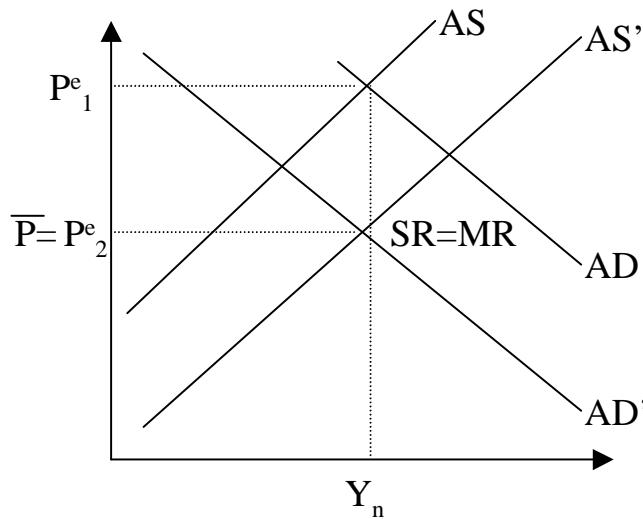


## 1 Question 1

- (a) This solution is analytically equivalent to question 3 on the second midterm.  
 (b) This solution is analytically equivalent (although it goes the opposite way) to question 2, part (b) on the second midterm. Here is the graph. The change in AD to AD' is because of the shift in money supply, and the shift in AS to AS' is because of the simultaneous shift in expected price.



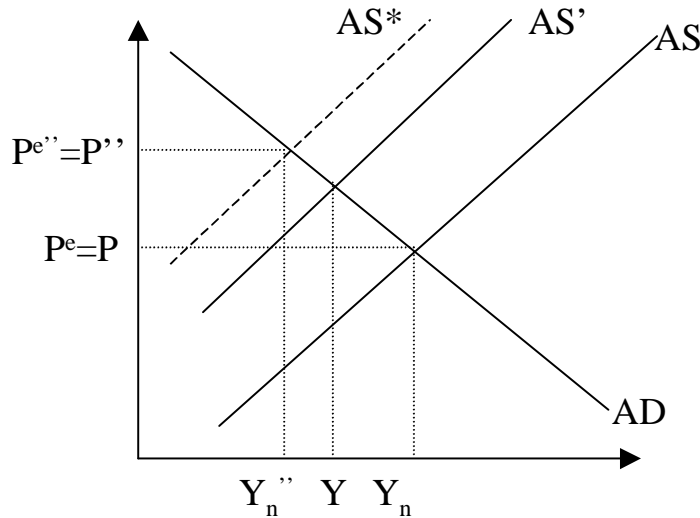
- (c) Price is a mechanism by which the economy works to accommodate shocks—prices move to reflect changes in the economy and help mitigate their effects. By relating price to expected price in the AS equation:  $P = P^e(1 + \mu)F(u, z)$ , we're introducing a friction so that the price is no longer able to adjust and compensate as quickly as it would if people were able to instantaneously adjust their expectations. If people updated their expectations instantaneously, we would not see the short run recessions (or booms) that might otherwise characterize the response of an economy to an exogenous shock.

## 2 Question 2

- (a) If unemployment benefits shrink, the AS curve shifts upward and to the left. The natural rate of unemployment, must be lower still.<sup>1</sup> Note that the

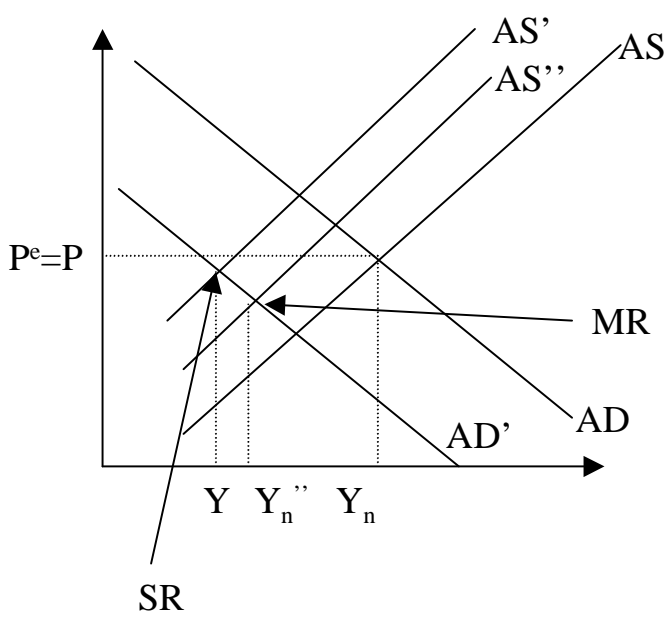
<sup>1</sup>This is not necessarily that easy to prove: Suppose we're starting at  $P, P^e, u_n, z$ . So the AS curve requires that  $P = P^e(1 + \mu)F(u_n, z)$  and note that in the initial MR equilibrium,

new natural output is where the AS' intersects the original  $P = P^e$  line. Note that AS\* does not actually exist, I simply put it in the graph so that you could see how the new natural rate of output relates to the SR in the absence of a demand side shock. So without the reduction in government spending, the graph looks like this.

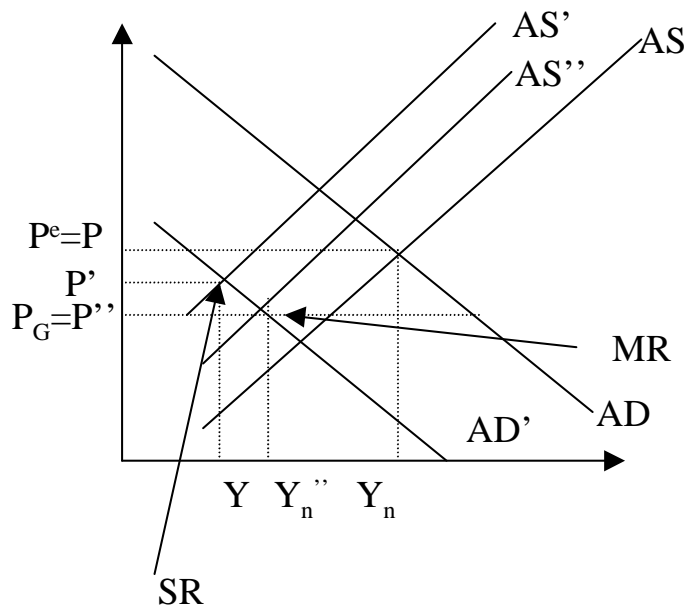


Now consider the adjustment in government spending that shifts the AD curve. I am assuming that the AD curve is going to shift such that the output at the new SR equilibrium is to the left of  $Y_n''$ , the new natural level of output. There is no reason to believe that this must be the case, it could be that AD shifts so subtly that we're still above the new natural level of output, but we'll assume that's not the case for the remainder of the question. Therefore, in the short run, we will be at the intersection of AD' and AS'. In the medium run, AS' will move as people adjust their expectations of price so that AS'' intersects AD' directly at the new natural level of output  $Y_n''$ .

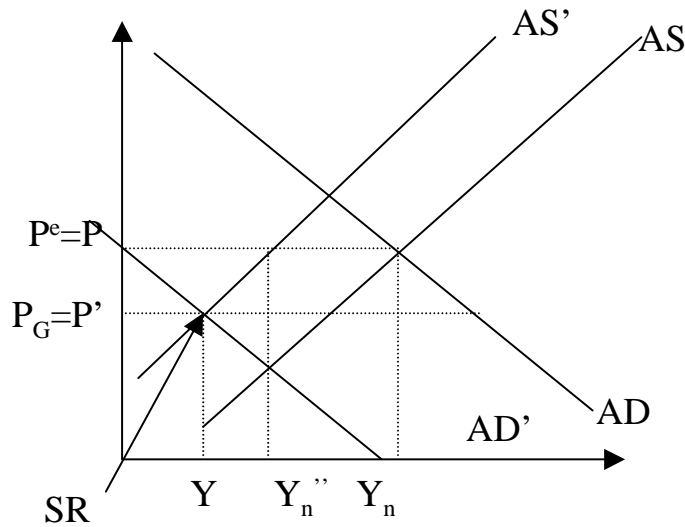
we have  $P = P^e$ . When the curve moves up and to the left, we are at a new point  $P' > P = P^e, u^* > u_n, z^* > z$ . In the medium run, we have the opportunity to revise  $P^e$  to  $P^{e''}$ . How do we know that  $P^{e''} > P'$  and as a consequence,  $u_n'' > u^*$ ? This requires a little effort. First note that we are on the AS curve in the SR equilibrium so  $P' = P^e(1 + \mu)F(u^*, z^*)$ . If  $u_n'' < u$ , then  $F$  is going to go up and since AD is downward sloping, we know that  $P'$  is going to go down. This suggests that  $P^e$  has to go down, which cannot be the case because people would be adjusting their expectations the wrong way. On the other hand, if  $u_n'' > u$ , then  $F$  is going to go down in the medium run while  $P'$  is going to go further up towards a higher MR level (again because of the downward sloping demand curve). This requires that  $P^{e''}$  go up even faster, which is okay.



(b) **Let's abstract away from the change in government spending because it will shift the AD curve in the same direction as the decrease in money supply.** Decreasing the money supply increases the interest rate and decreases output for any particular price level (you can see this in the IS-LM model, it involves a shift in the LM curve to the upper-left). Let  $P_G$  be the gold-standard price. If we want the price to settle on  $P_G$  in the medium-run, then we want to shift the AD curve such that  $AD'$  intersects  $P_G$  horizontal line at exactly the new natural rate of output. Therefore, we know that  $AS''$  will naturally settle to exactly that point  $P_G$  in the medium run as people revise their expectations.

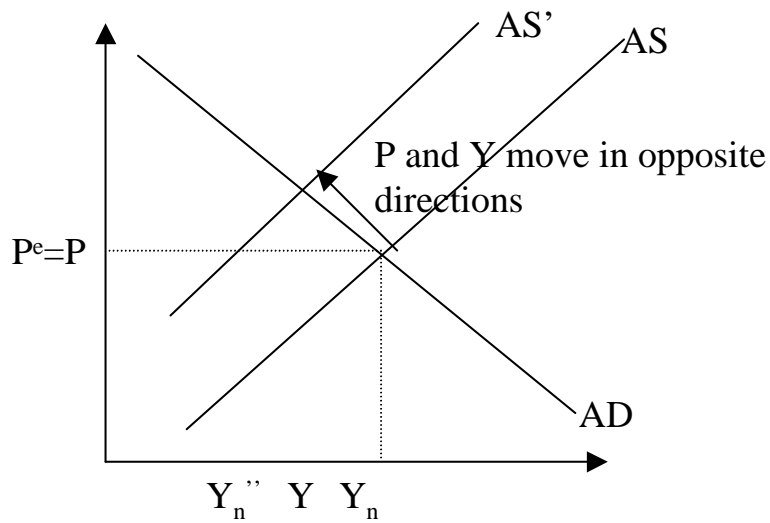


(c) The short run is very similar, except that the shift in  $AD$  to  $AD'$  is even more violent. In this case, we want the  $AD'$  to intersect  $P_G$  where  $AS'$  also hits  $P_G$ . That way we know that the short-run price  $P'$  will be coincident with  $P_G$ . Since we are moving the  $AD$  curve even further, it stands to reason that the decrease is much greater. Furthermore, since we are getting to  $P_G$  and not allowing people to revise their expectations (because we are in the short-run), we know that the level of output is going to be substantially lower than the medium-run natural level. We are moving further down and to the left along the  $AS$  curve, so the recession is going to be worse than it was in part (b).



### 3 Question 3

Since AD is downward sloping, that means we must be moving along the AD curve to get opposite movements in  $Y$  and  $P$ . Therefore, it is the AS curve that must be moving. Combining the information that the real wage is not changing with the price setting equation,  $P = (1 + \mu)W$ , suggests to us that the markup cannot be the thing to change. So if the AS curve is moving, that means that either the  $P^e$  term is being shocked or somehow the  $F(u, z)$  is being changed by some modification of  $z$  (like a change in unemployment benefits).



## 4 Question 4

Going back to the price setting equation  $P = (1 + \mu)W$ , we can infer that the markup is changing if  $W/P$  is changing. We still want the AS curve to shift, but now we know that a change to the markup is driving this movement. In this specific case,  $\frac{W}{P} = \frac{1}{1+\mu}$ , so an increase in the real wage would have to be the result of a decrease in the markup.