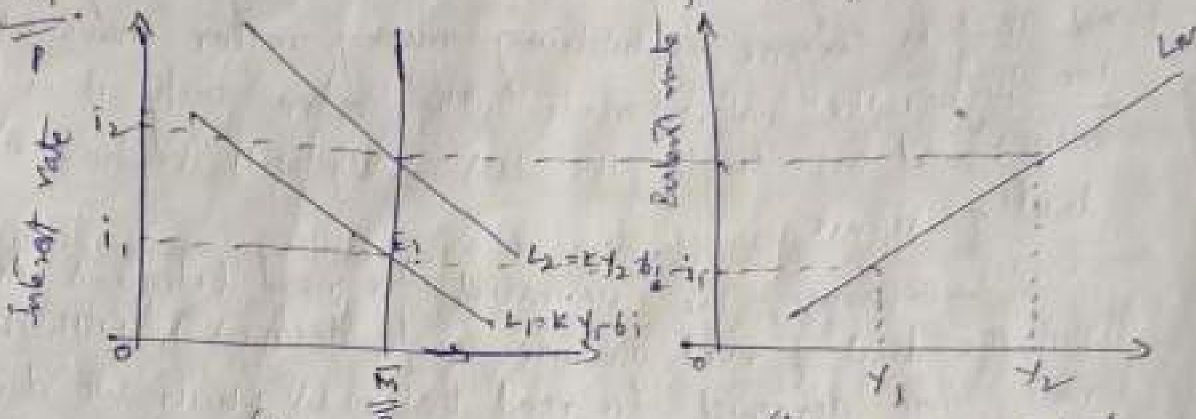
The Supply of money. The LM curve. Continuation -

The nominal quantity of money, m is controlled by the central Bank. We take the nominal quantity of mony as given at the level $\bar{m}$. We assume the price level is constant at the level $\bar{P}$, so the real money supply is at the level $\frac{\bar{m}}{\bar{P}}$.



(a) Real balances (b) Income, output

The figure (a) reveals that starting with the level of income Y_1 the corresponding demand curve for real balances, L_1 as a decreasing function of the interest rate. The existing supply of real balances, $\bar{m}$, is shown by the vertical line, since it is given and $\bar{P}$ therefor is independent of the interest rate. At interest rate i_1, the demand for real balances equals the supply. Therefore, point E_1 is an equilibrium point in the money market.

Consider next the effect of an increse in income to Y_2. The higher level of income causes the demand for real balances to the higher at each level of the interest rate, so the demand curve for real balances shifts up and to the right, to L_2. The interest rate increases to i_2 to maintain equilibrium in the money market at that higher level of income.

The LM curve is positively sloped. An increse in the interest rate reduces the demand for real balances. To maintain the demand for real balances equal to the fixed supply, the level of income has to rise. Accordingly, money market equilibrium implies that an increse in the interest rate is accompanied by an increse in the level of income.

The LM curve can be obtained directly by combining the demand curve for real balances, equation (6), and the fixed supply of real balances. For the money market to be in equilibrium, demand has to to equal supply, or

$$\frac{\overline{M}}{\overline{P}} = ky - hi$$

Solving for the interest rate,

$$i = \frac{1}{h}\left(ky - \frac{\overline{M}}{\overline{P}}\right)$$

The slope of the LM curve

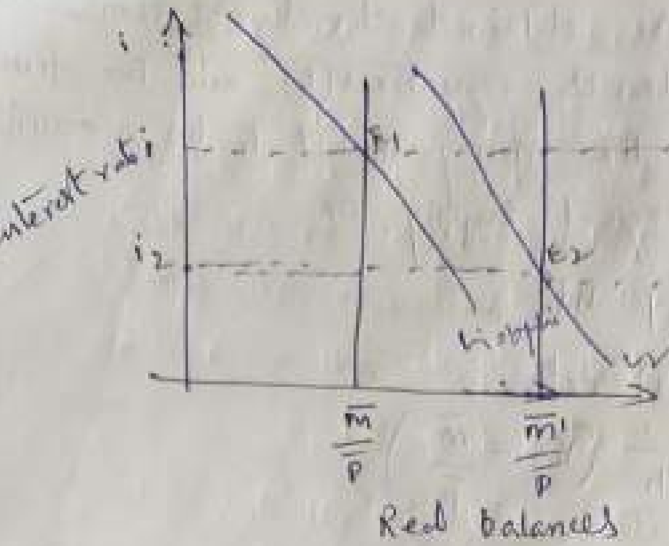
The greater the responsiveness of the demand for money to income, as measured by k and the lower the responsiveness of the demand for money to the interest rate, h the steeper the LM curve will be.

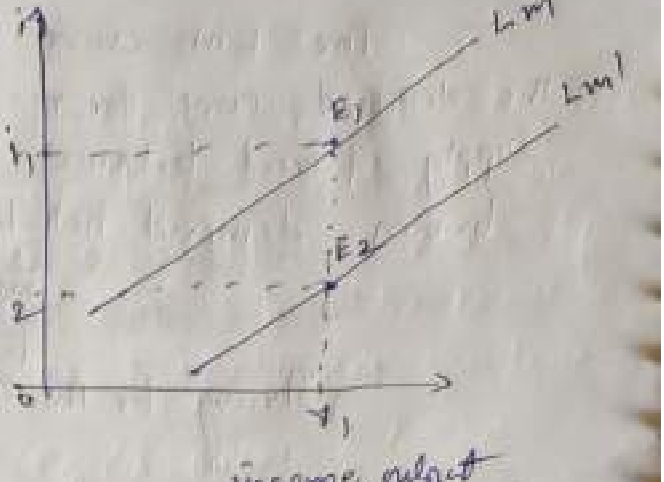
If the demand for money is relatively insensitive to the interest rate and thus h is close to zero, the LM curve is nearly vertical. If the demand for money is very sensitive to the interest rate and thus h is large, the LM curve is close to horizontal. In that case, a small change in the interest rate must be accompanied by a large change in the level of income in order to maintain money market equlibrium.

The position of the LM curve.

The real money supply is held constant along the LM curve. It follows that a change in the real money supply will shift the LM curve. The above figure show the effect of an increse in the real money supply.

With the initial real money supply, $\frac{\overline{M}}{\overline{P}}$, the equilibrium is at point E_1, with the interest rate i_1. The corresponding point on the LM schedule is E_1. Now the real money supply increses to $\frac{\overline{M}'}{\overline{P}}$, which we represent by a right ward shift of the money supply schedule. The new equlibrium is, therefor, at point E_2. This implies that, the LM curve shifts to the right and down to LM'. At each level of income the equilibrium interest rate has to be lower to induce people to hold the larger real quantity of money.

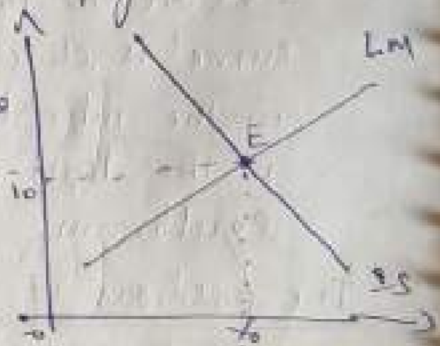




Equilibrium in the goods and money markets

The IS and LM schedules summarize the conditions that have to be satisfied in order for the goods and money markets, respectively, to be in equilibrium. For simultaneous equilibrium, interest rates and income levels have to be such that both the goods market and money market are in equilibrium. This condition is satisfied at point E in figure.

The equilibrium interest rate is therefore i_0 and the equilibrium level of income is Y_0, given the exogenous variables, in particular, the real money supply and fiscal policy.

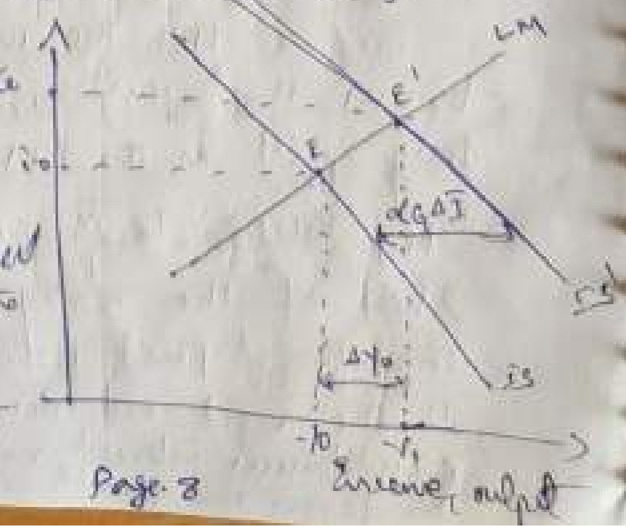


* CHANGES IN THE EQUILIBRIUM LEVELS OF INCOME AND THE INTEREST RATE.

The equilibrium level of income and the interest rate change when either IS or the LM curve shifts.

The figure shows the effects of an increase in the rate of autonomous investment on the equilibrium level of income and the interest rate.

-An increase in autonomous investment spending, $\Delta \bar{I}$, shifts the IS curve to the right by the amount $\alpha_G \Delta \bar{I}$; we would have argued that $\alpha_G \Delta \bar{I}$ would be the

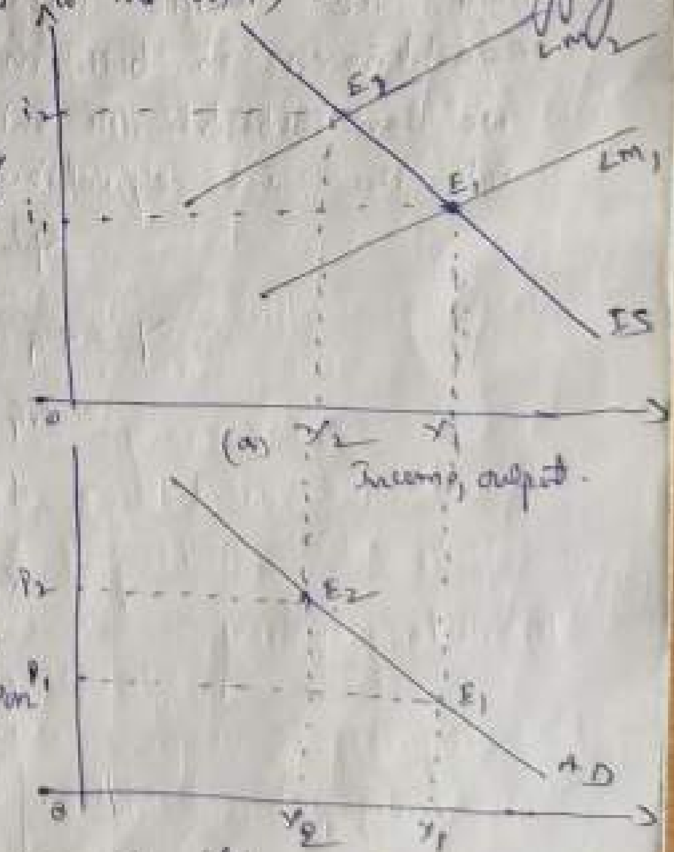


change in the level of income resulting from the change of $\Delta\bar{A}$ in autonomous spending. The change in income only ΔY_0, which is clearly less than the shift in the IS curve, $\alpha_G \Delta\bar{A}$.

If the LM curve were horizontal, there would be no difference between the extent of the horizontal shift of the IS-curve and the change in income. If LM curve were horizontal, the interest rate would not change when the IS curve shifts.

Deriving the Aggregate Demand Schedule

The aggregate demand schedule maps out the IS-LM equilibrium holding autonomous spending and the nominal money supply constant and allowing price to vary. Put simply, a higher price level means a lower real money supply an LM curve shifted to the left, and lower aggregate demand.



Suppose the price level in the economy is P_1, at that price level IS-LM equilibrium at point E given level of income Y_1, and interest rate I_1.

The real money supply $L = (ky - \frac{\bar{m}}{P} hi)$, which determines the position of the LM_1 curve, is $\bar{m}$. The intersection of the IS and LM_1 curve gives the level of AD corresponding to price P_1 and is so marked in the lower Panel (b).

Suppose, instead, that the price is higher, say P_2. The curve LM_2 shows the LM curve based on the real money supply $\frac{\bar{m}}{\bar{P}_2}$. LM_2 is to the left of LM_1 since $\frac{\bar{m}}{\bar{P_2}}, \frac{\bar{m}}{P_1}$ at point E_2 is the corresponding point on the aggregate demand curve.

Derivation of IS-LM model.

The intersection of the IS-LM schedules determines equilibrium income and the equilibrium interest-rate. We now derive expressions of for these equilibrium values by using the equations of the IS and LM schedules. Recall from earlier in the chapter that goods market equilibrium equation.

IS schedule : $Y = \alpha_G (\bar{A} - bi)$

and the equation for the money market equilibrium is

LM schedule : $i = \frac{1}{h}\left(kY - \frac{\bar{M}}{\bar{P}}\right)$ — 7(a)

The intersection of the IS and LM schedules equation 7(a) in equation (5) in the diagrams corresponds to a situation in which both the IS and the LM equations hold, the same interest rate and income levels ensure equilibrium in both in goods and the money market. We can substitute the interest rate from the LM equation (7a) into the IS equation (5).

$$Y = \alpha_G\left[\bar{A} - \frac{b}{h}\left(kY - \frac{\bar{M}}{\bar{P}}\right)\right]$$

$$\therefore Y = \alpha_G (\bar{A} - bi) \qquad i = \frac{1}{h}\left(kY - \frac{\bar{M}}{\bar{P}}\right)$$

$$= \alpha_G \left[\bar{A} - b\left\{\frac{1}{h}\left(kY - \frac{\bar{M}}{\bar{P}}\right)\right\}\right]$$

$$= \alpha_G \left[\bar{A} - b\left\{\frac{kY}{h} - \frac{1}{h}\frac{\bar{M}}{\bar{P}}\right\}\right]$$

$$= \alpha_G \left[\bar{A} - \frac{bkY}{h} + \frac{b}{h}\frac{\bar{M}}{\bar{P}}\right]$$

$$= \alpha_G \bar{A} - \frac{\alpha_G bkY}{h} + \alpha_G \frac{b}{h}\frac{\bar{M}}{\bar{P}}$$

$$Y\left[\frac{h + \alpha_G bk}{h}\right] = \alpha_G \bar{A} + \alpha_G \frac{b}{h}\frac{\bar{M}}{\bar{P}}$$

$$Y = \frac{1}{\frac{h + \alpha_G bk}{h}}\left[\alpha_G \bar{A} + \alpha_G \frac{b}{h}\frac{\bar{M}}{\bar{P}}\right]$$

$$= \frac{h}{h + \alpha_G bk}\left[\alpha_G \bar{A} + \alpha_G \frac{b}{h}\frac{\bar{M}}{\bar{P}}\right]$$

$$Y = \left[\frac{\alpha_G h}{h+\alpha_G bK}\right]\bar{A} + \left[\frac{\alpha_G b}{h+\alpha_G bK}\right]\frac{\bar{M}}{\bar{P}}$$

$$Y = \gamma \bar{A} + \gamma \frac{b}{h}\left(\frac{\bar{M}}{\bar{P}}\right) \quad \therefore \gamma = \frac{\alpha_G}{1+\left(\frac{\alpha_G bK}{h}\right)}$$

* Equation $Y = \frac{h\alpha_G}{h+Kb\alpha_G}\bar{A} + \frac{b\alpha_G}{h+Kb\alpha_G}\frac{\bar{M}}{\bar{P}}$ — (8) shows that the equilibrium level of income depends on two exogenous variables (i) autonomous spending ($\bar{A}$), including autonomous consumption and investment ($\bar{C}$ and $\bar{I}$) and fiscal policy parameters ($\bar{G}$, TR) and (ii) the real money stock ($\frac{\bar{M}}{\bar{P}}$). Equilibrium income is higher the higher the level of autonomous spending, $\bar{A}$, and the higher the stock of real balances.

Equation (8) is the aggregate demand schedule. It summarizes the IS-LM relation, relating Y and P for given levels of $\bar{A}$ and $\bar{M}$. Since P is in the denominator, the aggregate demand curve slopes downward.

The equilibrium rate of interest i, is obtained by substituting the equilibrium income level Y_0, from equation (8) into the equation of the LM schedule (7a).

LM equation $i = \frac{1}{h}\left(KY - \frac{\bar{M}}{\bar{P}}\right)$

$$i = \frac{K\alpha_G}{h+Kb\alpha_G}\bar{A} - \frac{1}{h+Kb\alpha_G}\frac{\bar{M}}{\bar{P}} \quad \text{— (9)}$$

(or) equivalently

$$i = \gamma\frac{K}{h}\bar{A} - \gamma\frac{1}{h\alpha_G}\frac{\bar{M}}{\bar{P}} \quad (9a)$$

Equation (9) shows that the equilibrium interest rate depends on the parameters of fiscal policy captured in the multiplier and the term $\bar{A}$ and on the real money stock. A higher real money stock implies a lower equilibrium interest rate.

The Fiscal policy multiplier

The fiscal policy multiplier shows how much an increase in govt spending changes the equilibrium level of income holding the real money supply constant.

The equation (8) and consider the effect of an increase in govt spending on income. The increase in govt spending, $\Delta\bar{G}$, is a change in autonomous spending, so $\Delta\bar{A} = \Delta\bar{G}$.

The effect of the change in $\bar{G}$ is given by

$$\frac{\Delta Y}{\Delta\bar{G}} = \gamma \qquad \therefore \gamma = \frac{h\alpha_G}{h + kb\alpha_G}$$

Where γ is the fiscal or govt spending multiplier once interest rate adjustment is taken into account. Inspection shows that γ is less than α_G since $1/(1 + k\alpha_G b/h)$ is less than 1. This represents the dampening effect of increased interest rates associated with a fiscal expansion in the IS-LM model.

The monetary policy multiplier shows how much an increase in the real money supply increases the equilibrium level of income keeping fiscal policy unchanged. Using equation (9) to examine the effects of an increase in the real money supply on income, we have

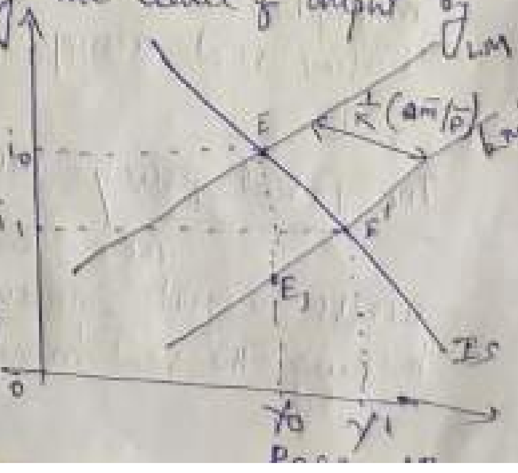
$$\frac{\Delta Y}{\Delta\left(\frac{\bar{M}}{\bar{P}}\right)} = \frac{b}{h}\gamma = \frac{b\alpha_G}{h + kb\alpha_G}$$

The smaller h and k and the larger b and α_G, the more expansionary the effect of an increase in real balances on the equilibrium level of income. Large b and α_G correspond to a very flat IS schedule.

Monetary policy shows how an increase in the quantity of money affects the economy, increasing the level of output by reducing interest rates.

The initial equilibrium at point E is on the initial LM schedule that corresponds to a real money supply, $\frac{\bar{M}}{\bar{P}}$.

Now consider an open market purchase by the Fed. This increases the nominal quantity of money and, given the price level, the real quantity of money.



① Numarical Questions ①

The consumption function is given by $C = 100 + .8Y$, while Investment is given by $I = 50$.

(a) What is the equilibrium level of Income in this case?

(b) What is the level of saving in equilibrium?

(c) If, for some reason, output is at the level of 700, what will the level of involuntary inventory accumulation be?

(d) If I rises to 100, what will the effect be on the equilibrium income

(e) What is the value of multiplier, α here?

(f) draw a diagram indicating the equilibria in both (a) and (d)

Solution

$$Y = C + I$$

(a) The General equilibrium condition - $Y = AD = C + I$

$$C = 100 + \cdot 8Y$$
$$I = 50$$

$$Y = C + I$$
$$= 100 + \cdot 8Y + 50$$
$$(Y - 0.8Y) = 100 + 50$$
$$Y(1 - 0.8) = 150$$
$$Y(0.2) = \frac{150}{\cdot 2}$$
$$= \frac{1500}{2}$$
$$= 750$$

Given the consumption function as $C = 100 + 0.8Y$

$$C = 100 + \cdot 8(750)$$
$$= 100 + 600$$
$$= 700$$

$$\frac{\overset{4}{750} \times \cdot 8}{600.0}$$

For equilibrium to exist, we know national Income must be equal to planned consumption plus planned Investment

$$Y = C + I$$
$$750 = 700 + I$$
$$I = 50$$

Thus, The equilibrium level of Income = 750

(b) The equilibrium level of saving $S = Y - C$

Saving is the difference b/w income (Y) and consumption (C)

i.e $S = Y - C$

$$= Y - (100 + \cdot 8Y)$$
$$= Y - 100 - \cdot 8(750)$$
$$= -100 + \cdot 2Y$$

$$Y - 100 - 0.8Y$$
$$-100 + 0.2Y$$

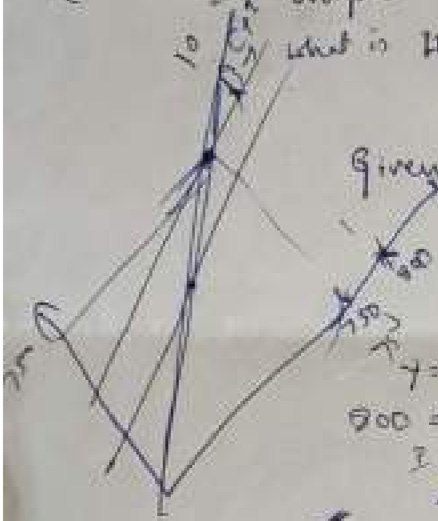
The equilibrium condition is $I = S$

Thus upon substitution in the equilibrium condition, we get.

$$50 = -100 + .2Y$$
$$.2Y = 150$$
$$Y = \frac{150}{.2}$$
$$= 750$$

Thus, the equilibrium level of saving is $-100 + .2Y$, and equilibrium level of income 750

(c) If output is at the level of 800 what is the level of involuntary inventory ~~for~~ accumulation be?



$Y = 800$ if is above 750 to 800

Given consumption function $= 100 + .8Y$
$= 100 + .8(800)$
$= 100 + 640$
$= 740$

$Y = C + I$
$800 = 740 + I$
$I = 60$ ✓

saving

When output is 800
$C = 100 + 0.8Y$
$= 100 + 640$
$= 740$

$800 = C + I_{planned} + I_{unplanned}$
$= 740 + 50 + (I_{unplanned})$

$I_{planned} = 50$

$I_{unplanned} = 10$

(d) $C = 100 + .8Y$
$I = 100$

The equilibrium level of income will be:

$Y = AD = C + I$
$= 100 + .8Y + 100$

$Y(0.2) = 200$
$Y = \frac{200}{.2}$
$= 1000$

Given the consumption function $C = 100 + .8Y$
$= 100 + .8(1000)$
$= 100 + 800$
$= 900$

$\therefore Y = C + I$
$1000 = 900 + 100$
$I = 100$ ✓

(e) The value of multiplier α?

The equilibrium level of income $Y = C + I$

Now let there be ΔI, when ΔI takes place it results in ΔY and ΔY induces ΔC. Thus, the post ΔI equilibrium level of income equals.

$$Y + \Delta Y = C + \Delta C + I + \Delta I$$

Subtracting equation $Y = C + I$

$$Y + \Delta Y = C + \Delta C + I + \Delta I$$

$$\cancel{Y} + \cancel{I} + \Delta Y = \cancel{C} + \Delta C + \cancel{I} + \Delta I$$

$$\Delta Y = \Delta C + \Delta I$$

Given the consumption function as $C = \bar{C} + cY$

$$\Delta C = c\Delta Y$$

$$C = \bar{C} + cY = \bar{C} + \frac{\Delta C}{\Delta Y} Y$$

$$\Delta C = b\Delta Y$$

by substituting equation $\Delta C = \Delta Y$

$$\Delta Y = c\Delta Y + \Delta I$$

$$\Delta Y - c\Delta Y = \Delta I$$

$$\Delta Y(1-c) = \Delta I$$

$$\Delta Y = \frac{1}{1-c}\Delta I$$

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1-c} = \alpha \text{ multiplier}$$

Thus, the term $\frac{1}{1-c}$ gives the value of investment multiplier

$\therefore$ Value of multiplier $= \frac{\Delta Y}{\Delta I} = \frac{1}{1-c}$

$$\alpha = \frac{800}{100} = \frac{1}{1-.8}$$

$$\Rightarrow 8 = \frac{1}{0.2}$$

$$= 8 \times 5$$

$$= 40 \text{ Time multiplier}$$

(8) equilibrium of a(a) and (b) in the following ...