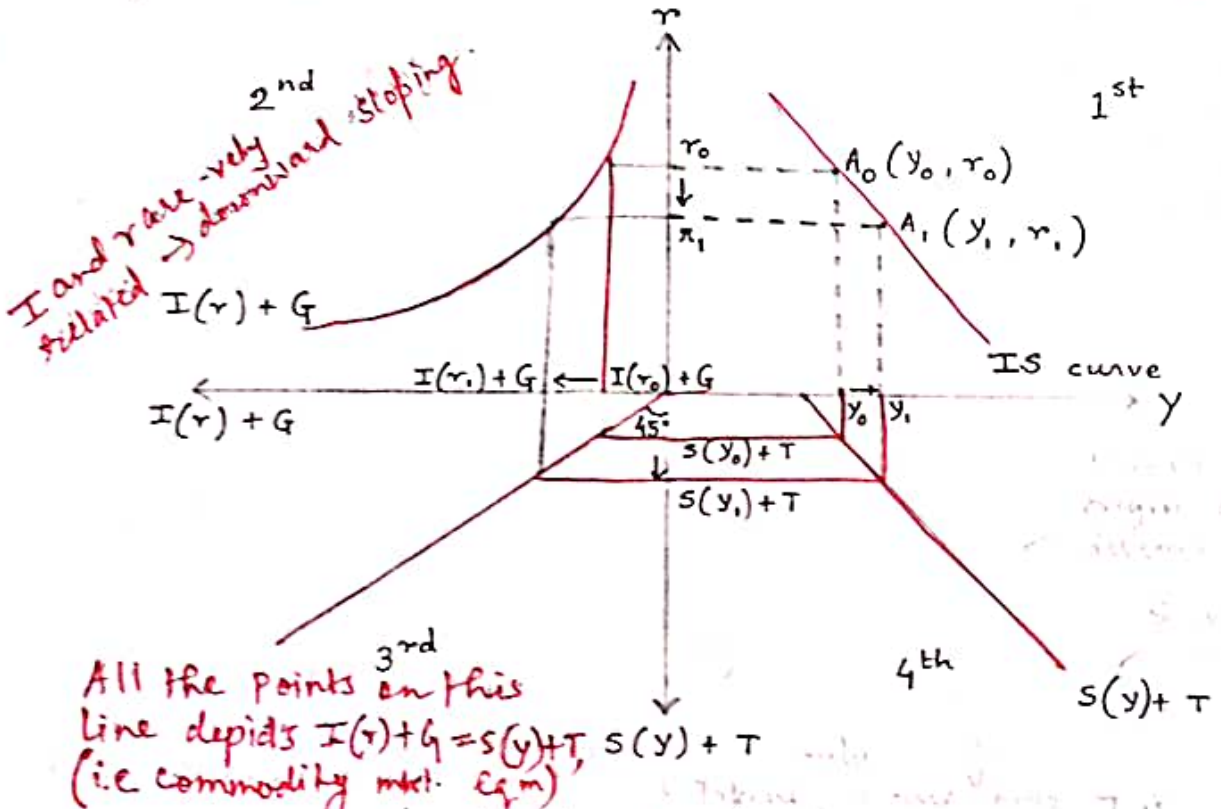
SEM - 3

# IS - LM Model

## Derivation of IS Curve

In Simple keynesian model, the equilibrium for commodity market is given by $S(y-T) + T = I + G$. Here, T, G and I are exogeneously given. But in case of IS - LM Model, money market is incorporated for which investment becomes a negative function of rate of interest. Investment basically depends on the borrowed capital. Now, higher is the rate of interest, higher will be the cost of borrowing, lower will be the borrowed capital and lower will be the volume of investment. So, in the presence of money market, the equilibrium condition for commodity market can be restructured as $S(y-T) + T = I(r) + G$.

Thus, we get 2 variables y and r, and it can be said that there will be several combinations of y and r for which commodity market equilibrium condition is satisfied. If we take the locus of all such combinations in ry plane, we get IS curve. So, IS curve is basically representing commodity market equilibrium.




4 Quadrant Diagram

In the 2nd quadrant of the diagram, negatively sloped $I(r) + G$ is drawn which exhibits negative relationship between rate of interest and investment. Here, G is not separately drawn because it is exogeneously given.

In the 3rd quadrant, a 45° line is drawn which is representing commodity market equilibrium.

In the 4th quadrant, a positively sloped savings function is drawn which exhibits the positive relationship between savings and income.

Let the initial interest rate be $r_0$ for which $I(r_0) + G$ will be the investment. Now, with respect to 45° line, $I(r_0) + G$ is consistent with $S(Y_0) + T$ level of savings. This amount of savings is generated from $Y_0$ level of income. Thus, $(r_0, Y_0)$ combination is depicted with respect to the 45° line of the 3rd quadrant i.e, the combination can satisfy commodity market equilibrium.

Let the rate of interest is given by $r_1$ (declines to $r_1$). According investment increases to $I(r_1) + G$. With respect to 45° line, i.e., to satisfy commodity market equilibrium, savings also increases to $S(Y) + T$. Now, this much of savings is generated from $Y_1$ income level. Thus, $(r_1, Y_1)$ is depicted with respect to 45° line and can satisfy commodity market equilibrium. Taking the locus of these combinations given by the points $A_0$ and $A_1$ respectively in the 1st quadrant, we can derive IS curve.

## The Slope of IS Curve

IS curve exhibits commodity market equilibrium where different combinations of r and y are to be considered which can satisfy the condition.

## B. Decrease in T

Let T decrease. With respect to the unchanged interest rate, $I(r) + G$ as a whole remains unchanged. Thus, to satisfy the commodity market equilibrium, $s(y-T)$ will have to increase, which is possible through an increase in y. So, for a fall in T with respect to the same interest rate, y expands and IS curve shifts parallely rightward.

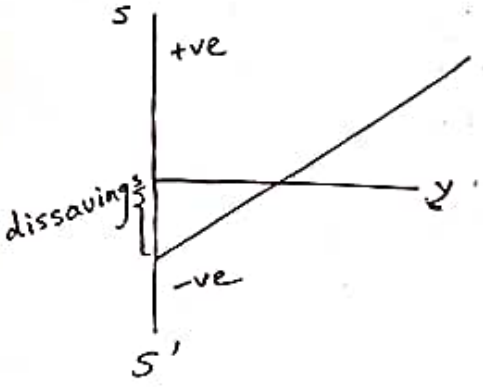
Contractionary fiscal Policy:

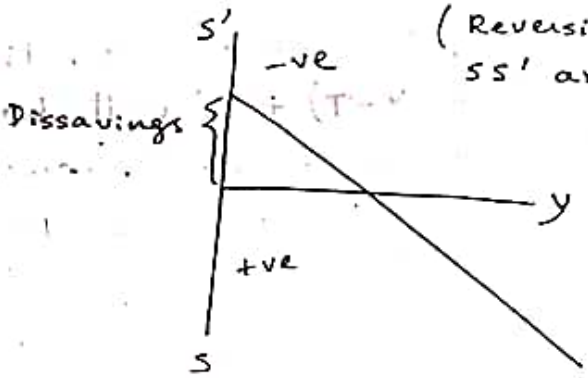
A. G declines.

⇒ IS curve shifts parallely leftwaid

B. T increases

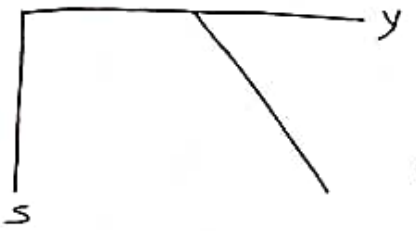
⇒ IS curve shifts parallely leftward



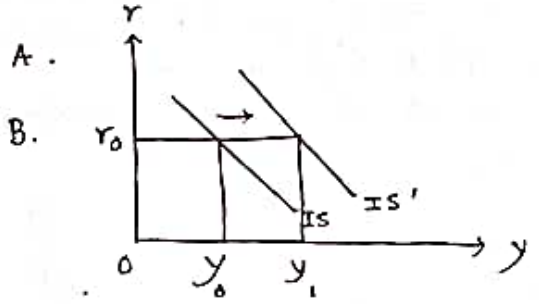




(Reversing the SS' axis)

By omitting the S'y part, we get →




4th quadrant




A. When G ↑, y ↑

∴ Rightward shift of IS.

B. When T ↓.

$I(r) + G$ remains unchanged.

∴ For comm. market eqm, $[s(y-T)]$ ↑ to nullify the effect of T ↓.

↳ For this to ↑, y ↑.

∴ Rightward shift of IS.

## Derivation of LM Curve

LM curve is all about the money market equilibrium. It is the locus of all such combinations of r (real int. rate) and y (real output) for which money market equilibrium condition is satisfied.

According to keynes, demand for money occurs for 3 reasons:

① **Transaction Money Demand**

Money demanded for sales and purchases of goods and services. This is denoted by $L_1(y)$ where $L_1' > 0$. (income)

② **Precautionary Money Demand**

Here, the money is demanded to overcome unforeseen situations. This is already being included in transaction money demand.

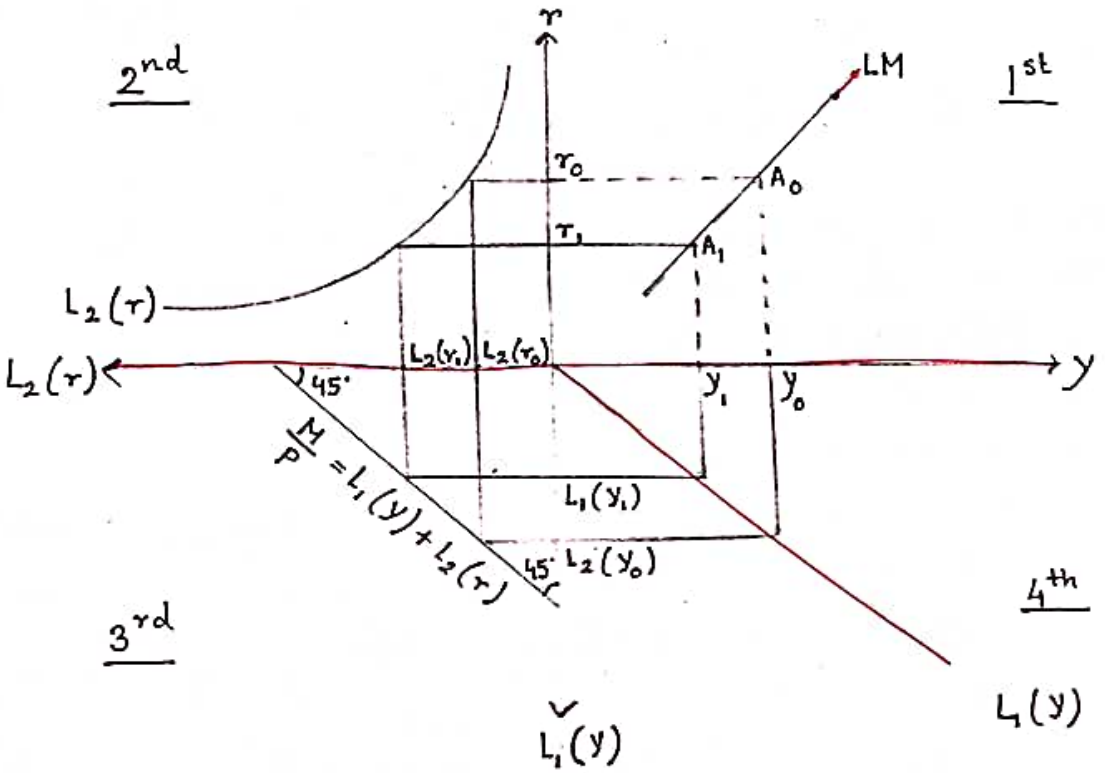
③ **Speculative Money Demand**

Money demanded for sales and purchases of bonds and shares. This is denoted by $L_2(r)$, where $L_2' < 0$

Therefore, total money demanded $(M_D) = L_1(y) + L_2(r)$

Now, in keynesian model, the real money balance or real money supply given by $(\frac{M}{P})$ is taken as exogeneously given parameter.

$\therefore$ Money market equilibrium: $\frac{M}{P} = L_1(y) + L_2(r)$



Let us suppose the initial interest rate is $r_0$ for which the speculative money demand is $L_2(r_0)$. Now, this level of speculative money demand is consistent with the transaction money demand $L_1(y_0)$ to satisfy the money market equilibrium condition. Now, $L_1(y_0)$ occurs for $y_0$ level of income. So, $(r_0, y_0)$ shown by the point $A_0$ is plotted in the 1st quadrant of the diagram.

For $r_1$ rate of interest, we get the level of income $y_1$ which can satisfy the money market equilibrium condition. Now, $(r_1, y_1)$ is shown by the point $A_2$. Now taking the locus of all such points, we get LM curve in 1st quadrant.

## The Slope of LM Curve

LM curve depicts the money market equilibrium shown by the equation $\frac{M}{P} = L_1(y) + L_2(r)$.

Now, totally differentiating, we get

$$d\left(\frac{M}{P}\right) = L_1' dy + L_2' dr$$

$$\Rightarrow 0 = L_1' dy + L_2' dr \quad \left(\because \frac{M}{P} \text{ is fixed}\right)$$

$$\Rightarrow \frac{dr}{dy} = -\frac{L_1'}{L_2'}$$

As $L_1' > 0$ and $L_2 < 0$, $\therefore \left.\frac{dr}{dy}\right|_{LM} > 0$

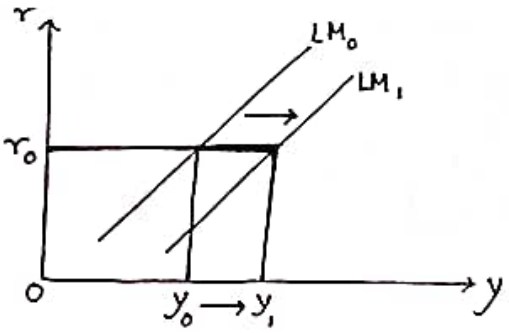
Let, the rate of interest declines. Then the speculative money demand $L_2(r)$ will increase. Now to satisfy money market equilibrium condition, $L_1(y)$ will have to fall and this is possible only when $y$ declines. So, to satisfy money market equilibrium condition, $r$ and $y$ will move in the same direction and LM curve will be positively sloped.

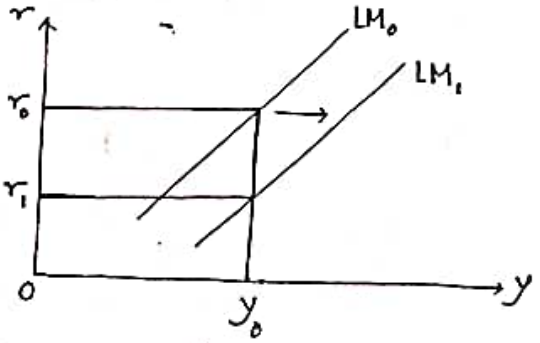
## Monetary Policy : Effects on LM curve

### Expansionary Monetary Policy

Let, the money supply increases. If the increased part of money supply is absorbed for transaction of goods and services, keeping the speculative activity constant, then $L_1(Y)$ will increase with an increase in $Y$. So, $r$ remains constant, $Y$ increases and LM curve shifts parallelly rightward.

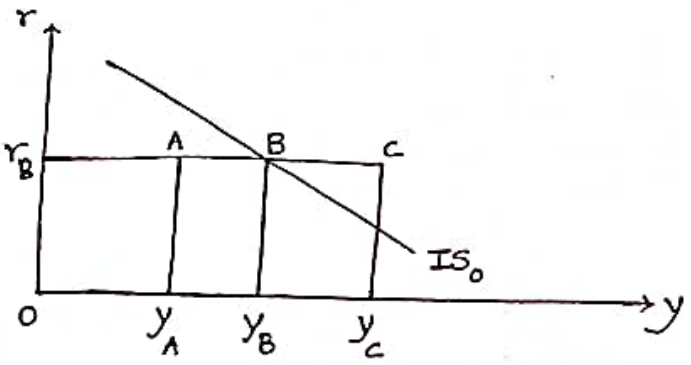
Let, the increased part of the money supply is absorbed for speculative activities, keeping the transaction money demand constant. So, $L_2(r)$ will increase with a fall in $r$. So, with a constant $Y$, when $r$ declines, LM shifts parallelly rightward.




(*) ∴ lying outside IS curve / left or right of the IS curve

### Points off the IS Curve




Point B is on IS curve and representing the commodity market equilibrium condition given by

$$S(y_B - T) + T = I(r_B) + G \quad \text{---------- (1)}$$

(Income and savings are truely related)

Now, at point A,

we get $y_A < y_B$

$\therefore S(y_A - T) < S(y_B - T)$

$S(y_A - T) + T < S(y_B - T) + T$

$S(y_A - T) + T < I(r_B) + G$ (from (1))

Supply for goods and services is less than demand for goods and services.

This implies excess demand for goods and services. Thus, a point lying to the left of IS curve exhibits excess demand for goods and services.

In contrary, we can say that, at point C, there will occur excess supply of G & S.

$$Y_C > Y_B$$

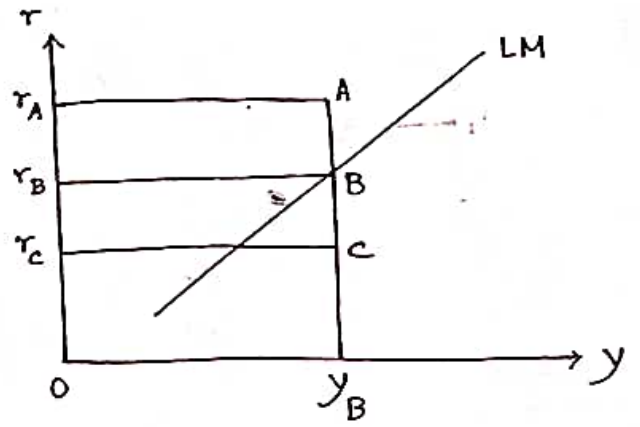
$$\Rightarrow S(Y_C - T) > S(Y_B - T) \Rightarrow S(Y_C - T) + T > S(Y_B - T) + T$$

$$S(Y_C - T) > I(r_B) + G$$

This implies, supply > demand.

So, there exists excess supply.

## Points off the LM Curve




Point B is lying on the LM curve and representing money market equilibrium:

$$\frac{M}{P} = L_1(Y_B) + L_2(r_B) \quad \text{-------} \quad (1)$$

Now, at point A, $r_A > r_B$

$$L_2(r_A) < L_2(r_B)$$

(Spec. money dem. is -vely related to r)

$r_A$ and $r_B$ both correspond to the income level $Y_B$ and can represent the same level of transaction money demand $L_1(Y_B)$.

$$L_2(r_A) + L_1(y_B) < L_2(r_B) + L_1(y_B)$$

$$L_2(r_A) + L_1(y_B) < \frac{M}{P}$$

Demand for money < Supply of money

This implies excess supply in the money market.

So, a point lying above the LM curve can represent excess supply in money market.

In contrary, when $r_c < r_B \Rightarrow L_2(r_c) > L_2(r_B)$

$$\Rightarrow L_2(r_c) + L_1(y_B) > L_2(r_B) + L_1(y_B)$$

$$\Rightarrow L_2(r_c) + L_1(y_B) > \frac{M}{P} \quad (\text{from } ①)$$

Thus, there exists ~~exists~~ excess demand in money market.

So, a point lying below the LM curve can represent excess demand in money market.

⊛ Contractionary Monetary Policy

Money Supply ↓

⇒ Transaction money demand ↓ (keeping speculative money demand constant)

⇒ $y$ ↓ ($r$ remaining same)

⇒ LM shifts $\frac{1}{k}y$ leftward.

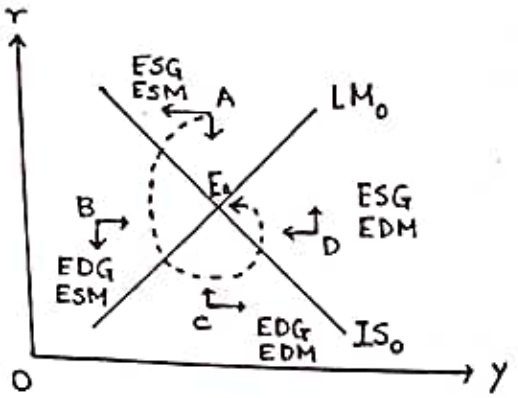
Similarly, Money Supply ↓

⇒ Speculative money demand ↓ (keeping trans. money d. constant)

⇒ $r$ ↑ ($y$ rem. same)

⇒ LM shifts $\frac{1}{k}y$ leftward.

# Simultaneous Equilibrium or General Equilibrium




Point A is lying to the right of IS curve and above LM curve. So, it is indicating excess supply in both the markets.

The leftward movement of horizontal trajectory towards IS curve and the downward movement of vertical trajectory towards LM curve is showing the ~~refte~~ rectification of disequilibrium in commodity market and money market respectively. So, the system will move leftward and downward shown by the dotted lines.

Point B is lying to the left of IS curve and above LM curve. So, it is showing excess demand in commodity market and excess supply in money market. So for rectification, y will have to increase as shown by the rightward movement of horizontal trajectory. Now for rectification, money market, r will have to fall as shown by the downward movement of the vertical trajectory. So, the system will move rightward and downward as shown by the dotted lines in the diagram.

Point C is lying to the left of IS curve and below LM curve. So, it is indicating excess demand in both the markets. Accordingly for rectification, y and r will increase as shown by the rightward and upward movement of the horizontal trajectory and vertical trajectory respectively, and the system moves upward right as shown by the dotted lines.

Now, Point D is lying to the right of IS curve and below LM curve and indicating excess supply in commodity market and excess demand in money market. Accordingly, y will fall and r will increase which is shown by the leftward movement of horizontal trajectory and upward movement of the vertical trajectory respectively

and the system moves upward left shown by the dotted lines.

In this way, we can generate a phase path which finally reaches at $E_0$, i.e. at the point of intersection between IS and LM curve. So, $E_0$ is lying on IS and LM simultaneously and can represent the simultaneous equilibrium or general equilibrium for the economy as a whole.

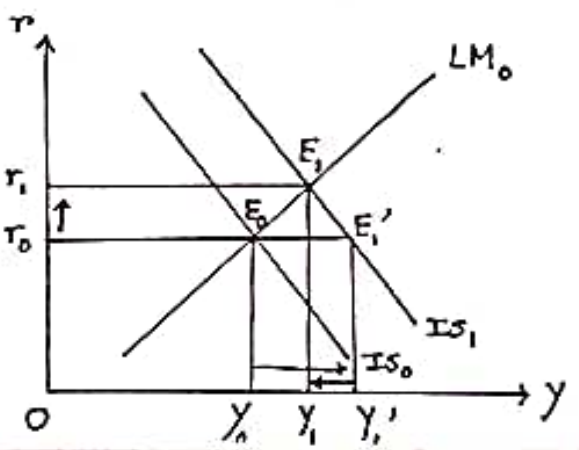
## Policy Implications in IS - LM Model

### Expansionary Fiscal Policy

Let us suppose the govt. implements expansionary fiscal policy for which G increases or T declines. Due to the expansionary fiscal policy, IS curve will shift parallely rightward but LM curve will remain at its initial position.

Due to an increase in Govt. expenditure, initially y will increase upto the fullest extent by the amount of increase in G.

When G increases, budget deficit occurs; to finance the deficit, govt. will sell out bonds and shares to the public to raise the funds. Accordingly, supply of bonds in the bond market will increase and bond price will fall. As a result, the rate of interest will increase for which investment declines. For a fall in investment, y will partially fall from its increased level. In other words, a portion of increased income declines due to a fall in investment caused by the increase in rate of interest due to money market intervention in the process of public borrowing. This is known as crowding out effect of Expansionary Fiscal Policy.




Thus, due to expansionary fiscal policy, y and r both increases.

$E_0$ is the initial equilibrium point for which $r_0$ and $y_0$ are initial combination of interest rate and income.

PTO.

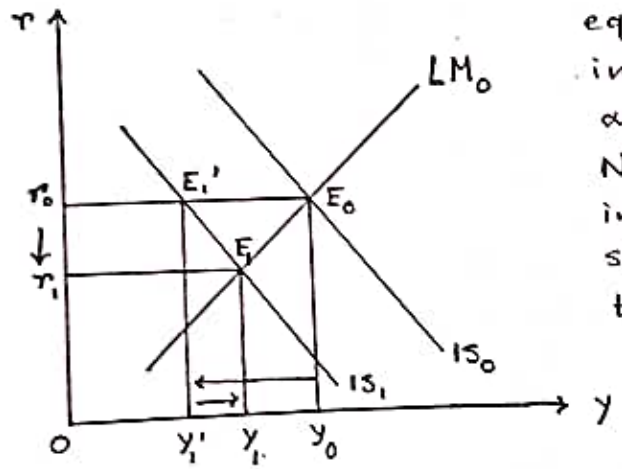
Due to increase in G, IS curve shifts parallely rightward to $IS_1$. Initially, with respect to $r_0$, the economy moves from $E_0$ to $E_1'$ with a full expansion of y from $y_0$ to $y_1'$. Now, due to money market interaction, as the interest rate increases from $r_0$ to $r_1$, investment falls and income declines from the expanded level $y_1'$ to $y_1$ as the system moves from $E_1'$ to $E_1$.

So, $y_1y_1'$ portion of expanded output is being wiped out which is treated as the crowding out effect of expansionary fiscal policy. So net increase in y from $y_0$ to $y_1$ and increase in r from $r_0$ to $r_1$.

## CONTRACTIONARY FISCAL POLICY

In case of contractionary fiscal policy, G declines or T increases. In this case, IS curve shifts parallely leftward and initially y declines upto its fullest extent where the rate of interest initially remains unchanged.

Now, due to decrease in G and increase in T, budget deficit declines or budget surplus increases. Here, the govt. will purchase bonds from the market. As a result, supply of bond will fall and bond price will increase. Accordingly, the rate of interest will fall because interest interest rate and bond price are inversely related to each other. For a fall in interest rate, investment will increase for which income will partially increase from its reduced level. This is known as crowding in effect of contractionary fiscal policy.




With respect to the initial curves $IS_0$ and $LM_0$, the equilibrium is $E_0$ for which initial interest rate is $r_0$ and initial income level is $y_0$. Now, due to fall in G or increase in T, IS curve shifts parallely leftward to $IS_1$.

With the initial interest rate $r_0$, economy moves from $E_0$ to $E_1'$ with a fall in $y$ from $Y_0$ to $Y_1'$. Now, due to money market interaction, i.e. due to purchase of bonds by the Govt., bond price increases and rate of interest starts falling from $r_0$ level and level of income starts increasing from $Y_1'$ following the increase in investment. Finally, the economy reaches $E_1$, for which the interest rate is $r_1$ and income level is $Y_1$. Thus, $Y_1'Y_1$ portion of reduced income is revived due to increase in investment caused by a fall in the rate of interest and this is the crowding in effect of Contractionary Fiscal Policy.

Note: • Expansionary Fiscal Policy implies:

① Increase in G

② Decrease in T

① Increase in G

When G increases, $(C + I + G)$ as a whole increases, for which $y$ increases. Thus, increase in G can be treated as expansionary fiscal policy.

② Decrease in T

When T declines, disposable income will increase, for which consumption expenditure will increase. As a result, $(C + I + G)$ as a whole will increase, i.e. $y$ will increase. ∴ A fall in T can be treated as an expansionary fiscal policy.

• Contractionary Fiscal Policy implies:

① Decrease in G

② Increase in T

① ↓ in G : $G \downarrow$
$\Rightarrow (C + I + G) \downarrow$
$\Rightarrow y \downarrow$

∴ ↓ in G can be treated as contractionary fiscal policy.

② ↑ in T : $T \uparrow$
$\Rightarrow$ Disposable income ↓
$\Rightarrow$ Consumption exp. ↓
$\Rightarrow (C + I + G) \downarrow \Rightarrow Y \downarrow$

∴ ↑ in T can be treated as contractionary fiscal policy.

# Mathematical Derivation of $\left(\frac{dy}{dG}\right)$

Equation of IS curve -

$$S(y-T) + T = I(r) + G$$

Totally differentiating,

$$S'(dy - dT) + dT = I'dr + dG$$

$$S'dy = I'dr + dG \quad (\because dT = 0)$$

——— ①

Equation of LM curve -

$$\frac{M}{P} = L_1(y) + L_2(r)$$

$$d\left(\frac{M}{P}\right) = L_1'\,dy + L_2'\,dr$$

$$\Rightarrow 0 = L_1'\,dy + L_2'\,dr$$

$$\Rightarrow dr = -\frac{L_1'\,dy}{L_2'} \quad \text{——— ②}$$

Substituting ② in eqn. ①, we get

$$S'\,dy = I'\left(\frac{-L_1'}{L_2'}\right)dy + dG$$

$$\Rightarrow S'dy + I'\left(\frac{L_1'}{L_2'}\right)dy = dG$$

$$\Rightarrow dy\left(S' + \frac{I'L_1'}{L_2'}\right) = dG$$

$$\Rightarrow \left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{S' + \frac{I'L_1'}{L_2'}}$$

$$\Rightarrow \left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{1 - c' + \frac{I'L_1'}{L_2'}} \quad (\text{where } S' = 1 - c')$$

$$\Rightarrow \left.\frac{dy}{dG}\right|_{SKM} = \frac{1}{1-c'}$$

Simple keynesian Model

Now, $I' < 0$, $L_1' > 0$, $L_2' < 0$

$$\therefore \frac{I'L_1'}{L_2'} > 0$$

$$\frac{I'L_1'}{L_2'} + 1 - c' > 0 + 1 - c'$$

$$\Rightarrow \frac{1}{1-c' + \frac{I' L_1'}{L_2'}} < \frac{1}{1-c'}$$

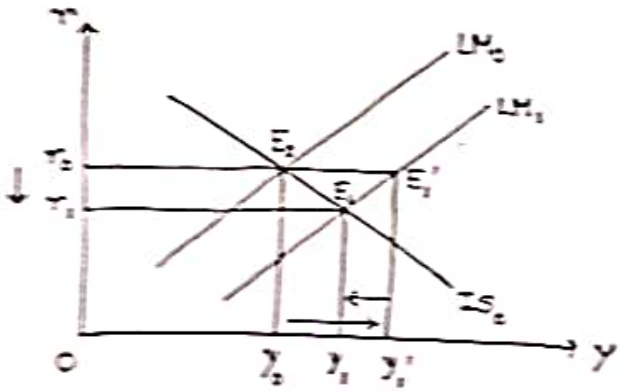
$$\Rightarrow \left.\frac{dy}{dG}\right|_{IS-LM} < \left.\frac{dy}{dG}\right|_{SKM}$$

Magnitude of Govt. expenditure multiplier in IS-LM is less than Magnitude of Govt. expenditure multiplier in SKM; due to the presence of $\frac{I' L_1'}{L_2'}$, that is why income cannot increase fully due to money market intervention.

The difference between these two is due to the effect of $\frac{I' L_1'}{L_2'}$. This constitutes the crowding out portion in IS-LM Model which actually represents the money market interaction and its impact on investment through a change in the rate of interest

## Monetary Policy Effects in case of IS-LM Model

Let us consider an expansionary monetary policy for which the money supply increases. Accordingly, LM curve will shift parallelly rightward. Initially, the increased portion of the money supply is entirely used for transaction purposes for which transaction demand for money will increase for which $y$ will increase upto its fullest extent keeping the rate of interest unchanged at its initial level.




Due to implementation of expansionary monetary policy, income level initially expands from $y_0$ to $y_1'$ and economy moves from $E_0$ to $E_1'$ keeping the ~~initial~~ interest rate constant at $r_0$

When $y$ increases, savings will increase and to maintain equilibrium in commodity market, investment will have to increase which is possible for a decrease

in rate of interest. Now, when interest rate declines, speculative activities will increase and transaction of goods and services will fall. Thus, with an increase in speculative demand for money, transaction money demand will fall and $y$ will fall from its expanded level $y_1'$. The process will continue till the economy reaches at E, with respect to which final interest rate and income are $r_1$ and $y_1$ respectively. Thus, $y_1' y_1$ portion of the expanded output is wiped out which is known as Crowding Out Effect of Expansionary Monetary Policy.

## Mathematical Derivation of $\frac{dY}{dM}$ (Money Multiplier)

IS eqⁿ. $S(y-T) + T = I(r) + G$

$\Rightarrow S'(dy - dT) + dT = I' dr + dG$

$\Rightarrow S' dy = I' dr \quad (\because dT = dG = 0)$ ——— ①

LM eqⁿ. $\frac{M}{P} = L_1(y) + L_2(r)$

$\Rightarrow d\left(\frac{M}{P}\right) = L_1' dy + L_2' dr$

$\Rightarrow \frac{P\,dM - M\,dp}{P^2} = L_1' dy + L_2' dr$

$\Rightarrow \frac{dM}{P} = L_1' dy + L_2' dr \quad (\because dp = 0)$ ——— ②

Putting the value of $dr$ from ① in ②,

$\Rightarrow \frac{dM}{P} = L_1' dy + L_2' \frac{S'}{I'} dy$

$\Rightarrow \frac{dM}{P} = \left[L_1' + \frac{L_2' S'}{I'}\right] dy$

$\Rightarrow \frac{dy}{dM} = \frac{1}{P\left[L_1' + \frac{L_2' S'}{I'}\right]}$

$$S' > 0 \ , \ L_1' < 0 \ , \ I' < 0$$

$$\therefore \frac{dy}{dM} > 0 .$$

$\frac{L_2' S'}{I'}$ is the crowding out component of expansionary monetary policy.

## Effectiveness of Fiscal Policy

Effectiveness of fiscal policy differs with respect to the differences in the slope of IS curve and LM curve.

① When IS curve is parallel to the horizontal axis:

$$\left.\frac{dr}{dY}\right|_{IS\ curve} = \frac{S'(Y)}{I'(r)}$$

For horizontal IS $\Rightarrow \frac{S'(Y)}{I'(r)} = 0$

$$\Rightarrow I'(r) = \infty \quad \Rightarrow \frac{\partial I}{\partial r} = \infty$$

This implies that investment demand is infinitely or perfectly interest sensitive or elastic.

$$\left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{1 - c' + \frac{I' L_1'}{L_2'}} \ , \text{ for } I' = \infty \ , \ \frac{dy}{dG} = 0 .$$

So, increase in output cannot be realized in this case and fiscal policy is completely ineffective.

② When IS curve is parallel to the vertical axis:

$$\frac{dr}{dY} = \frac{S'(Y)}{I'(r)} = \infty \quad \Rightarrow I'(r) = 0 \quad \Rightarrow \frac{\partial I}{\partial r} = 0$$

$$\left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{1 - c' + \frac{I' L_1'}{L_2'}} \quad \text{for } I' = 0$$

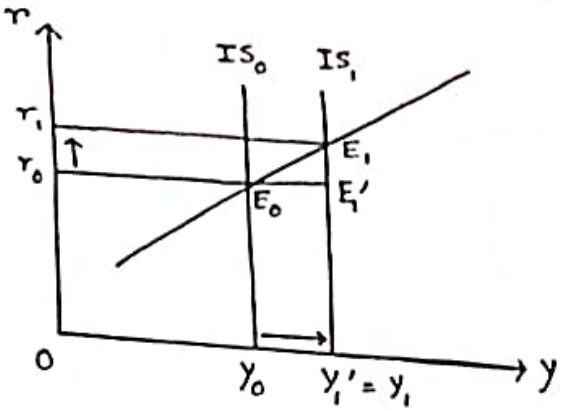
(Here, investment demand remains unchanged even when rate of interest changes infinitely)

$$\left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{1 - c'} = \left.\frac{dy}{dG}\right|_{SKM}$$

Here, Crowding out is zero.

We get the fully expansion of output and fiscal policy is fully effective.

Investment is insensitive to rate of interest.

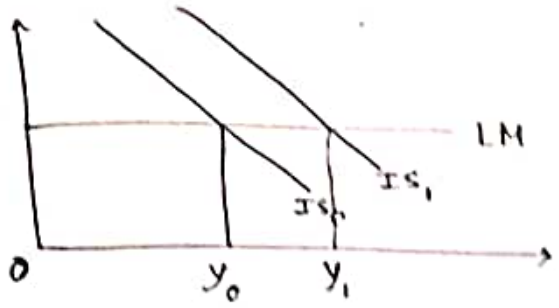



Initial equilibrium occurs at $E_0$ with respect to which initial interest rate and income are $r_0$ and $Y_0$ respectively.

Now, with an increase in G, IS curve shifts parallely rightward to IS, with respect to the initial interest rate $r_0$, economy moves from $E_0$ to $E_1'$ with an expansion in output from $Y_0$ to $Y_1'$. Now, for money and capital market interaction, rate of interest increases from $r_0$ to $r_1$ with a movement of the economy from $E_1'$ to $E_1$. Here, even after the increase in the rate of interest, investment remains at its previous level because $I'(r) = 0$, i.e., investment is completely interest insensitive. So, Y does not fall from its expanded level $Y_1'$ or $Y_1$, full expansion of output is realized and fiscal policy becomes fully effective.

With an increase in G, Budget deficit increases. Now, to finance this deficit, Govt. will follow public borrowing and will sell bonds to the public to raise funds to finance the deficit. As a result, the supply of bond in bond market increases and price of bonds will fall. We know that price of bonds and rate of interest

③ LM curve is horizontal and fiscal Policy is fully effective




$\frac{dr}{dy} = -\frac{L_1'(y)}{L_2'(r)}$ for horizontal LM curve.

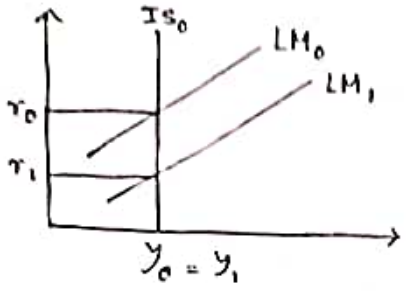
$\left|\frac{dr}{dy}\right| = \frac{L_1'(y)}{L_2'(r)} = 0$

$\Rightarrow L_2'(r) = \infty$ for $L_2' = \infty$, (a)

$\Rightarrow \frac{\partial L_2}{\partial r} = \infty$, for $L_2' = \alpha$ (x)

## Effectiveness of monetary Policy

② Here, we get the full crowding out effect and expansion in $y$ is not realised even after expansion in money supply.




1. If $I'(r) = \infty$, we can say that investment demand is perfectly or infinitely interest elastic or interest sensetive.
2. If $I'(r) = 0$ implies investment demand is perfectly or infinitely interest inelastic or interest insensitive.
3. $L_2'(r) = \infty$
   ⇒ Speculative money demand is perfectly or infinitely interest elastic or interest sensitive
4. $L_2'(r) = 0$
   ⇒ Speculative money demand is perfectly interest inelastic or interest insensitive.

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(x) $\frac{dy}{dG} = \frac{1}{1 - C' + \frac{I' L_1'}{L_2'}}$

$\left.\frac{dy}{dG}\right|_{IS-LM} = \frac{1}{1 - C'} = \left.\frac{dy}{dG}\right|_{SKM}$

Here, Speculative Money Demand is fully interest sensitive and the expansion in $y$ is fully realized and fiscal policy becomes fully effective.

(1) LM curve is parallel to the vertical axis -

$$\left|\frac{dr}{dy}\right| = \frac{L_1'(y)}{L_2'(r)} = \infty$$

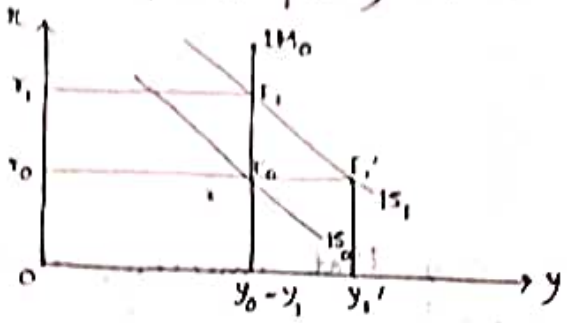
$$\Rightarrow L_2'(r) = 0$$

$$\Rightarrow \frac{\partial L_2}{\partial r} = 0$$

Here, speculative money demand is completely interest insensitive.

$$\frac{dy}{dG} = \frac{1}{1 - c' + \frac{I' L_1'}{L_2'}} \quad \text{for } L_2' = 0 \Rightarrow \frac{dy}{dG} = 0$$

So, expansion of output cannot be realized and fiscal policy is completely ineffective.




So, we have started from the initial income level $y_0$ and finally moved back to $y_0$ even after the increase in G. So, the entire portion of the increased income is wiped out. We get full crowding out and fiscal policy is completely ineffective.

## Effectiveness of Monetary Policy

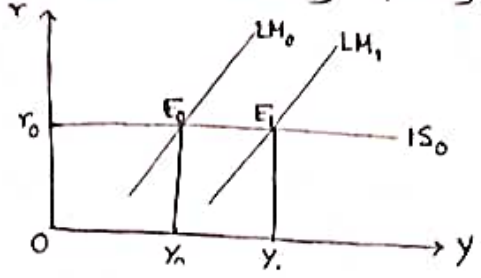
Here, we have to consider 4 extreme cases -

(1) IS curve is parallel to the horizontal axis.

$$I'(r) = \infty \Rightarrow \frac{dy}{dM} = \frac{1}{P\left[L_1' + \frac{S' L_2'}{I'}\right]}$$

$$\frac{S' L_2'}{I'} = 0 \quad \therefore \frac{dy}{dM} = \frac{1}{P L_1'}$$

Here, change in M cannot influence speculative money demand, i.e. full expansion of output is realized through the expansion in transaction demand for money. So, the crowding out is 0 and monetary policy is fully effective.




Here, rate of interest remains same. So, speculative money demand remains same and cannot interfere in the process and we get full expansion in output.

② IS curve is parallel to the vertical axis —

$I'(r) = 0$ $\quad \left.\frac{dy}{dM}\right|_{IS-LM} = \frac{1}{P\left[L_1' + \frac{S'L_2'}{I'}\right]} = 0$ for $I'(r) = 0$

Monetary policy is completely ineffective in this case.

③ LM Curve is parallel to the horizontal axis —

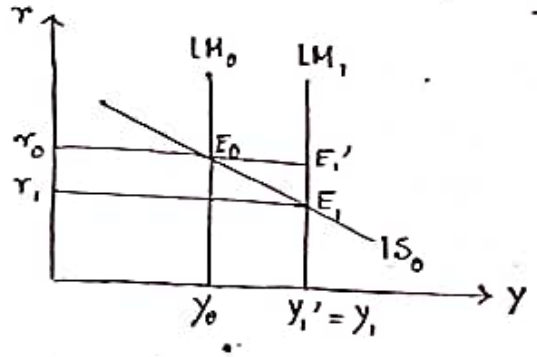
$L_2' = \infty$, $\frac{\partial L_2}{\partial r} = \infty \Rightarrow \frac{\partial y}{\partial M} = \frac{1}{P\left[L_1' + \frac{L_2'S'}{I'}\right]} = \frac{1}{\infty} = 0$

Monetary policy is completely ineffective. for $L_2' = \infty$.

④ LM Curve is parallel to the vertical axis —

$L_2' = 0$, $\frac{\partial L_2}{\partial r} = 0 \Rightarrow \frac{\partial y}{\partial M} = \frac{1}{P\left[L_1' + \frac{L_2'S'}{I'}\right]} = \frac{1}{PL_2'}$ for $L_2' = 0$.

Here, the influence of speculative money demand is not there in the money market. So, the full expansion of output can be realized and monetary policy becomes fully effective.




Here, expanded output is at $Y_1'$ and final output is at $Y_1$. So, the expanded portion of the output is not wiped out and crowding out is 0 and monetary policy is fully effective.

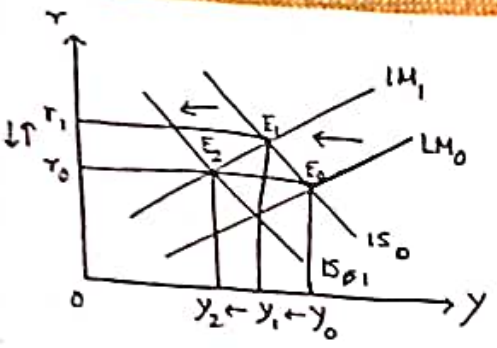
## Monetary and Fiscal Policy Mix

The combination of monetary and fiscal policy is adopted to fulfill the following objectives —

1. To keep interest rate constant.
2. To keep $Y$ constant.

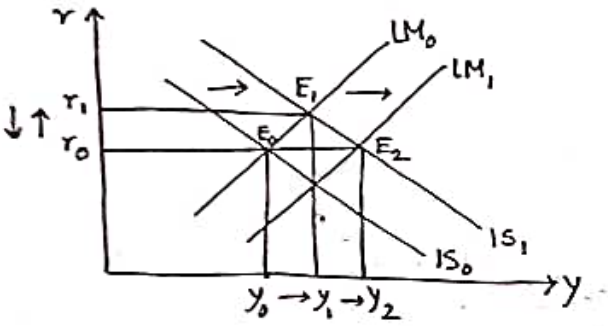
### ① To keep the interest rate constant

a) Let us consider a contractionary monetary policy is adopted for which the rate of interest initially increases and $y$ declines. To keep the interest rate at its initial level, an accomodating contractionary fiscal policy is adopted. As a result, the rate of interest will come down to its initial level with a further fall in $Y$.




To keep the interest rate unchanged at $r_0$, income level will fall initially from $y_0$ to $y_1$ and further from $y_1$ to $y_2$. So, this is not a desirable situation for the economy.

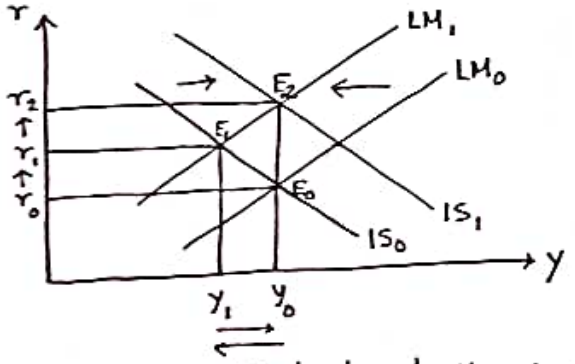
b) Let us suppose the Govt. implements an expansionary fiscal policy for which there occurs an increase in the rate of interest along with an increase in the level of income. Here, an accomodative expansionary monetary policy will be adopted to bring back the rate of interest at its initial level alongwith a further increase in $y$.




Here, due to consecutive implementation of expansionary fiscal policy and expaiisionary monetary policy, rate of interest initially increases from $r_0$ to $r_1$ and then declines upto its initial level $r_0$ with an increase in income from $y_0$ to $y_1$ and then from $y_1$ to $y_2$.

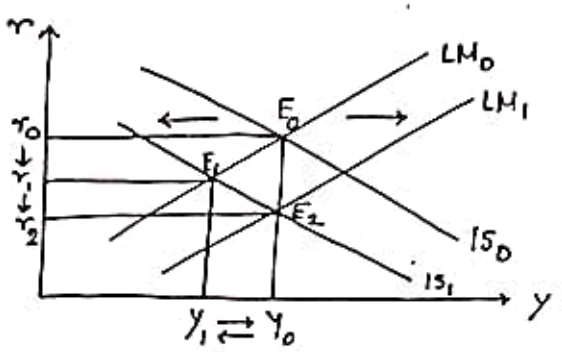
## (2) To keep $y$ constant

a) Let us consider a contractionary monetary policy is adopted for which $r$ increases and $y$ declines. Now, to keep $y$ constant at its initial level, the govt. will adopt an accomodative expansionary fiscal policy for which $y$ will come back to its initial level but $r$ will further increase.




Here, consecutive implementation of contractionary monetary and expansionary fiscal policy results in a fall in $y$ initially from $y_0$ to $y_1$ but further it increases upto the initial level $y_0$. In case of interest rate, initially it increases from $r_0$ to $r_1$ and further it increases from $r_1$ to $r_2$.

b) let us consider that the Govt. implements a contractionary fiscal policy for which r and y both decline. Now, to keep y at its initial level, the govt. will further implement an expansionary monetary policy for which y will increase upto its initial level but interest will further decline.




Here, consecutive implementation of contractionary monetary and expansionary fiscal policy results in a fall in y initially from $Y_0$ to $Y_1$ but further it increases upto the initial level $Y_0$. In case of interest rate, initially it increases from $r_0$ to $r_1$ and further increases from $r_1$ to $r_2$.