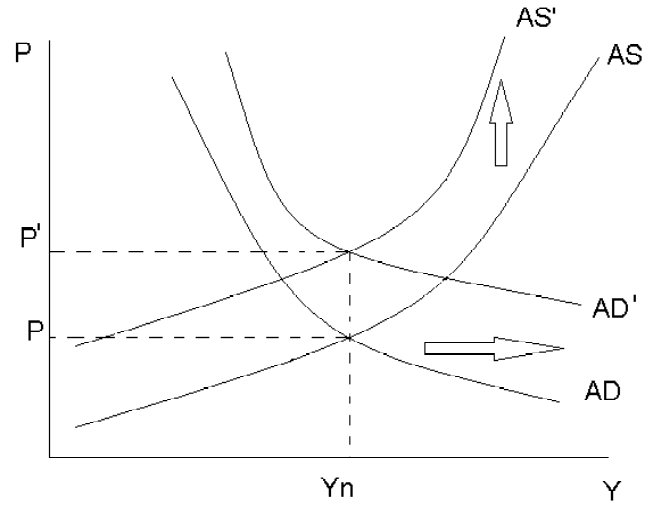
e. Short-run unemployment rate with the policy intervention is lower than the short-run unemployment rate without the intervention. In the long run, in both cases the unemployment rate is equal to the natural rate of unemployment.

9.

a. See Figure 9.15.

b. See Figure 9.14.

c.



d. The price level in the short run increases more than without the Central Bank intervention but Y_n will not change both in short and medium run.

e. In the case of the policy intervention the short-run unemployment rate is maintained at the natural level, so in the short run it is higher than without the intervention.

10. There also other factors which influence u_n and Y_n. Besides, an expansionary monetary policy causes a rise in the price level, so it must be used with attention.

11.

a. An increase in the oil price will decrease Y_n and u_n will increase. From the short run to the medium run, Y decreases and u increases to the new levels. The real wage $\frac{W}{P}$ decreases (and also the after-tax income if T is constant).

b. A decrease in income tax will increase AD. But P increases in the short run, so AS will increase too. In the medium run $Y = Y_n$ will remain at the same level as before and P will increase. The real wage will decrease while unemployment will remain the same. Nominal after-tax income will increase but prices increase too, so the real wage does not change.

c. The government should use policies that affect AS curve changing the parameter z. (increase in antitrust law, increase in unemployment benefits and increase in minimum wage).

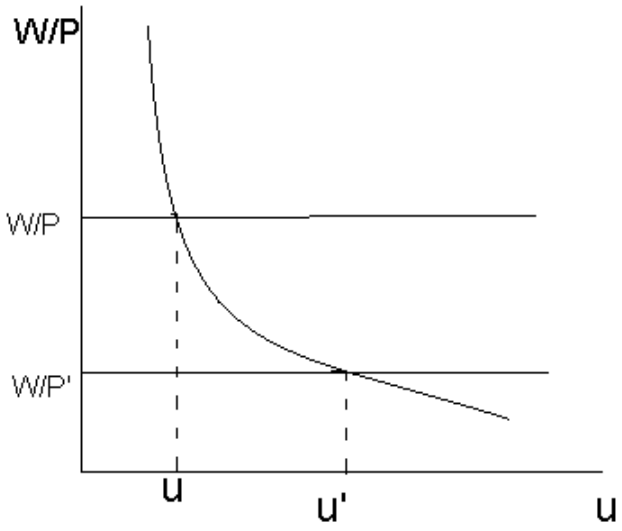
d. As seen in answer b, a decrease in T will cause an increase in AD and AS increases to Y_n, so there is also an increase in P. In this way the real after tax wage remains the same.

12.

a. The aggregate supply function is: $P = (1+\mu)\left[P^e F(u,z)\right]^{\alpha} P_E^{1-\alpha}$

b. Solution given in the book.

c.



d. With $\frac{W}{P} = \frac{1}{(1+\mu)\frac{1}{ax}\frac{1-a}{\alpha}}$. If x increases, the real wage decreases and the natural unemployment rate increases.

e. The effect is similar to an increase in the mark-up. See Figures 9.14 and 9.15.

f. If the Central Bank decreases the money supply in the short run, the *AS* increases in the short run because of the increase in the energy prices but the *AD* decreases so $P = P^e$ does not change and Y_n decreases to a new equilibrium level.