

**Problem Set 1 Answers**

Due *in lecture* on Tuesday, 29 September. "Box-in" your answers to the algebraic questions.

**1. Policy in an IS-LM model**

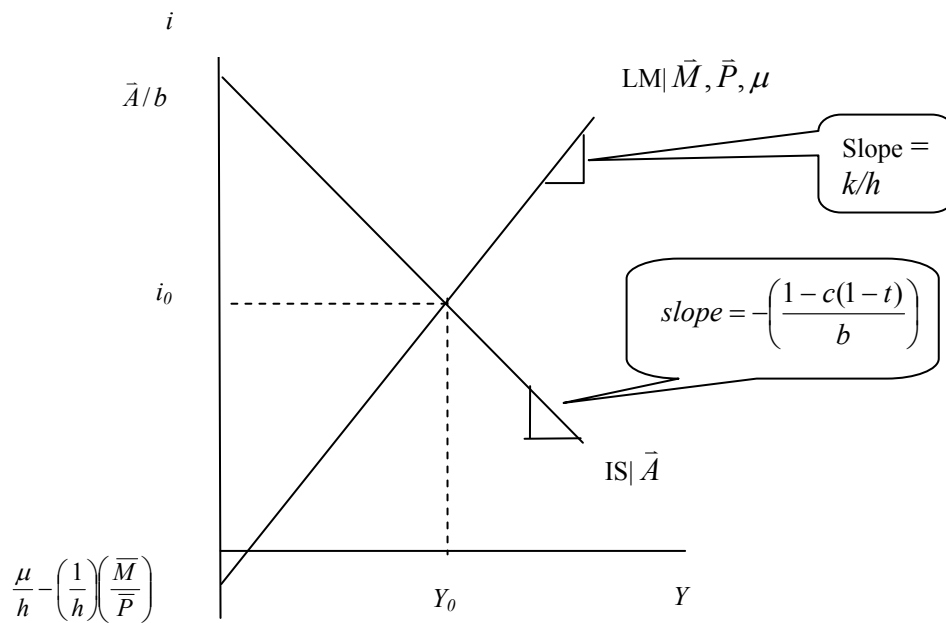
Suppose the real side of the economy is given by:

- |     |  |   |
|-----|--|---|
| (1) | $Y = AD$                                 | Output equals aggregate demand – an equilibrium condition               |
| (2) | $AD \equiv C + I + G$                    | Definition of aggregate demand  |
| (3) | $C = \overline{C\bar{O}} + c(Y - T + F)$ | Consumption function, $c$ is the marginal propensity to consume         |
| (4) | $T = \overline{T\bar{A}} + tY$           | Tax function; $\overline{T\bar{A}}$ is lump sum taxes, $t$ is tax rate. |
| (5) | $F = \overline{F\bar{T}}$                | Transfers function; $\overline{F\bar{T}}$ is lump sum transfers.        |
| (6) | $I = \overline{I\bar{N}} - bi$           | Investment function   |
| (7) | $G = \overline{G\bar{O}}$                | Government spending on goods and services                               |

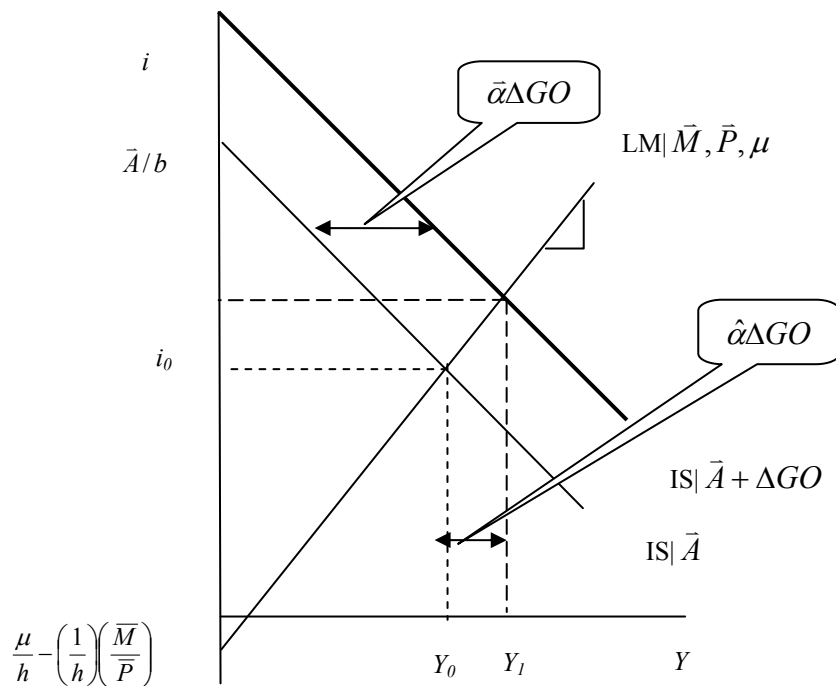
and the monetary sector is given by:

<u>Eq.No.</u>	<u>Equation</u>	<u>Description</u>
(8)	$\frac{M^d}{P} = \frac{M^s}{P}$	Equilibrium condition
(9)	$\frac{M^s}{P} = \frac{\overline{M}}{P}$	Money supply
(10)	$\frac{M^d}{P} = \mu + kY - hi$	Money demand

1.1 Graph the IS and LM curves on a single graph. Show the vertical intercepts, the slopes, and the intersection. Also show what each curve depends on.

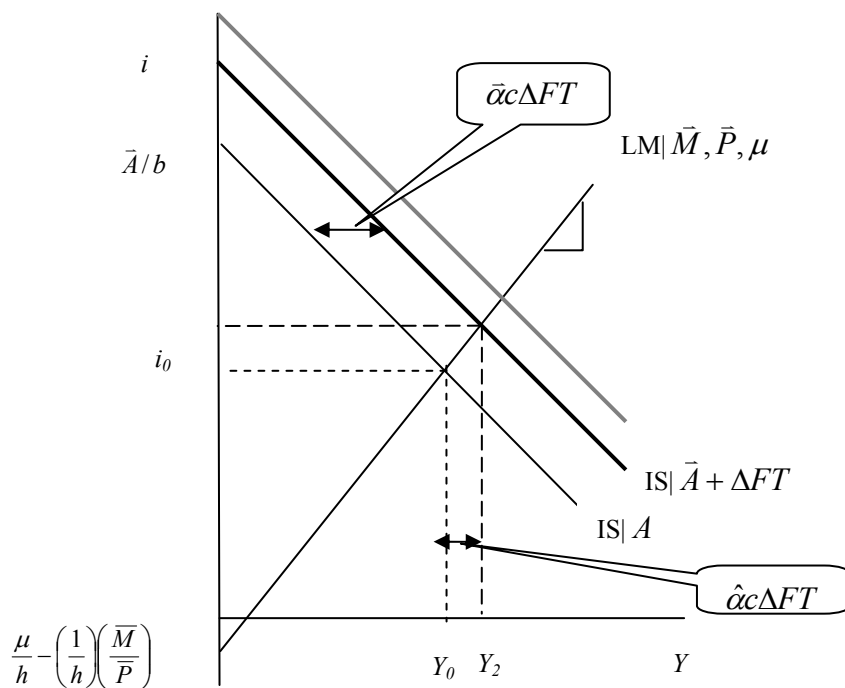


1.2 Show what happens if government spending on goods and services are increased by  $\Delta GO$ .



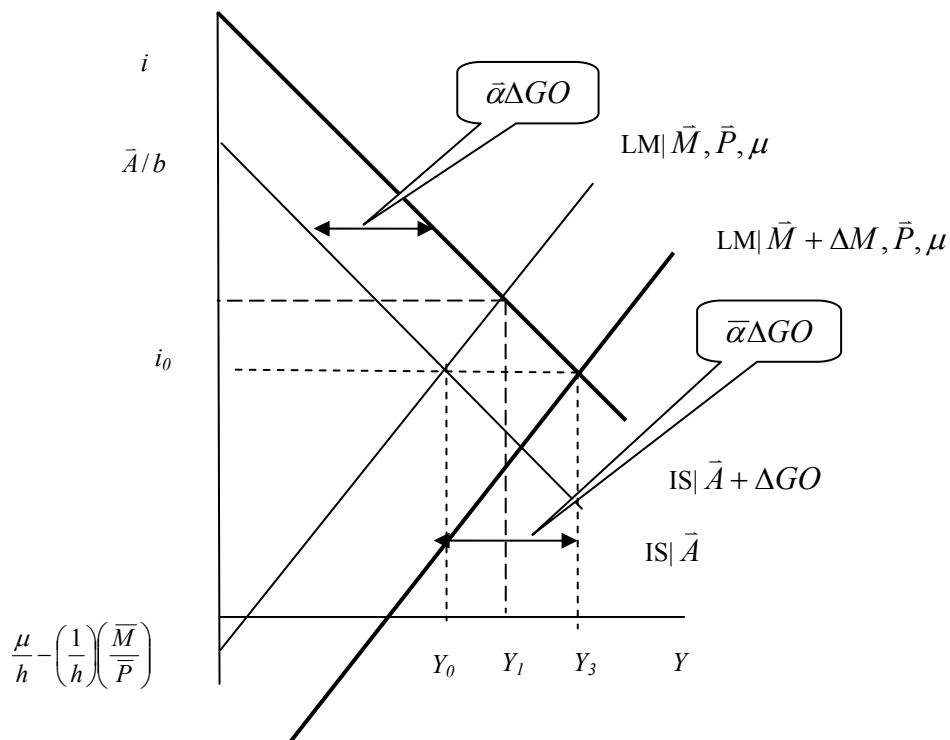
Where  $\bar{\alpha} \equiv \frac{1}{1-c(1-t)}$  and  $\hat{\alpha} \equiv \frac{1}{1-c(1-t) + bk/h}$

1.3 Using the same graph as in 1.2, compare what happens if government spending on *transfers* is increased by  $\Delta FT$ , where  $\Delta FT$  is numerically equivalent to  $\Delta GO$ .



Notice the output increase is smaller now, by a factor  $c$  (the marginal propensity to consume).

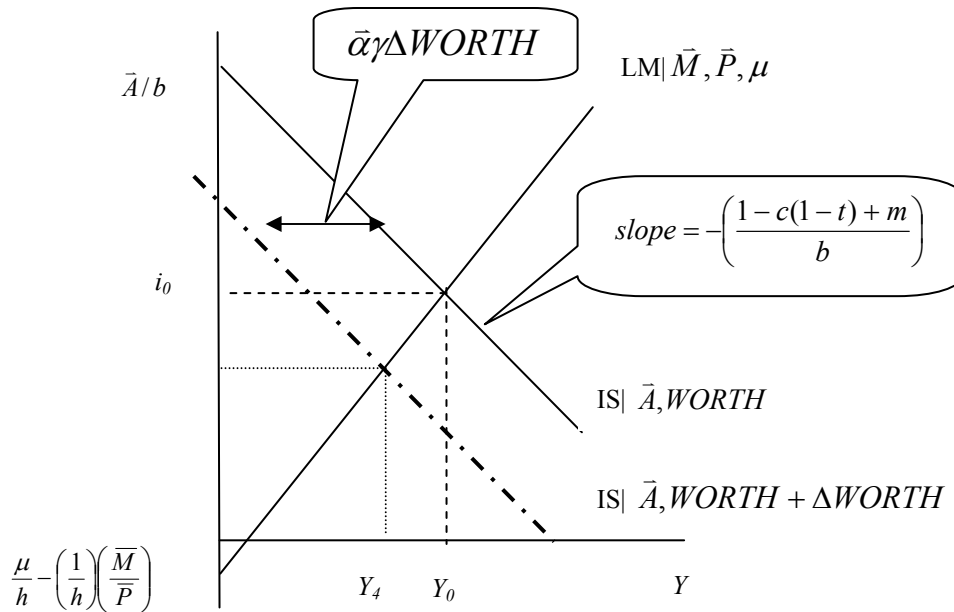
- 1.4 Show what happens if the only fiscal policy is an increase in government spending by amount  $\Delta GO$ , and the Fed increases the money supply to keep the interest rate constant. What is the multiplier in this case?



1.5 Suppose the economy is given by equations (1)-(10), but equation (3) is given by:

$$(3') \quad C = \bar{C}\bar{O} + c(Y - T + F) + \gamma WORTH$$

Where WORTH is net private sector household wealth (assets minus liabilities), including housing and equity. What happens when net worth falls by  $\Delta WORTH$ ?



As worth falls, then consumption falls, which is then multiplied by the multiplier.

1.6 Compare what happens if a lump sum tax cut of \$100 billion occurs if consumers either spend or “rebuild their balance sheets” (i.e., save). For simplicity, set  $c = 0.7$ ,  $t=0$ , and  $\gamma=0.05$ .

If consumers behave in the Keynesian fashion, then the standard multiplier is applied:

$$\Delta Y = -\hat{\alpha}c\Delta TA$$

Assume perfectly accommodating monetary policy:

$$\Delta Y = -\bar{\alpha}c\Delta TA = -(1 - 0.7)^{-1} \times (0.7) \times (-100) = 233.3$$

If the entire tax cut is saved on the first round, but the resulting higher income is consumed in a normal fashion, then (assuming accommodating monetary policy again):

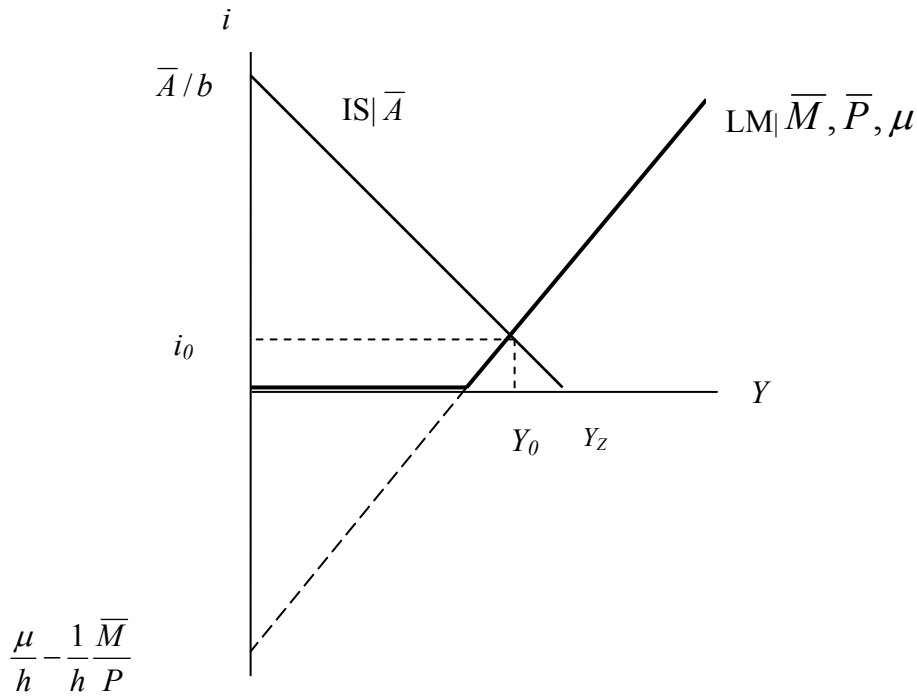
$$\Delta Y = -\bar{\alpha}\gamma\Delta TA = -(1 - 0.7)^{-1} \times (0.05) \times (-100) = 11.7$$

but if there is no MPC for subsequent rounds of spending/income, then

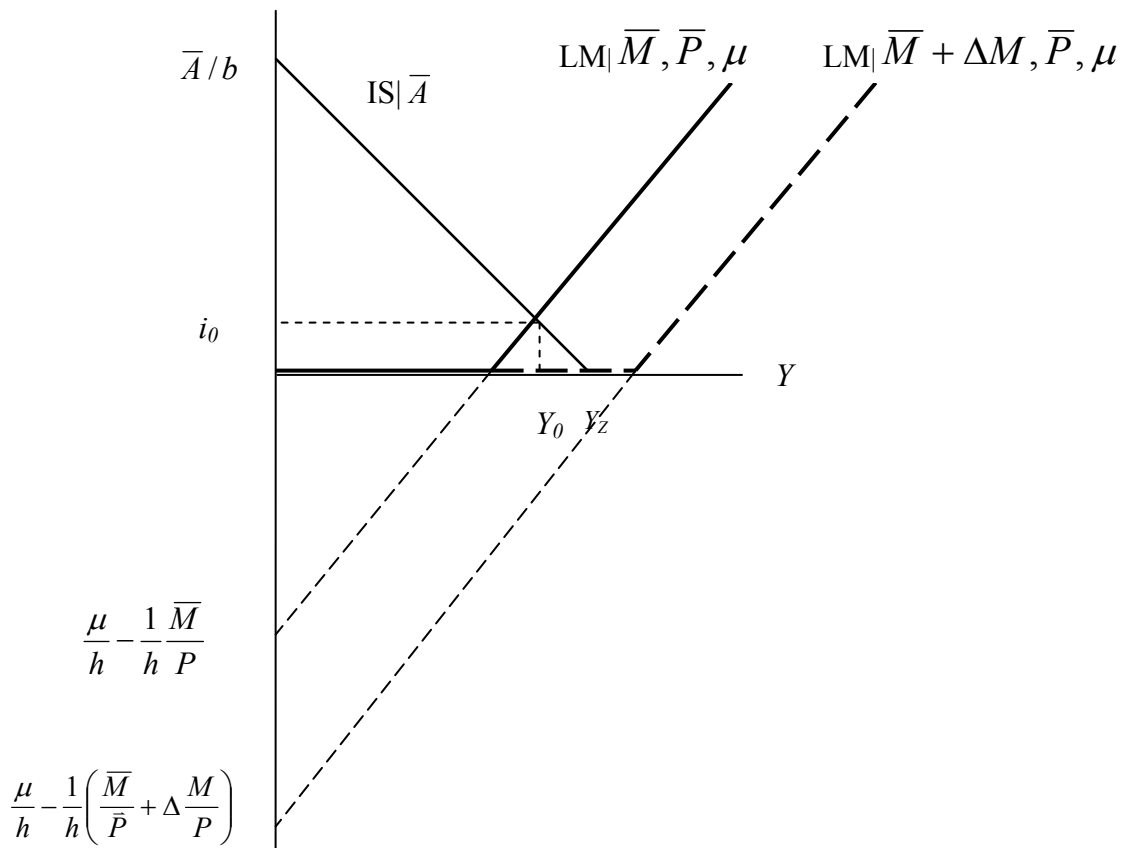
$$\Delta Y = -\gamma\Delta TA = -(0.05) \times (-100) = 5$$

## 2. Liquidity Trap

Consider the following diagram.



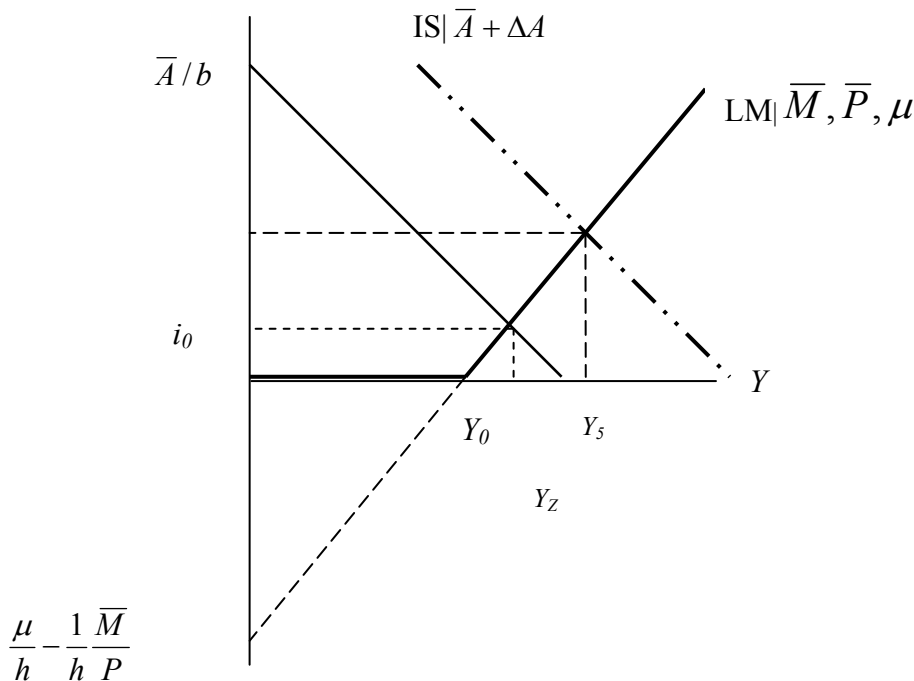
2.1 Using the above graph, show what happens if expansionary monetary policy is used (label the curve shift assuming  $\Delta(M/P)$  ).



In this case, the increase in the money supply cannot increase output in excess of where the IS curve intersects the horizontal axis at  $Y_Z$ . That's because of the liquidity trap, wherein at a certain point, monetary policy cannot affect interest rates and hence investment.

2.2 What is the maximal impact on income that can be obtained using monetary policy? See above.

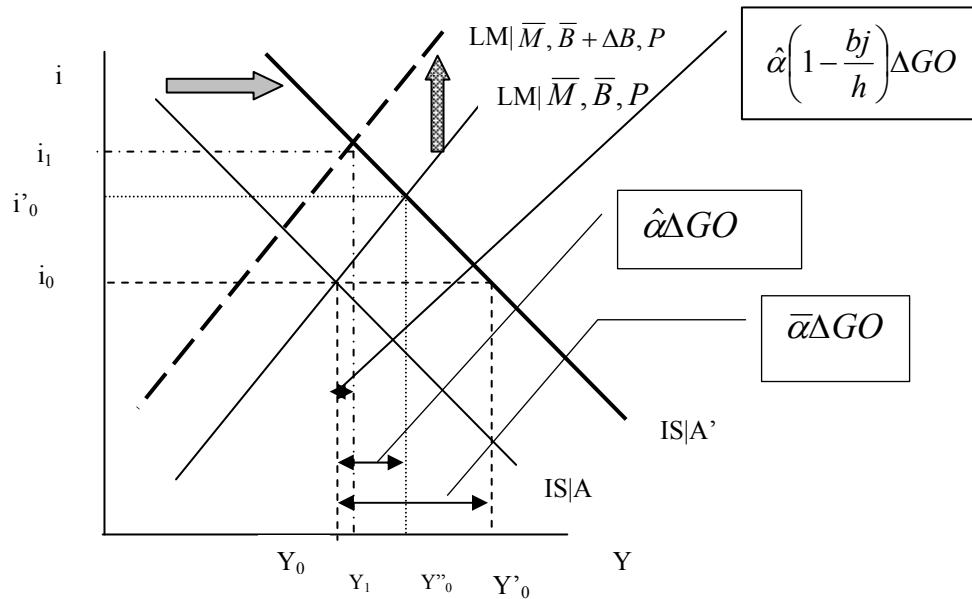
2.3 Show what happens if expansionary fiscal policy is used (label the curve shifts assuming  $\Delta GO$ ).



3. Given an economy defined by equations (1)-(7) in problem 1, setting  $t=0$ , and:

<u>Eq.No.</u>	<u>Equation</u>	<u>Description</u>
(8)	$\frac{M^d}{P} = \frac{M^s}{P}$	Equilibrium condition
(9)	$\frac{M^s}{P} = \frac{\bar{M}}{P}$	Money supply
(10)	$\frac{M^d}{P} = \mu + kY - hi + j\left(\frac{\bar{M} + \bar{B}}{P}\right)$	Money demand
(11)	$BuD = G - T$	

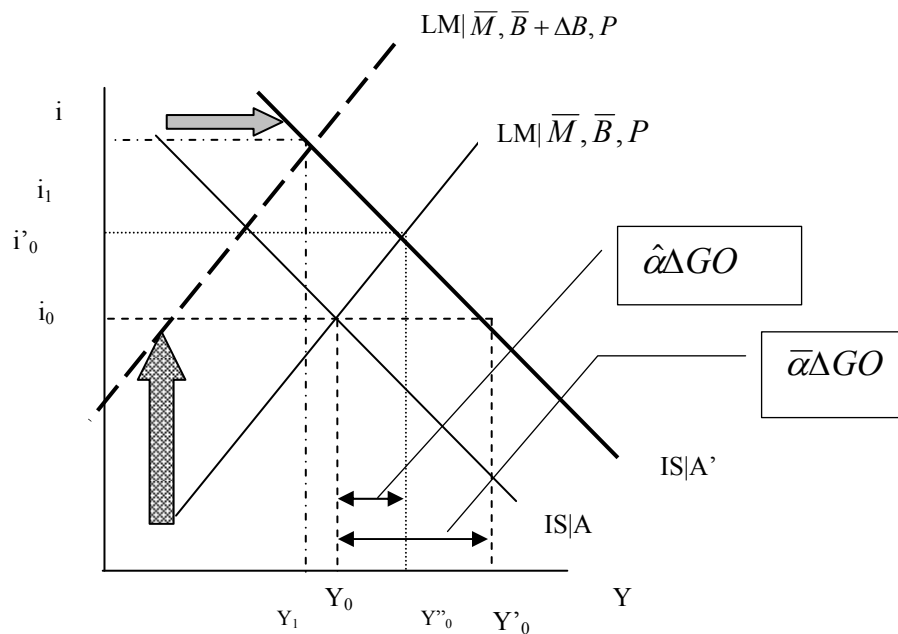
3.1 Analyze the implications of running a budget deficit for one period induced by increasing government spending, assuming the initial budget deficit is zero. Use an IS/LM diagram, clearly indicating what you think happens (curve shifts, etc.).



Where  $\Delta GO = \Delta(B/P)$

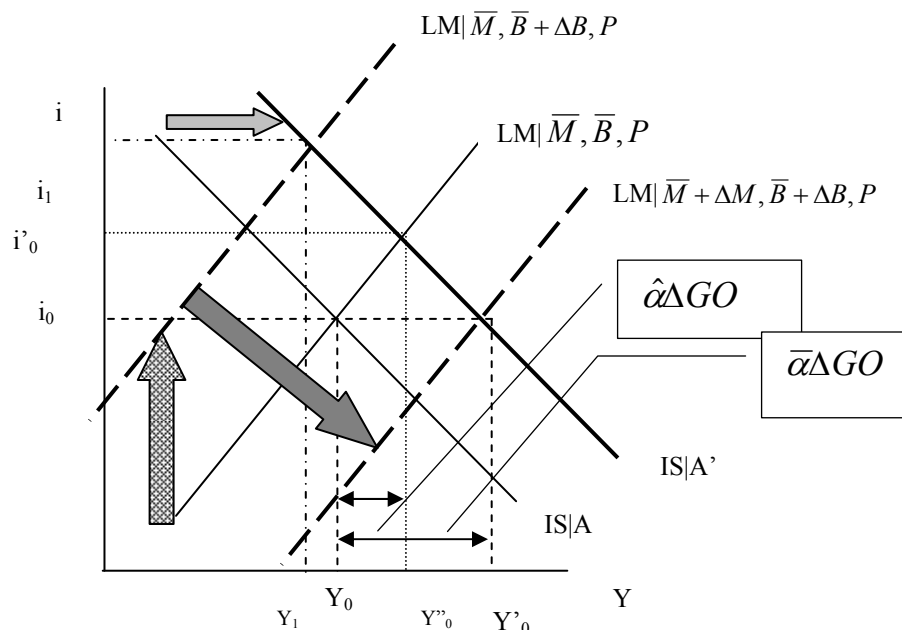
3.2 Assume the initial budget deficit is very large. Show what an increase in government spending does.

Now  $\Delta GO < \Delta(B/P)$



The LM curve shifts up so much that the resulting level of output is lower than initially.

3.3. Can monetary policy change the result obtained in 3.2? If so, show how, using an IS-LM diagram.



Expansionary monetary policy could keep the interest rate constant. In that case, one would obtain the result from Keynesian cross.

#### 4. Leverage, liquidity, and bank balance sheets

4.1 Consider two banks, H (high bank capital) and L (low bank capital).

High Bank Capital		Low Bank Capital	
Assets	Liabilities	Assets	Liabilities
Reserves \$9M	Deposits \$90M	Reserves \$10M	Deposits \$96M
Loans \$71M	Bank Capital \$10M	Loans \$70M	Bank Capital \$4M
ABS \$20M		ABS \$20M	

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

Calculate the return on equity (ROE) for each bank, if the rate of return on loans is 5%, and 10% on ABS, and the interest rate on deposits is 2%.

For H,  $[(71 \times 0.05 + 20 \times 0.10) - (90 \times 0.02)]/10 = \underline{\underline{0.375}}$

For L,  $[(70 \times 0.05 + 20 \times 0.10) - (96 \times 0.02)]/4 = \underline{\underline{0.895}}$



4.2 Show what happens to each of the bank balance sheets when the asset backed securities lose 25% of their value.

$(20 \times .75) = 15$ , so liabilities side must fall by 5. The Low Bank Capital bank becomes insolvent.

High Bank Capital			Low Bank Capital				
Assets		Liabilities		Assets		Liabilities	
Reserves	\$9M	Deposits	\$90M	Reserves	\$10M	Deposits	\$96M
Loans	\$71M	Bank Capital	<b>\$5M</b>	Loans	\$70M	Bank Capital	<b>-\$1M</b>
ABS	<b>\$15M</b>			ABS	<b>\$15M</b>		

Bank capital is the equity of the owners (shareholders) of the bank. ABS stands for asset backed securities.

4.3 Now consider two banks, one which borrows a nothing short term, and one that borrows a lot on short term money markets.

Bank Deposit Based			Money Market Based				
Assets		Liabilities		Assets		Liabilities	
Reserves	\$6M	Deposits	\$60M	Reserves	\$3M	Deposits	\$30M
Loans	\$74M	Short term	\$30M	Loans	\$77M	Short term borrowing	\$60M
ABS	\$20M	Bank Capital	\$10M	ABS	\$20M	Bank Capital	\$10M

Calculate the return on equity (ROE) for each bank, if the rate of return on loans is 5%, and 10% on ABS, and the interest rate on deposits is 2%, and the interest rate on short term borrowing is 1%.

For B,  $[(74 \times 0.05 + 20 \times 0.10) - (60 \times 0.02 + 30 \times 0.01)]/10 = \underline{0.42}$

For M,  $[(77 \times 0.05 + 20 \times 0.10) - (30 \times 0.02 + 60 \times 0.01)]/10 = \underline{0.465}$

4.4 Show what each bank must do when short term money markets freeze, so that the banks cannot continue to borrow short term.

Bank Deposit Based			Money Market Based				
Assets		Liabilities		Assets		Liabilities	
Reserves	\$6M	Deposits	\$60M	Reserves	\$3M	Deposits	\$30M
Loans	<b>\$44M</b>	Short term	<b>\$00M</b>	Loans	<b>\$17M</b>	Short term borrowing	<b>\$00M</b>
ABS	\$20M	Bank Capital	\$10M	ABS	\$20M	Bank Capital	\$10M