

Middle East Technical University-FEAS

Department of Economics

ECON 202 Section 02 Fall 2025

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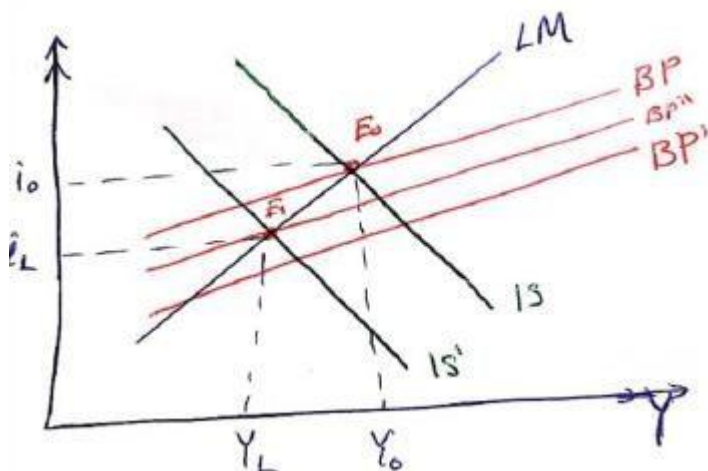
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PROBLEM SET 7 SOLUTIONS

IS/LM/BP MODEL (CHAPTERS 25 AND 26 OF APPELYARD&FIELD)

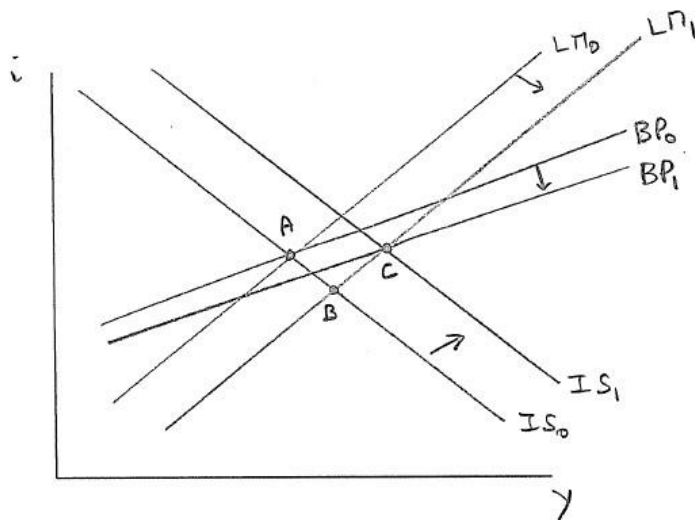
PART A: TRUE-FALSE

- 1) If capital mobility is perfect and import demand is completely insensitive to changes in the level of domestic output, the BP curve is vertical
False. Under these circumstances, BP curve is horizontal
- 2) In an IS-LM-BP model with fixed exchange rates and perfect capital mobility, contractionary fiscal policy will cause BoP deficit.
True. IS curve shifts to left and interest rate declines. This causes capital outflow from the country, $FAB < 0$
- 3) When there is a perfect capital mobility, an increase in government expenditure shifts BP curve to the right.
False. If there is a perfect capital mobility, the BP curve is horizontal and does not shift as a result of change in government spending.
- 4) In a flexible exchange rate system with perfect capital mobility, Fiscal expansion causes depreciation in domestic currency.
False, when G increases, IS shifts to the right and interest rate increases. As a result of this, there is capital inflow and domestic currency appreciates.
- 5) Consider the IS-LM-BP model, where the BP curve is flatter than the LM curve. A decrease in foreign interest rates will cause domestic output to fall under imperfect capital mobility and flexible exchange rate.
True. If interest rates fall abroad (causing the BP curve to shift down by), there will be a net inflow of capital –thus improving the balance in the capital account-- since the domestic rate of interest has not changed yet. This will cause an appreciation of the domestic currency. The price of domestic goods will become relatively more expensive on world markets, resulting in a decrease in net exports (i.e., lower exports and higher imports) --thus worsening the balance in current account. A decrease in net exports, in turn, implies a decrease in aggregate expenditure and the IS curve starts shifting down to the left. A new equilibrium will be reached when the IS curve shifts all the way to IS' (see diagram) where the overall balance of payment is once again equal to zero (i.e., the improvement in the capital account is equal in absolute value to the worsening in the current account) and the net inflow of capital and the appreciation of the domestic currency stop. Therefore, the domestic output falls as a result of the fall in foreign interest rate



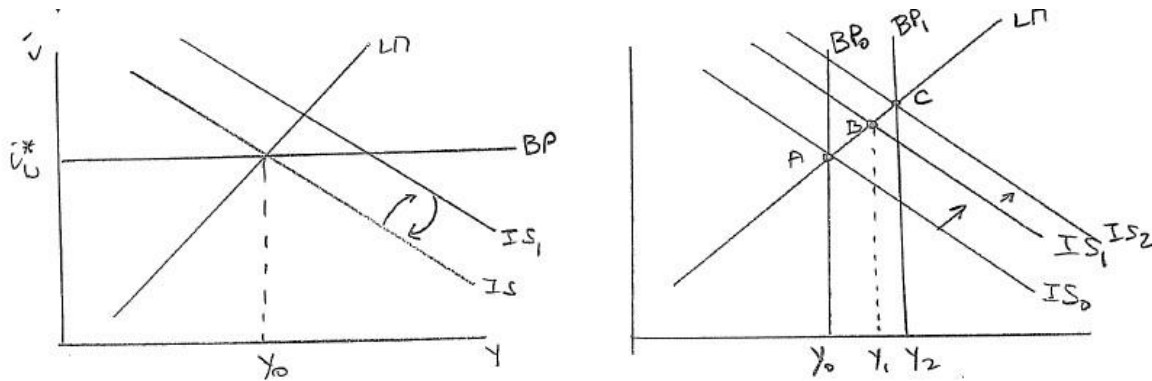
- 6) In an economy with flexible exchange rates, if the Central Bank engages in an open market purchase, the short-run impact will be an increase in the level of income, an appreciation of the exchange rate, a deterioration of the current account, and an improvement of the financial account.

False. An open market purchase is monetary expansion. An increase in domestic money supply leads to a decrease in domestic interest rate, hence an outflow of financial capital out of the country, implying a depreciation of domestic currency. With depreciation of domestic currency, the current account improves.



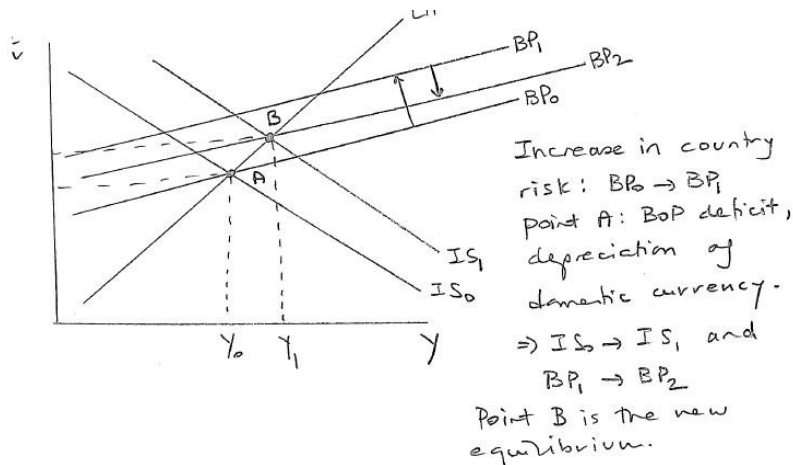
- 7) Under flexible exchange rates, fiscal policy is most effective in influencing national income when capital is perfectly immobile internationally and least effective when capital is perfectly mobile internationally.

True. Under flexible exchange rates, fiscal policy is fully ineffective with fully mobile capital. That is, any increase in domestic income with fiscal expansion will be completely reversed with domestic currency appreciation and thus a fall in aggregate demand.



- 8) Under flexible exchange rates, an increase in instability and country risk in Country A leads to a depreciation in Country A's currency, and an increase in the interest rate in Country A.

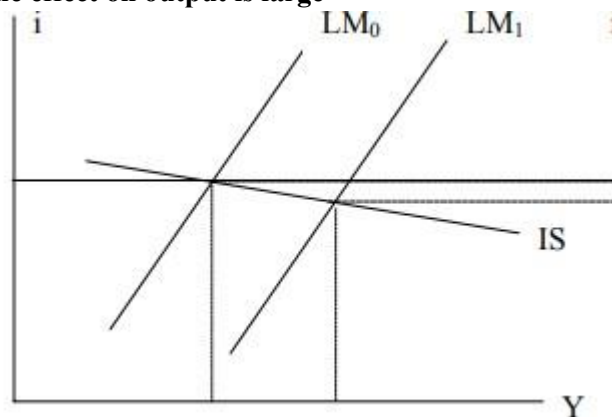
True.



- 9) If the IS curve is very flat, an increase in the domestic money supply causes a small depreciation of the exchange rate, and has a large effect on output.

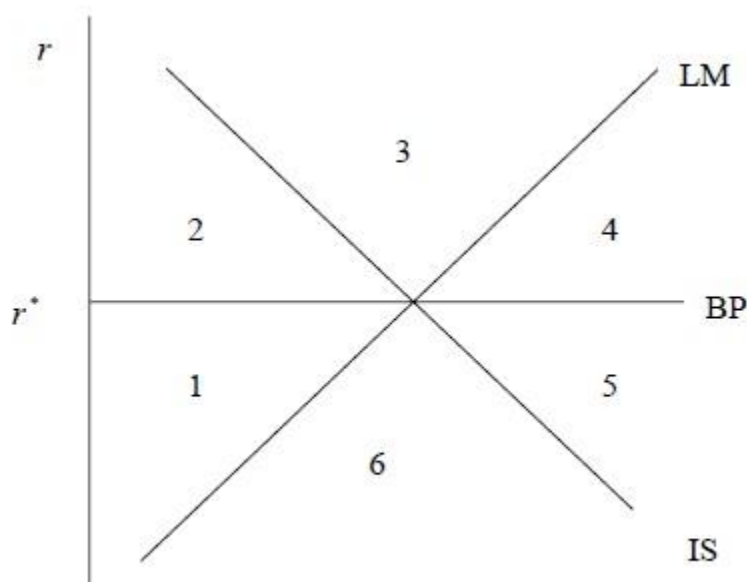
True.

An increase in M/P shifts out the LM curve, causing higher Y and lower interest rates (and therefore an increase in E , i.e. a depreciation of the exchange rate). As the diagram shows, when the IS curve is very flat, the change in i and E is small, and the effect on output is large



PART B: LONG QUESTIONS

1) The IS-LM-BP model defines six regions, each corresponding to disequilibrium in the money market, goods market and/or the balance of payments. Identify and describe each of these when capital is perfectly mobile.

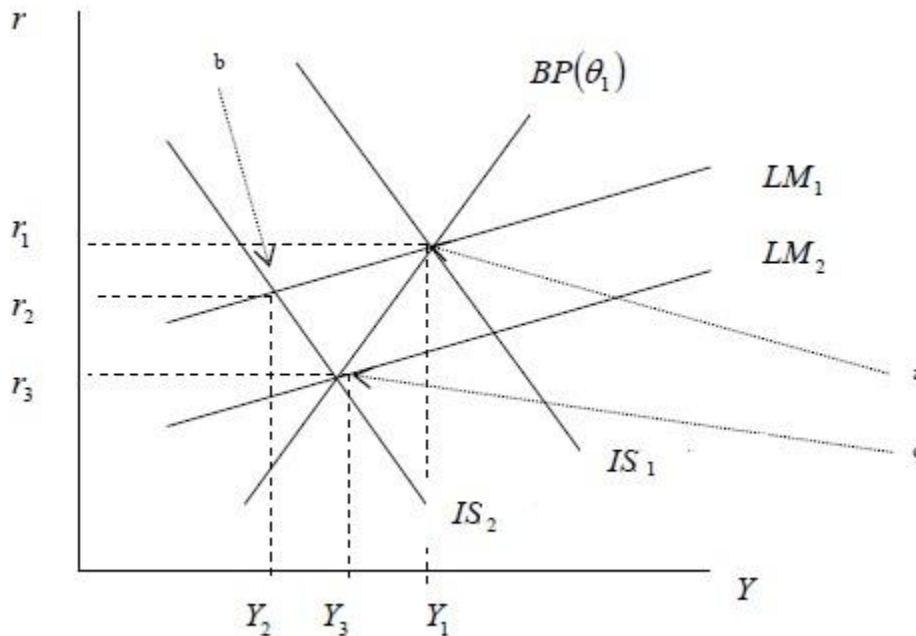


Answer:

Zone	BP: Balance of payments	IS: Goods market	LM: Money market
1	Deficit ($r < r^*$)	Excess demand (Expenditure > output)	Excess supply ($M^S > M^D$)
2	Surplus ($r > r^*$)	Excess demand (Expenditure > output)	Excess supply ($M^S > M^D$)
3	Surplus ($r > r^*$)	Excess supply (Expenditure < output)	Excess supply ($M^S > M^D$)
4	Surplus ($r > r^*$)	Excess supply (Expenditure < output)	Excess demand ($M^S < M^D$)
5	Deficit ($r < r^*$)	Excess supply (Expenditure < output)	Excess demand ($M^S < M^D$)
6	Deficit ($r < r^*$)	Excess demand (Expenditure > output)	Excess demand ($M^S < M^D$)

2) Using IS-LM-BP model with a low degree of capital mobility, what will be the effects of the following?

a. A deterioration in the business optimism with fixed exchange rates

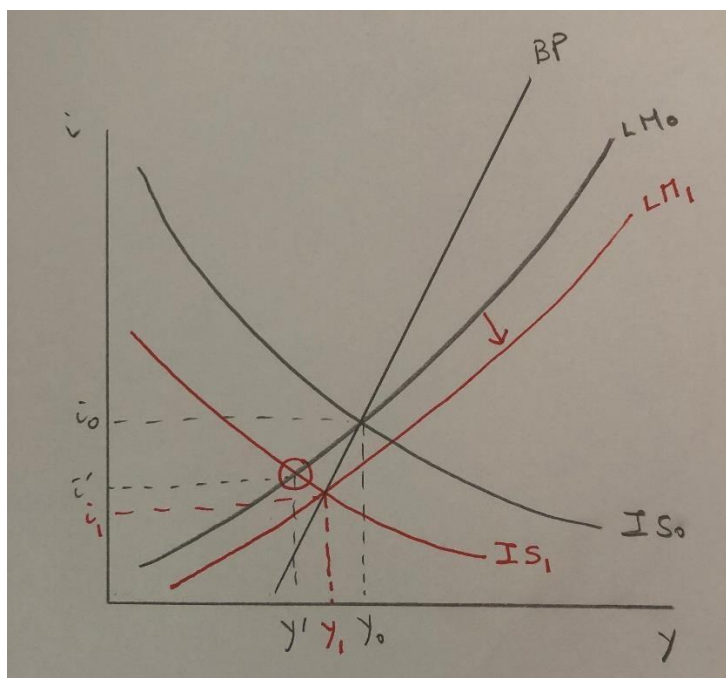


A fall in business optimism sees a contraction in investment and an inward shift in the IS curve.

At point b the balance of payments has moved into surplus. Although the domestic interest rate has fallen, which encourages capital outflows; these have a small effect because capital mobility is low. The fall in income on the overhand reduces the level of imports, and this is relatively more important.

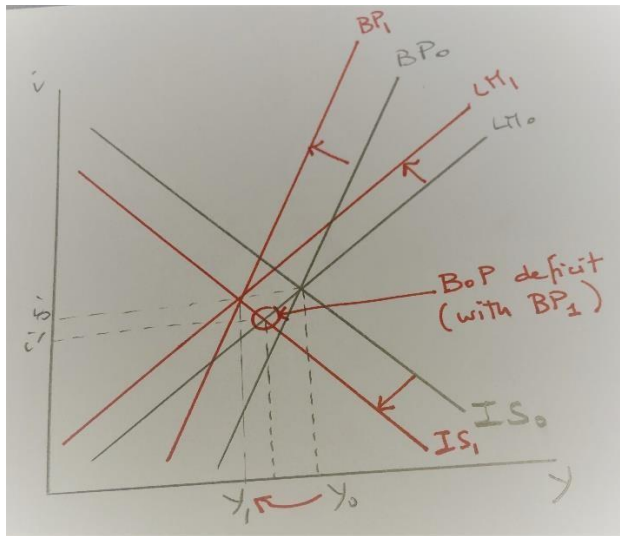
The surplus on the balance of payments highlights demand and supply movements in currency markets that will lead to an exchange rate appreciation. To prevent this, policy makers must expand the money supply until the balance of payments has been returned to equilibrium at point c . The expansion in the money supply reduces interest rates so encourages capital outflows, but also raises domestic output increasing imports- both effects offset the surplus and the pressure for appreciation.

b. A rise in taxes with fixed exchange rates



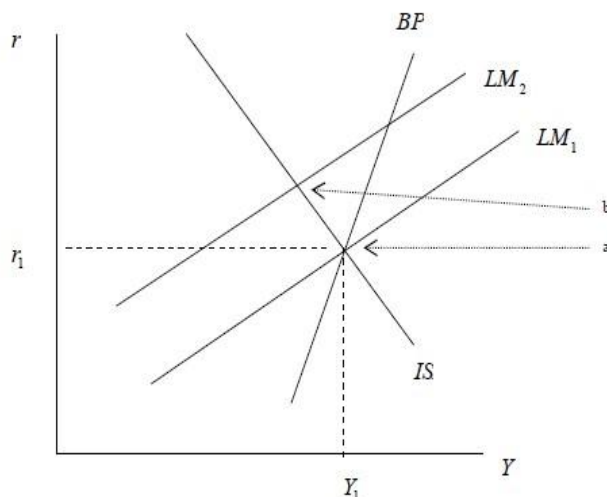
With the rise in taxes, there will be a fall in disposable income, therefore a fall in consumption and aggregate demand. The IS will shift to the left. Now at the new domestic interest rate and lower income level, there appears a BoP surplus (income falls, therefore imports fall and Current Account improves, the interest falls and leads to outflow of capital to some extent, but since capital is relatively less responsive to the changes in interest rate, the BoP surplus occurs because the change in Y and thus the Current Account changes dictate what happens to BoP). At the point of BoP surplus, there will be an appreciation pressure on domestic currency (imports fall thus the demand for foreign currency falls, leading to a lower value of foreign currency against domestic currency). To stop appreciation pressure on domestic currency, the CB buys foreign currency and increases domestic Money supply, until BoP equilibrium is reestablished. (Same effects as in part a above)

c. A fall in foreign income with fixed exchange rates



In this case, with the fall in foreign income, exports fall and thus NX falls exogenously. This first shifts the IS to the left (aggregate demand falls with lower NX). Also, the BP curve shifts to the left with worsening of NX and Current Account Balance (no a higher i is required to maintain the BoP equilibrium). So both IS and BP shift to the left. The new domestic equilibrium is now to the right of the new BP curve with BoP deficit. Income is lower, imports are lower, hence NX improved but at the same time X is lower, so NX is worsened. Also the i is lower leading to an outflow of capital to some extent. But in this case the current Account effect on BoP is dominant nevertheless. At the point of BoP deficit, now there is depreciation pressures on domestic currency, leading the CB to reduce the Money supply by purchasing foreign currency. The fall in money supply will continue until we have BoP equilibrium again. Change in i is ambiguous but Y falls definitely.

d. A fall in the money supply with fixed exchange rates



A contraction in the money supply, through a combination of raising the domestic interest rate and reducing income moves the balance of payments into surplus and creating pressure for an exchange rate appreciation. This however, cannot be allowed to persist if the fixed exchange rate is

to be maintained, therefore an offsetting monetary expansion is required to return the economy to its original position.

e. Under the fixed exchange rate regime, what are the effects of an expansion in foreign income when there is

- perfect capital mobility
- relative capital mobility (BP curve is flatter than LM curve)
- relative capital immobility (BP curve is steeper than LM curve)
- perfect capital immobility

Under perfect capital mobility, BP curve is horizontal so only IS curve shifts to the right due to increasing exports as a result of foreign income increase; domestic interest rate increases. By UIP, increasing domestic interest rate causes an instantaneous financial capital inflow. This increases the supply of foreign currency in the foreign exchange market, putting a pressure on the domestic currency to appreciate but since fixed exchange rate policy is implemented, Central Bank increases its reserves by increasing the demand for foreign currency, which in turn increases the monetary base and hence the domestic money supply; LM shifts to the right. As a result, new equilibrium is reached at the same interest rate and higher domestic income.

With relative capital mobility BP curve is flatter than the LM curve, the expansion in exports leads to shifts of BP and IS to the right. Similar events occur as above but at a slower pace. Hence financial capital inflow puts a pressure on domestic currency to appreciate. The CB interfere with the foreign exchange market and LM shifts to the right to settle the equilibrium. New equilibrium is established at higher national income, but what happens to the domestic interest rates is ambiguous.

With relative capital immobility, again, BP and IS shift to the right. However in this case BP curve is steeper than the LM curve. Again due to higher exports and increased capital inflow pressure on domestic currency in appreciation direction builds. CB interferes and LM shifts to the right. Due to lower sensitivity of interest rate to changes in foreign exchange supply, shift of LM curve to the right is limited. Again in new equilibrium income is higher and domestic interest rate is slightly higher as well.

With perfect capital immobility, IS curve and BP curve which is vertical line, shift to the right due to improvement in CAB. Excess supply of foreign exchange builds a pressure on the exchange rate which is eliminated by the CB and LM also shifts to the right. At the end, national income increases as well as the domestic interest rate.

f. “There is no room for active monetary policy under fixed exchange rate regime.” Discuss.

In fixed exchange regime, to expand the economy we should not use the monetary policy tool because it is ineffective in the long-run. Applying an expansionary policy will cause the LM curve to shift rightwards but this will cause BOP deficit and affect the exchange rate under all capital mobility assumptions. Because CB does not let the exchange rate to change, it will shift the LM curve to its original level by selling FX to market. (domestic Ms contracts)

- 3) Consider an open economy with fixed prices, fixed exchange rates, and imperfect capital mobility. This economy is represented by the following equations:

$$C = 60 + 0.8Y_D \quad P^* = 2$$

$$I = 200 - 20i + 0.1Y \quad P = 1$$

$$G = 300$$

$$TA = 0.25Y \text{ (taxes)} \quad MD = 0.2Y - 10i$$

$$TR = 50 \text{ (transfers)} \quad MS = 200$$

$$X = 250 + 100 eP^*/P \text{ (exports)} \quad CF = 25(i - i^*) \text{ (financial capital)}$$

$$Im = 400 - 50 eP^*/P + 0.1Y \text{ (imports)} \quad i^* = 9$$

- a. What is the equation for the IS curve in this model?

$$Y = C + I + G + NX$$

$$Y = 60 + 0.8(Y - 0.25Y + 50) + 200 - 20i + 0.1Y + 300 + 250 + 200e - 400 + 100e - 0.1Y$$

$$Y = 450 + 300e + 0.6Y - 20i \rightarrow i = 22.5 + 15e - 0.02Y \text{ (IS equation)}$$

- b. What is the equation for the LM curve in this model?

$$MS = MD \rightarrow 200 = 0.2Y - 10i$$

$$i = -20 + 0.02Y \text{ (LM equation)}$$

- c. What is the equation for BP curve in this model?

$$NX + CF = 0$$

$$-150 + 300e - 0.1Y + 25(i - 9) = 0$$

$$-150 + 300e - 0.1Y + 25i - 225 = 0$$

$$-375 + 300e - 0.1Y + 25i = 0$$

$$25i = 375 - 300e + 0.1Y$$

$$i = 15 - 12e + 0.004Y$$

- d. What are the values of Y, i and e at which the goods market, the money market, and the external sector are simultaneously in equilibrium?

$$1. IS: i = 22.5 + 15e - 0.02Y$$

$$2. LM: i = -20 + 0.02Y$$

$$3. BP: i = 15 - 12e + 0.004Y$$

$$(1) - (2) \rightarrow 42.5 + 15e - 0.04Y = 0$$

$$(1) - (3) \rightarrow 7.5 + 27e - 0.024Y = 0 \quad 112.5 + 405e - 0.36Y - 1147.5 - 405e + 1.08Y = 0$$

$$0.72Y - 1035 = 0 \text{ and } Y = 1437.5$$

$$i = -20 + 0.02(1437.5) = 8.75$$

$$8.75 = 15 - 12e + 0.004(1437.5)$$

$$12e = 15 + 5.75 - 8.75 \rightarrow e = 1$$

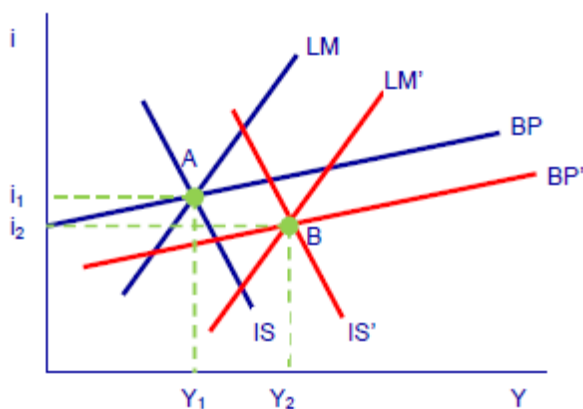
e. What are the balances in the current account and the capital account in this equilibrium?

$$NX = -150 + 300e - 0.1Y = -150 + 300 - 0.1(1437.5) = 150 - 143.75 = 6.25$$

$$CF = 25(i - i^*) = 25(8.75 - 9) = -6.25$$

f. Suppose the central bank devalues the domestic currency such that $e = 1.5$ now (was $e=1$). What are the new equilibrium values of Y and i ?

At the initial equilibrium (point A), there is now a surplus in the external sector because of the improvement in the balance of the current account (Assume Marshall-Lerner condition holds). The central bank, therefore, buys foreign currency to eliminate the surplus and the domestic money supply increases. Graphically, the increase in the money supply causes the LM curve to shift to the right. This process continues until a new equilibrium is reached at point B. The new equilibrium, therefore, is determined by the intersection of the IS and BP curves, and the money supply just changes as a result of the elimination of surpluses in the external sector by the central bank. So we have to equate the IS and BP curve to determine equilibrium income and equilibrium rate of interest.



$$IS: i = 22.5 + 15e - 0.02Y = 22.5 + 15(1.5) - 0.02Y = 45 - 0.02Y$$

$$BP: i = 15 - 12e + 0.004Y = 15 - 12(1.5) + 0.004Y = -3 + 0.004Y$$

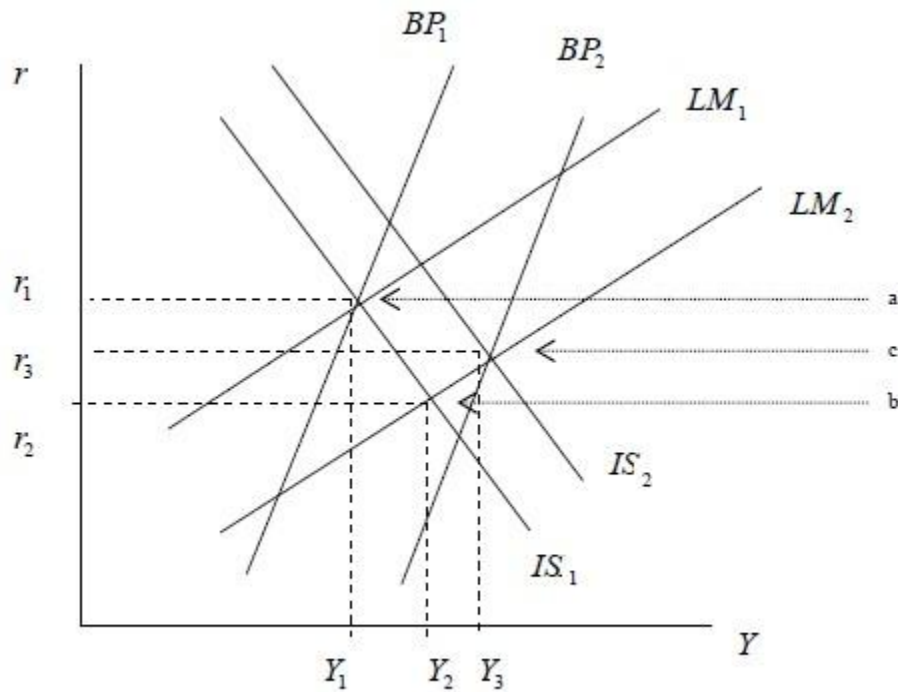
$$IS = BP \rightarrow 45 - 0.02Y = -3 + 0.004Y = 0$$

Then, $0.024Y = 48 \rightarrow Y = 2000$

And thus, $i = 45 - 0.02(2000) = 45 - 40 = 5$

- 4) Using IS-LM-BP model with a relatively low degree of capital mobility (assume slope of BP is higher than the slope of LM), what will be the effects of the following?

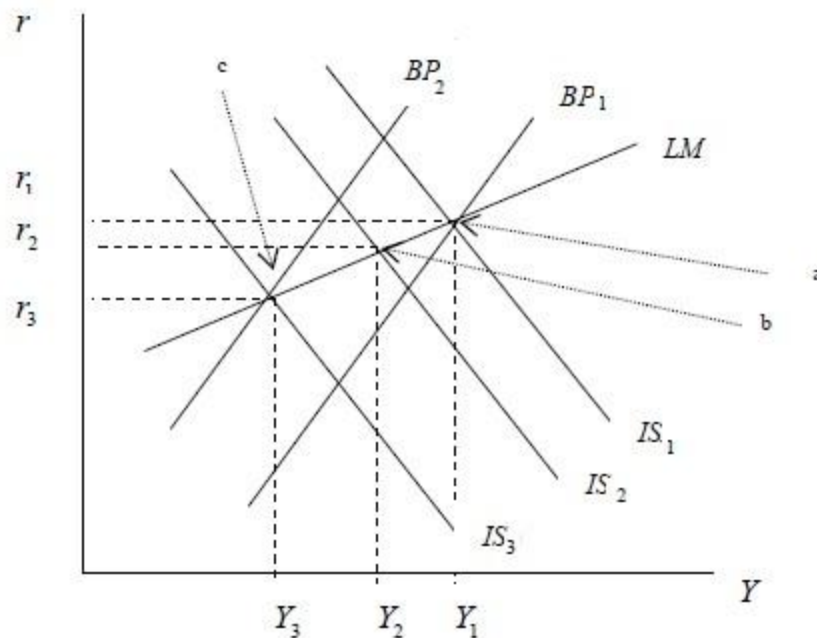
a) An increase in money supply with flexible exchange rate



A monetary expansion shifts the LM curve outwards- this reduces interest rates and increases income- both of which lead to balance of payments deficit.

Given the deficit the exchange rate depreciates, the improvement in competitiveness shifts both the BP and IS curves outwards. The new equilibrium of the economy is at point c.

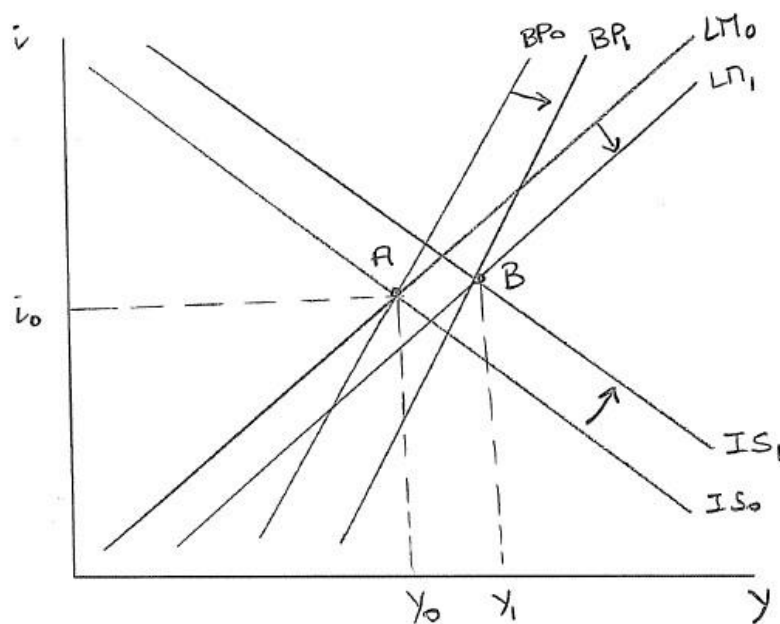
b. A rise in taxes with flexible exchange rates



The rise in taxes reduces disposable incomes and leads to a fall in consumption. Consequently, the IS curve shifts inwards and output and interest rates fall. The fall in output lowers imports and the balance of payments moves into surplus.

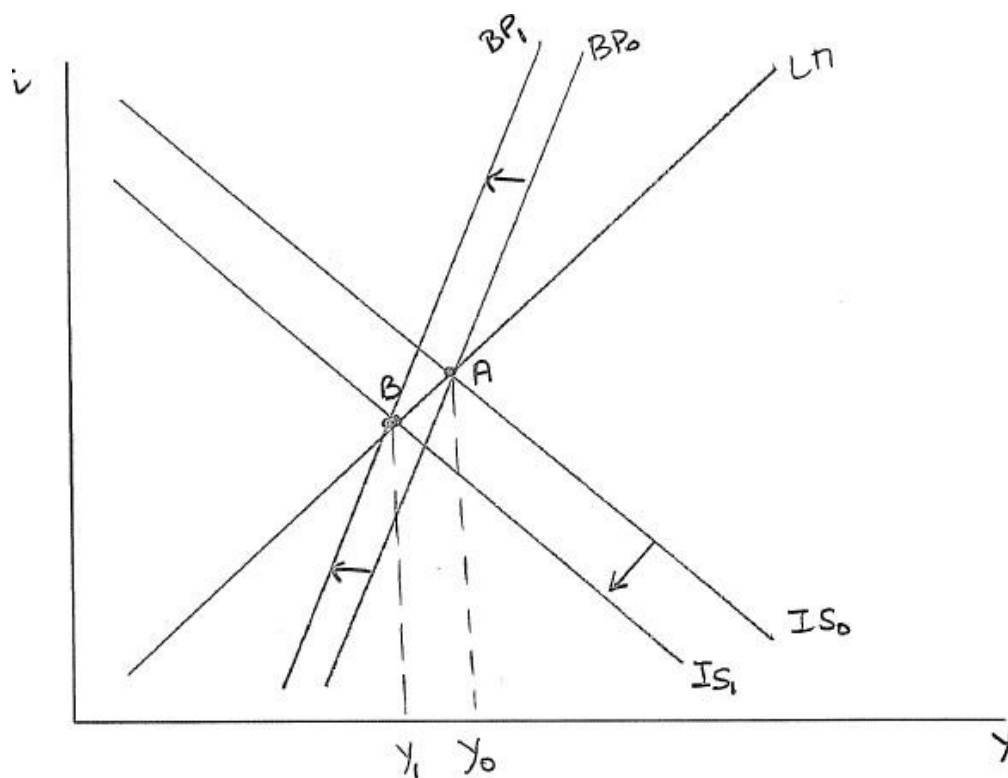
This surplus position reflects a fall in the demand for overseas currency, and also a fall in the supply of domestic currency. Both these movements lead to an exchange rate appreciation, the competitiveness effects of which shift both the IS and BP curves inwards. Therefore, output falls further and the economy moves to point c.

c. A sudden drop in domestic prices, ceteris paribus, with flexible exchange rates



A sudden drop in domestic prices (*ceteris paribus*) makes domestic goods relatively cheaper compared to foreign goods, there will be expenditure switching towards domestic goods, exports rise, imports fall, net exports increase, then the aggregate demand for domestic goods increases, IS_0 moves to IS_1 and BP_0 moves to BP_1 . At the same time, real money supply in the domestic economy increases with the fall in domestic prices P , (M/P) increases, LM curve shifts to the right. The internal and external balance moves from point A to point B. At the new equilibrium B, there is higher income and output.

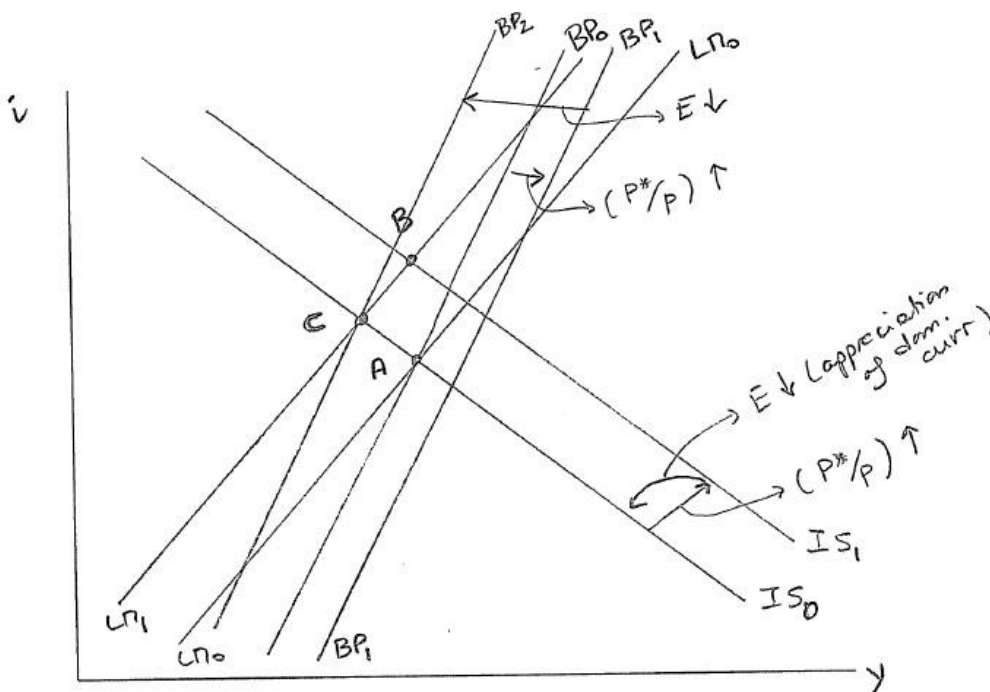
d. A sudden drop in foreign prices, *ceteris paribus*, with flexible exchange rates



A sudden drop in foreign prices (*ceteris paribus*) makes foreign goods relatively cheaper compared to domestic goods, there will be expenditure switching towards foreign goods; exports fall, imports rise, therefore net exports fall as a result. IS_0 moves to IS_1 and BP_0 moves to BP_1 . The new equilibrium is established at point B with lower income level. Important point to see here is that this outcome is different than what we obtain with a relatively mobile international capital where a drop in foreign prices lead to a depreciation in domestic currency, and thus any initial drop in aggregate demand is compensated with depreciation leading to an increase in net exports. Here, it does not

happen because the capital flows do not respond to interest rate changes, and the fall in the interest rate does not prompt any capital outflows, and thus a depreciation of domestic currency.

- e. Rate of foreign inflation exceeds rate of domestic inflation with flexible exchange rates



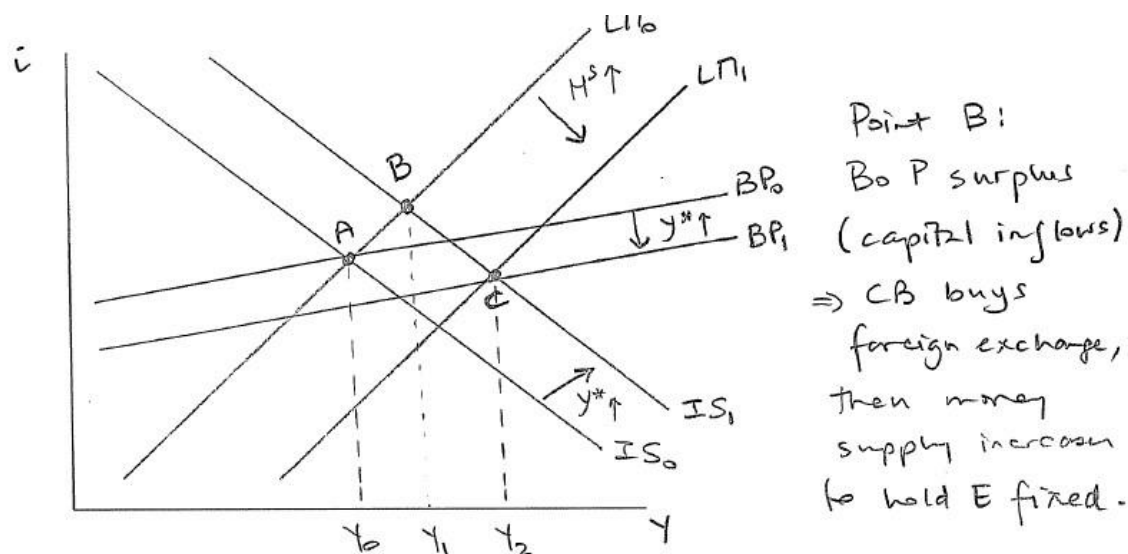
Here, two events are happening simultaneously: foreign goods are now relatively more expensive, so there is expenditure switching towards domestic goods (exports rise, imports fall), but at the same time, since domestic prices are rising, real money supply falls, (M/P) falls.

IS_0 moves to IS_1 ; BP_0 moves to BP_1 ; LM_0 moves to LM_1

But now, at the new internal balance at point B, there is a BoP surplus, and an appreciation of domestic currency (as imports fall, demand for foreign currency falls leading to a drop in relative price of foreign currency, and an appreciation of domestic currency). Hence IS and BP start shifting back towards their original positions. But since LM has shifted to the left, now the new equilibrium will be along the new LM_1 . The changes in i and Y depend on the relative shifts in LM, IS and BP and the degree of capital mobility: i and Y may fall, increase, or stay the same compared to original equilibrium values. (Also check that with fully immobile capital, the new equilibrium is reached with an increase in i and Y , and no change in exchange rate)

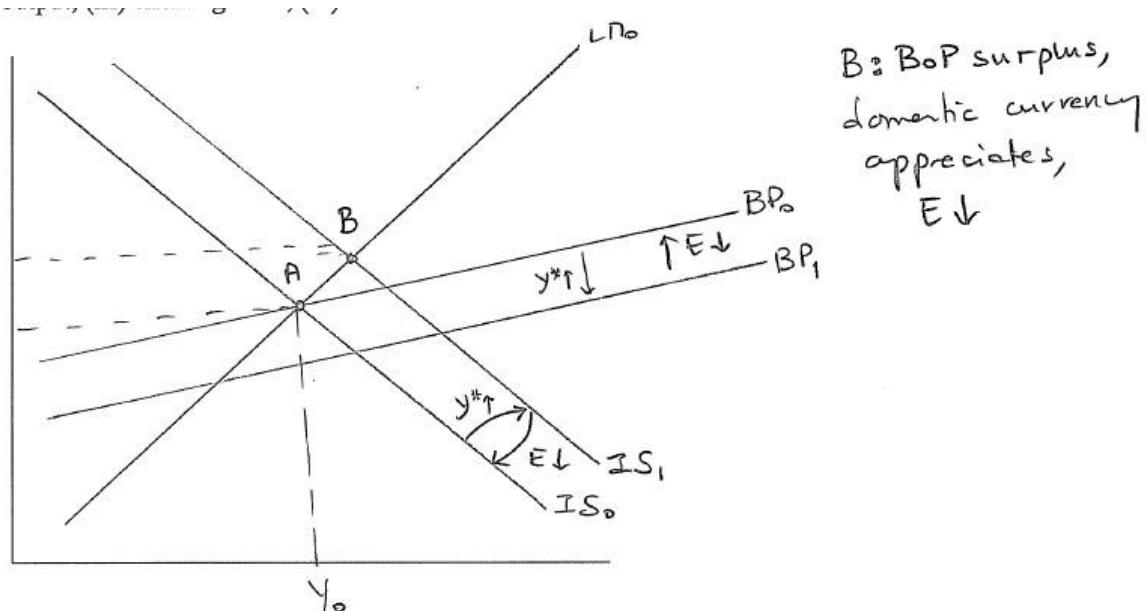
- 5) Consider an open economy with neither perfect capital mobility nor perfect capital immobility (assume the slope of BP is lower than the slope of LM). The value of the domestic currency is pegged to the USD, i.e. the country operates under fixed exchange rate regime. Initially, the economy is at equilibrium at interest rate i_0 and income level Y_0 . Suppose now that the country's largest trade partner experiences growth in income and output. Using the IS-LM-BP model, answer the following with the help of appropriate diagrams (throughout assume that a depreciation/devaluation of domestic currency leads to an improvement in the current account, an appreciation/revaluation leads to a deterioration in the current account):

a. Under the fixed exchange rate regime, what is the impact of the increase in foreign income on (i) domestic interest rate, (ii) domestic income and output, (iii) exchange rate, (iv) official reserves.



- (i) Domestic interest rate falls
- (ii) Domestic income and output increases
- (iii) Exchange rate is fixed, no change
- (iv) Official reserves increase

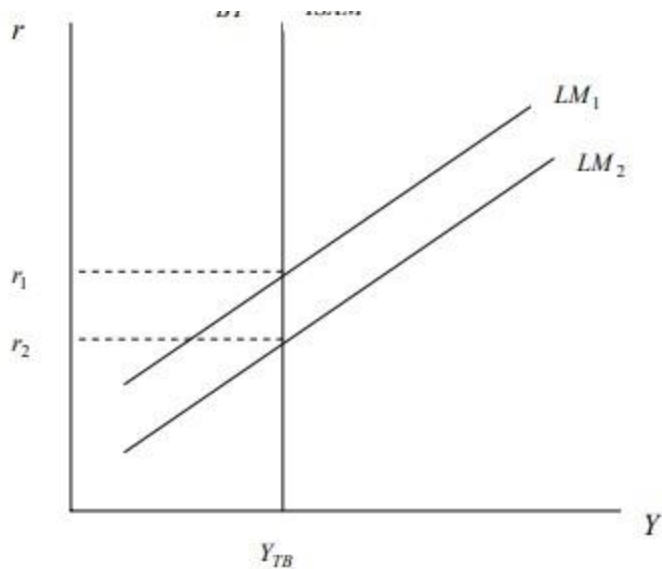
b. Now consider the impact of the same change in foreign income under flexible exchange rate regime and the economy is at initial equilibrium (i_0, Y_0). Under the new exchange rate regime, what would be the impact on (i) domestic interest rate, (ii) domestic income and output, (iii) exchange rate, (iv) official reserves.



- (i) Domestic interest is the same
 - (ii) Domestic output is the same
 - (iii) Domestic currency appreciates
 - (iv) No change in official reserves
- 6) If exchange rates are free to float, under what conditions does an expansive monetary policy fail to increase the equilibrium level of output?

Under a floating exchange rate, there are two situations in which an expansionary monetary policy will fail to increase the level of output.

- One situation is where Investment is interest inelastic and there is perfect immobility of capital, both IS and BP curves are vertical and they lie on top of each other. Any shift in the LM curve will alter the level of prevailing interest rates, but will have no impact on the level of output.



The other situation is where there is a liquidity trap. In this case monetary expansion fails to put any downward pressure on interest rates. The demand for money is perfectly elastic, so any increase in the money supply simply adds to money holding because current rates are too low to encourage agents to purchase bonds. If a liquidity trap position has been reached, then monetary policy is always ineffective in failing to shift the LM schedule and change output.

