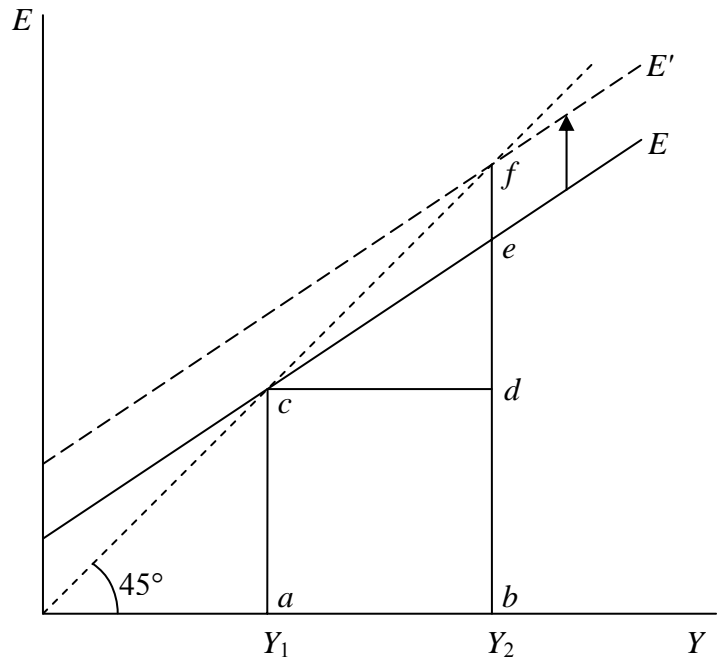


**Homework #4**  
**The IS-LM Model**  
**Due March 18**

1. Fun with the Keynesian Cross:

- a. Use the geometry of the Keynesian Cross diagram shown at the right to derive that the government purchases multiplier is  $1/(1-MPC)$ , where  $MPC$  is the slope of the planned expenditure line,  $E$ . In the figure, planned expenditure has increased (for any given income) by the amount of an increase in government purchases,  $\Delta G$ . Use the labels in the figure ( $a, b, c, \dots$ ) to denote the distances involved (e.g.,  $ab$  is the distance from  $Y_1$  to  $Y_2$ , or  $\Delta Y$ ). First, identify the following:

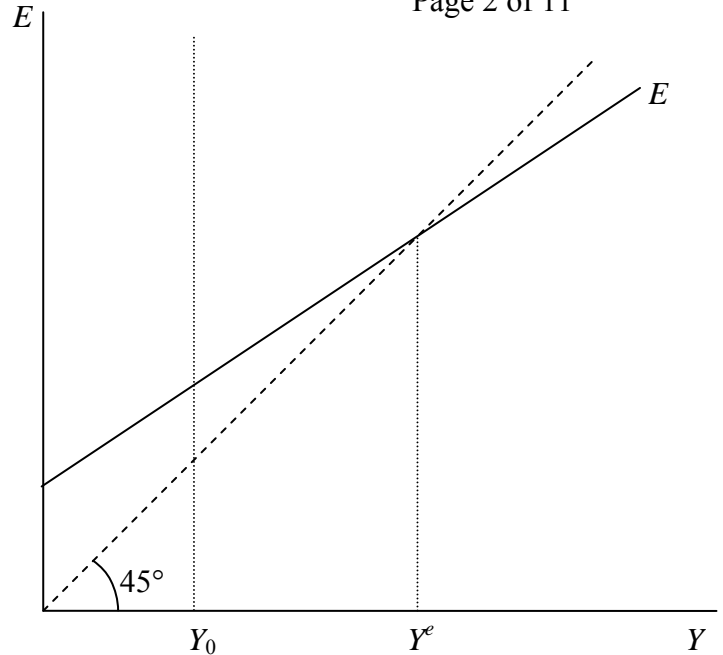


$\Delta Y$	$ab$
$\Delta G$	
$MPC$	
Two other distances that = $ab$	

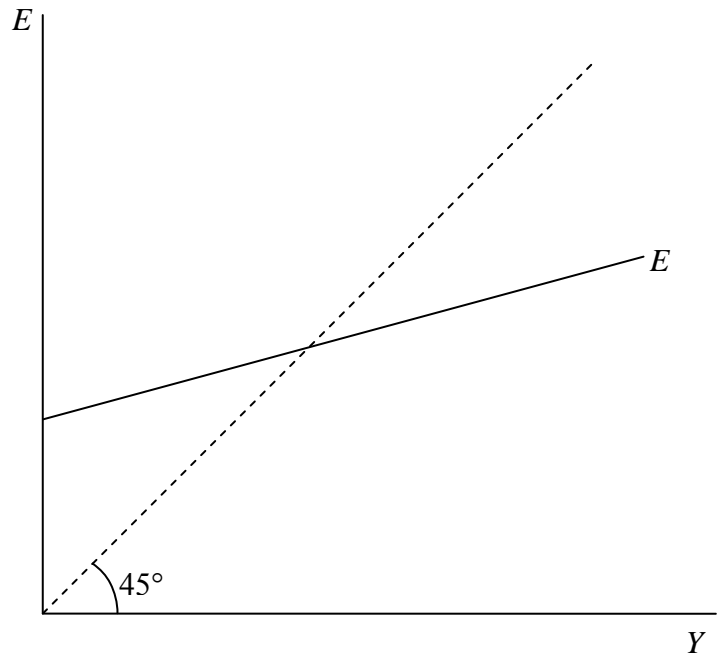
Then use these to derive the government purchases multiplier:

$$\frac{\Delta Y}{\Delta G} =$$

- b. In the diagram at the right, suppose that the economy starts, in time period  $t=0$ , out of equilibrium at income  $Y_0$ . Suppose also the following dynamic process for adjusting when out of equilibrium: in each period,  $t$ , the economy produces an output equal to the level of planned expenditure from the *previous* period. Find and label in the figure the levels of income for time periods 1, 2, and 3.



- c. In the diagram at the right, draw the new planned expenditure curve that will exist if there is a *cut* in taxes of  $\Delta T = \frac{1}{2}$  inch. Label  $\Delta T$  so as to show how you determined where the new curve should be. (Hint: If taxes are cut by some amount, say \$1000, then at any total income  $Y$  consumers will buy the same amount that they would have bought before if their income had been  $Y+1000$ .) Identify also the old and new equilibrium levels of income,  $Y_1$  and  $Y_2$  and the change in income  $\Delta Y$ . How does  $\Delta Y$  compare to  $\Delta T$ ?



- d. (Optional) Return to the diagram of part (a) and identify the planned expenditure curve that would reflect *both* the increase in government purchases *and* an accompanying tax increase sufficient to finance it. What is the multiplier ( $\Delta Y / \Delta G = \Delta Y / \Delta T$ ) in that case? Can you show that in the figure?

2. The following are the equations of the IS-LM model, here including a feature that taxes are not simply given but depend on income through a tax function,  $T(Y)$ .

$$\text{IS Curve:} \quad Y = C(Y - T(Y)) + I(r) + G$$

$$\text{LM Curve:} \quad M / P = L(r, Y)$$

- a. Differentiate the model totally and solve for the government spending multiplier,  $dY/dG$ , in terms of the various slopes of the functions:  $C'$  = marginal propensity to consume out of disposable income,  $T'$  = marginal tax rate,  $I'$  = effect (derivative) of the interest rate on investment, and  $L_r, L_Y$  = the effects (partial derivatives) of the interest rate and income on liquidity preference.
- b. From this, what would the multiplier be if taxes did *not* depend on income? Does the income tax ( $T' > 0$ ) make the multiplier larger or smaller?
- c. Can you tell whether this multiplier from part (a) is larger or smaller than one? What features of behavior tend to make the multiplier smaller, and what make it larger?

3. We normally draw the IS curve as downward sloping and the LM curve as upward sloping, as appropriate for our usual assumptions about behavior. How would either or both of these curves look different if the following *unusual* assumptions were made? Either describe or draw your answers, being sure in either case to make clear what you mean.

a. Investment does not depend on the interest rate.

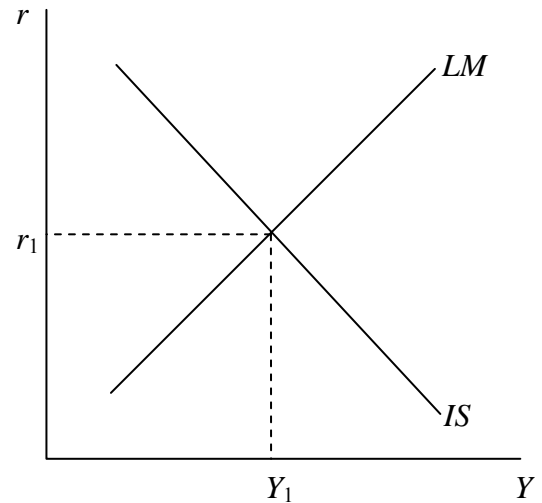
b. The *MPC* is zero.

c. The *MPC* is one.



4. In each case below, you are given the IS-LM diagram with an initial equilibrium. Show how one or both of the curves change for the following exogenous changes in the model. Then, from that, determine the qualitative changes (+, -, 0, ?) in the indicated variables (where “?” means the variable could go either way). Give reasons for your results, where asked.

a. A reduction in government purchases



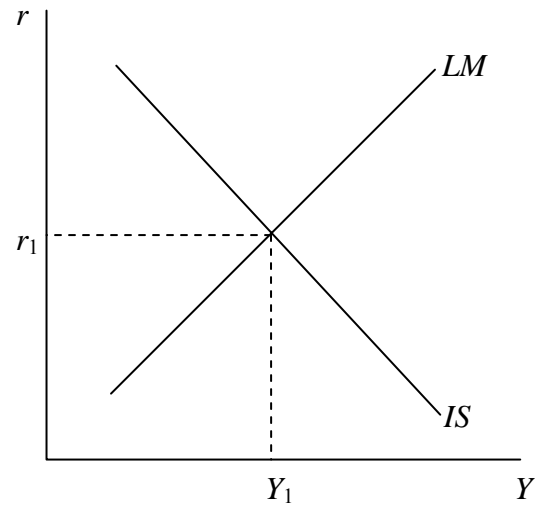
$Y$  \_\_\_\_\_

$r$  \_\_\_\_\_

$C$  \_\_\_\_\_ Why?

$M$  \_\_\_\_\_ Why?

b. An increase in the money supply.



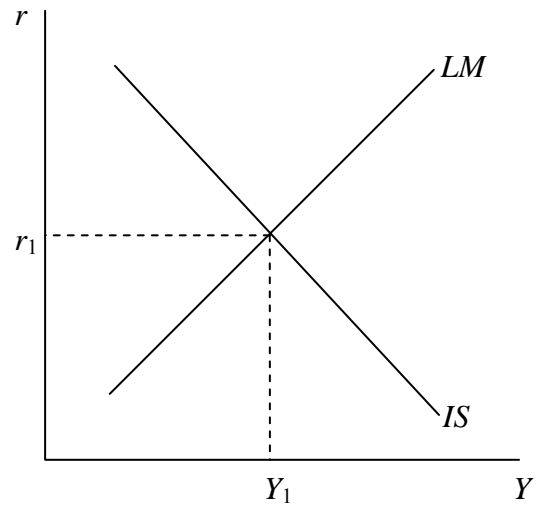
$Y$  \_\_\_\_\_

$r$  \_\_\_\_\_

$I$  \_\_\_\_\_ Why?

$L$  \_\_\_\_\_ Why?

c. A downward shift in the consumption function (less consumed at each  $Y-T$ ).



$Y$  \_\_\_\_\_

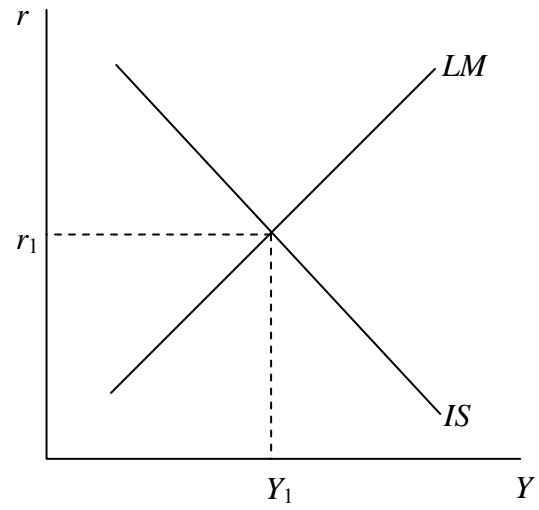
$r$  \_\_\_\_\_

$L$  \_\_\_\_\_ Why?

$C$  \_\_\_\_\_ Why?



- d. An upward shift in the investment function (more investment at each interest rate).



$Y$  \_\_\_\_\_

$r$  \_\_\_\_\_

$S$   
(=national savings) \_\_\_\_\_ Why?

$I$  \_\_\_\_\_ Why?

5. In part (c) of question 4 above you found (I hope) that the downward shift in the consumption function caused a fall in output. Suppose now that policy makers try to prevent this by expansionary monetary or fiscal policy. For each of the policies indicated below, assume that the policy is used in exactly the right amount to offset the effect on  $Y$ , so that the combined effect of the shift of the consumption function and of the policy is for equilibrium  $Y$  not to change at all. Determine in each case how private savings, government savings, and national savings in the new equilibrium compare to what they were before all this happened.

a. A change in the money supply

b. A change in government purchases

c. A change in taxes. How does the effect on the government budget here compare to part (b)?

6. Suppose that at a moment in time neither the goods market nor the money market is in equilibrium, so that the economy is neither on the IS curve nor on the LM curve.
- a. Based on what you know about how these two markets adjust toward equilibrium, which market would you expect to move more quickly towards equilibrium? Why?

- b. Based on your answer to (a), show in the IS-LM diagram at the right, and then on the time axes below, how you would expect income and the interest rate to respond to a sudden large increase in the money supply that occurs at time  $t_0$ .

