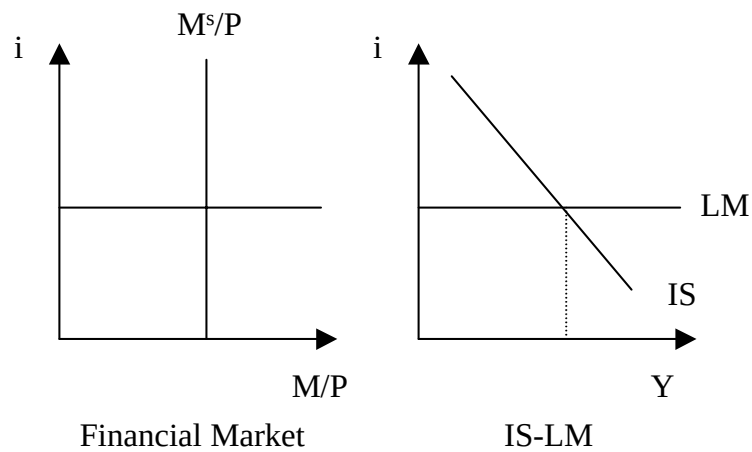
Problem Set #5
Solutions

1 Question 1 (Problem #6, p. 159)

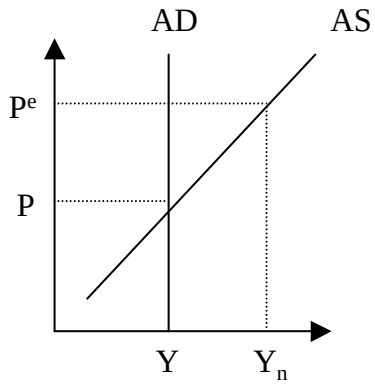
(a) That the money demand curve is flat means clearly (in the graph) that money demand only admits one interest rate. Because the money demand is only defined for one interest rate, the LM curve must have 0 slope (otherwise the LM curve is implying that we can be in equilibrium at a different interest rate, which is clearly not the case). This also suggests that money demand is unresponsive to output as well, so we're just going to assume that money demand is whatever the supply is $\frac{M^d}{P} = \frac{M^s}{P}$.

(b) Nothing is implied about the slope of the IS curve as it represents pairs of interest rates and outputs that achieve equilibrium in the goods market, about which no additional assumptions were made. We'll assume that it is typically downward sloping.



(c) The AD curve must be vertical. To see this, start with a P and a Y. Now consider $P' < P$. At this new, lower price, real money supply and real money demand is increased. As real money demand is not dependent on output or interest rate, the LM curve goes nowhere. Therefore, for P', the equilibrium level of output must be exactly the same as it was for P. So for any P, the Y will remain unchanged and AD is vertical.

(d) Increasing the money stock, by virtue of the answers in part (a) and part (c) does nothing to the AD curve anymore because the LM curve is immune to any effects. Therefore, there is no monetary policy that can push our economy back toward the natural rate of output. Similarly, in the medium run, people can adjust P^e, however since AD is still vertical and revisions to P^e will only adjust the AS curve. Alone, this is insufficient to change the medium-run equilibrium level of output, so we're stuck at a below natural level of output.



AD-AS

2 Question 2 (Problem #7, p. 159)

(a) For us to be at the natural rate of unemployment (and hence output), $P = P^e$. If this isn't immediately obvious, take a look at the labor markets in Chapter 6 to see why this must be the case. Using the AS eqauation then:

$$\begin{aligned} P &= P^e + d(Y - Y_n) \\ 0 &= d(Y - Y_n) \\ Y &= Y_n \end{aligned}$$

So as we might have suspected by notation, Y_n is the natural rate of unemployment.

Given $M = M_0$ we want to solve for the initial price level P_0 in terms of exogenous variables (so we don't want to see P_0 equal to anything involving a Y). Another way to understand: want the price at the intersection of the demand and supply curves, so we're going to need both equations in order to locate that point. Therefore we're going to want to substitute one in for the other, in this case we're going to plus AD into the AS equation to get:

$$\begin{aligned} P_0 &= P^e + d(c(M_0 - P_0) - Y_n) \\ P_0 &= \frac{P^e + dcM_0 - dY_n}{1 + dc} \end{aligned}$$

So here we have P_0 in terms of exogenous variables (remember that P^e is considered exogenous in the short run). Note that we did NOT assume here that we were in a medium-run equilibrium, but if were stipulated that we were in a medium-run equilibrium, we can use this equation. Simply make $P_0 = P^e$ and solve for P_0 to get:

$$P_0 = M_0 - \frac{Y_n}{c}$$

(b) Substitute in our expression for P_0 into the AD function:

$$\begin{aligned} Y_1 &= c(M_1 - P_1) \\ Y_1 &= c(M_1 - \frac{P^e + dcM_1 - dY_n}{1 + dc}) \end{aligned}$$

(c) The AD curve here is clearly downward sloping in price, so we know that the IS and LM curves must have be not be horizontal or vertical. Therefore, an increase in the money supply is going to shift LM outwards driving Y up and i down. Rising prices will somewhat blunt the increase to output, but not entirely . Because the IS curve has a negative slope, investment is going to respond to the change in the interest rate, we would expect that investment would go up in the short run. Note that you can prove that Y is higher at M_1 than M_0 from the expression above.

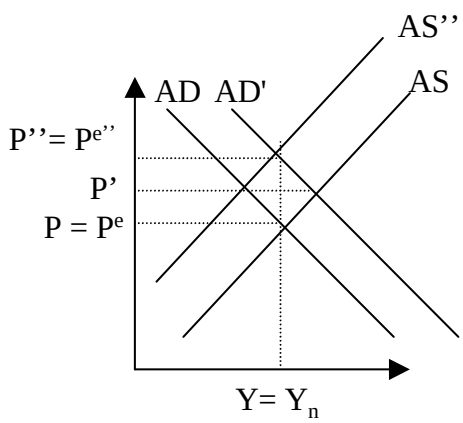
(d) $Y = Y_n$ (again because $P = P^e$).

(e) In the medium run, lots of stuff returns to its original value. Output (Y) is the same as it originally was. Consumption (C), a function of unchanging output and taxes, is similarly unchanged. Government spending (G) is similarly unchanged. Therefore, the expression $Y = C + I + G$ demonstrates that investment is unchanged in the medium run.

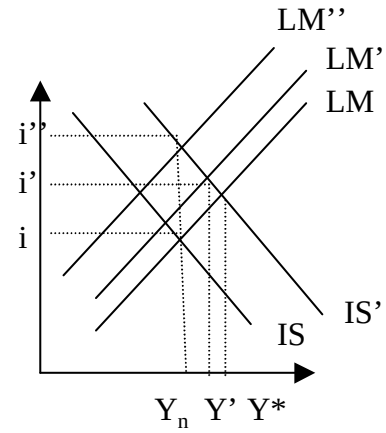
HINT: As there are a lot of variables that end up returning to their original values in the medium run, the national accounting identity $Y = C + I + G$ is frequently very useful. We'll appeal to it again in question 3.

3 Question 3

Note the following notation. If something has no apostrophe, it is in original state. So IS means the original IS curve. One prime is a shift in the short-run (that persists into the medium-run as well). So IS' is a short-run change in the IS curve. A double-prime denotes a change that does not occur until the medium-run. For example LM'' is a change the the LM curve in the medium-run. Here are the graphs:



AD-AS



IS-LM

The IS curve shifts out by an amount equal to $\frac{\Delta \overline{I}}{1-c_1}$ (assuming no financial accelerator or anything of the sort). But the interest rate also increases. So the new equilibrium, absent any change in price, would be Y^*. Note that $Y_n - Y^*$ is the distance by which the AD curve shifts to the right as well (and this type of information is expected on the second midterm if you were asked to draw these graphs). However, the price now goes up to P', which causes a drop in real money pushing the LM curve to LM'. Therefore output contracts to its new level Y', its short-run equilibrium level. So the short-run AS-AD multiplier is smaller than the IS-LM multiplier because price is going up.

In the medium run, people adjust their expectations about price and the AS curve is going to move up as P^e moves to $P^{e''}$. So we are going to push the short-run equilibrium price up higher from P' to P'', which pushes LM' to LM'' as real money further declines. And we're back to the natrual level of output Y_n. Note that the medium-run multiplier is 0 as there was no change in output.

The composition of the different elements is as follows:

(a) Government spending: No change as this is exogenously given.

(b) Consumption is a function of disposable income, which is going to increase in the short run. It will return to its natural level in the medium-run.

(c) Investment increases exogenously in the beginning, part of which is lost because of interest rates increasing. But because only part of the increase in Y is spent on consumption and G remains constant, we know that overall investment must increase because $Y = C + I + G$. As a further consequence of that equation, overall investment will return to its original level in the medium-run.