MULTIPLIER

The Concept of Investment Multiplier:

The theory of multiplier occupies an important place in the modern theory of income and employment.

The concept of multiplier was first of all developed by F.A. Kahn in the early 1930s. But Keynes later further refined it. F.A. Kahn developed the concept of multiplier with reference to the increase in employment, direct as well as indirect, as a result of initial increase in investment and employment.

Keynes, however, propounded the concept of multiplier with reference to the increase in total income, direct as well as indirect, as a result of original increase in investment and income.

Therefore, whereas Kahn's multiplier is known as 'employment multiplier', Keynes' multiplier is known as investment or income multiplier. The essence of multiplier is that total increase in income, output or employment is manifold the original increase in investment. For example, if investment equal to Rs. 100 crores is made, then the income will not rise by Rs. 100 crores only but a multiple of it.

If as a result of the investment of Rs. 100 crores, the national income increases by Rs. 300 crores, multiplier is equal to 3. If as a result of investment of Rs. 100 crores, total national income increases by Rs. 400 crores, multiplier is 4. The multiplier is, therefore, the ratio of increment in income to the increment in investment. If ΔI stands for increment in investment and ΔY stands for the resultant increase in income, then multiplier is equal to the ratio of increment in income (ΔK) to the increment in investment (ΔI).

Therefore $k = \Delta Y/\Delta I$ where k stands for multiplier.

Now, the question is why the increase in income is many times more than the initial increase in investment. It is easy to explain this. Suppose Government undertakes investment expenditure equal to Rs. 100 crores on some public works, say, the construction of rural roads. For this Government will pay wages to the labourers engaged, prices for the materials to the suppliers and remunerations to other factors who make contribution to the work of road-building.

The total cost will amount to Rs. 100 crores. This will increase incomes of the people equal to Rs. 100 crores. But this is not all. The people who receive Rs. 100 crores will spend a good part of them on consumer goods. Suppose marginal propensity to consume of the people is 4/5 or 80%.

Then out of Rs. 100 crores they will spend Rs. 80 crores on consumer goods, which would increase incomes of those people who supply consumer goods equal to Rs. 80 crores. But those who receive these Rs. 80 crores will also in turn spend these incomes, depending upon their marginal propensity to consume. If their marginal propensity to consume is also 4/5, then they will spend Rs. 64 crores on consumer goods. Thus, this will further increase incomes of some other people equal to Rs. 64 crores.

In this way, the chain of consumption expenditure would continue and the income of the people will go on increasing. But every additional increase in income will be progressively less since a part of the income received will be saved. Thus, we see that the income will not increase by only Rs. 100 crores, which was initially invested in the construction of roads, but by many times more.

Derivation of Investment Multiplier:

How much increase in national income will take place as a result of an initial increase in investment can be expressed in the following mathematical form:

Increase in income Or $\Delta Y = 100 + 100 \times 4/5 + 100(4/5)^2 + 100(4/5)^3 + 100(4/5)^4 \ldots$

$= 100[1 + (4/5) + (4/5)^2 + (4/5)^3 + (4/5)^4 \ldots]$

But the above series is one of geometric progression. Therefore, increase in income,

$$(\Delta Y) = 100 \frac{1}{1-4/5} \quad \ldots(i)$$

$$= 100 \times \frac{1}{1/5}$$

$$= 100 \times 5$$

$$= 500$$

It is thus clear that if the marginal propensity to consume is 4/5, the investment of Rs. 100 crores leads to the increase in the national income by Rs.500 crores. Therefore, multiplier here is equal to 5. We can express this in a general formula.

If ΔY stands for increase in income, Δl stands for increase in investment and MPC for marginal propensity to consume, we can write the equation (i) above as follows:

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

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

$\frac{\Delta Y}{\Delta I}$ measures the size of the multiplier. Therefore,

$$\text{Size of multiplier or } k = \frac{1}{1 - MPC} \quad \ldots(ii)$$

It is clear from above that the size of multiplier depends upon the marginal propensity to consume of the community. The multiplier is the reciprocal of one minus marginal propensity to consume. However, we can express multiplier in a simpler form. As we know that saving is equal to income minus consumption, one minus marginal propensity to consume will be equal to marginal propensity to save, that is, 1 – MPC = MPS. Therefore, multiplier is equal to 1/ 1- MPC =1/MPC.

Algebraic Derivation of Multiplier:

The multiplier can be derived algebraically as follows:

Writing the equation for the equilibrium level of income we have

$Y = C + I$ ... (1)

As in the multiplier analysis we are concerned with changes in income induced by changes in investment, rewriting the equation (1) in terms of changes in the variables we have

$\Delta Y = \Delta C + \Delta I$ ... (2)

In the simple Keynesian model of income determination, change in investment is considered to be autonomous or independent of changes in income while changes in consumption are function of changes in income.

In the consumption function,

$C = a + bY$

where a is a constant term, b is marginal propensity to consume which is also assumed to remain constant. Therefore, change in consumption can occur only if there is change in income. Thus

$$\Delta C = b\Delta Y \quad \ldots(3)$$

Substituting (3) into (2) we have

$$\Delta Y = b\Delta Y + \Delta I$$

$$\Delta Y - b\Delta Y = \Delta I$$

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

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

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

As b stands for marginal propensity to consume,

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1 - MPC} = \frac{1}{MPS}$$

This is the same formula of multiplier as obtained earlier. Note that the value of multiplier ΔY/ΔI will remain constant as long as marginal propensity to consume remains the same.

The Size or Value of Investment Multiplier:

The multiplier tells us how much increase in income occurs when autonomous investment increases by Rs. 1, that is, investment multiplier ΔY/ΔI is and its value is equal to 1/1-b where b stands for marginal propensity to consume (MPC). Thus, multiplier =ΔY/ΔI =1/ 1-b equals marginal propensity to save (MPS) the value of investment multiplier is equal to 1/1-b = 1/s where s stands for marginal propensity to save. In other words, the size of multiplier is equal to 1/1- MPC = 1/MPC Thus, the value of multiplier can be obtained if we know either the value of MPS or MPS.

Now, higher the marginal propensity to consume (b) (or the lower the value of marginal propensity to save (s), the greater the value of multiplier. For example, if marginal propensity to consume (b) is 0.8, investment multiplier is

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1-08} = \frac{1}{0.2} = 1 \times \frac{10}{2} = 5$$

If MPC or $b = 0.75$, multiplier is

$$= \frac{\Delta Y}{\Delta I} = \frac{1}{1-0.75} = \frac{1}{0.25} = \frac{100}{25} = 4$$

As mentioned above, the size or value of multiplier can be calculated using either the value of marginal propensity to consume (MPC) or the value of marginal property to save (MPS or s). In fact, the value of multiplier is the reciprocal of marginal propensity to save (ΔY/ΔI = 1/MPS or 1/s) When marginal propensity to consume is 0.8, marginal propensity to save will be 1 – 0.8 = 0.2.

The multiplier will be 1/0.2 or 1/2/10 = Likewise if marginal propensity to consume (b) is 0.75, marginal propensity to save will be 1 – 0.75 = 0.25 and multiplier will be 1/0.25 = 1/25/100 = 4.

Given the size of multiplier we can find out the increase in income (ΔY) resulting from a certain increase in investment (ΔI) by using the multiplier relationship. Thus

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

$$\Delta Y = \Delta I . \frac{1}{1-b}$$

If marginal propensity to consume is equal to 0.8, with the increase in investment by ₹ 100 crores the increase in income will be:

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

$$\Delta Y = \Delta I \times \frac{1}{1-b} = 100 \times \frac{1}{1-0.8}$$

$$100 \times \frac{1}{0.2} = 100 \times 5 = 500$$

Two Limiting Cases of the Value of Multiplier:

There are two limiting cases of the multiplier. One limiting case occurs when the marginal propensity to consume is equal to one, that is, when the whole of the increment in income is consumed and nothing is saved.

In this case, the size of multiplier will be equal to infinity, that is, a small increase in investment will bring about a very large increase in income and employment so that full employment is reached and even the process goes beyond that. "In such circumstances, the Government would need to employ only one road builder to raise income indefinitely, causing first full employment and then a limitless spiral of inflation."

However, this is unlikely to occur since marginal propensity to consume in the real world is less than one. The other limiting case occurs when marginal propensity to consume is equal to zero, that is, when nothing out of the increment in income is consumed, and the whole increment in income is saved.

In this case, the value of the multiplier will be equal to one. That is, in this case, the increment in income will be equal to the original increase in investment and

not a multiple of it. But in actual practice the marginal propensity to consume is less than one but more than zero ($1 > \Delta C/\Delta Y > 0$).

Working of Multiplier and its Assumptions:

In our above explanation of multiplier, we have made many simplifying assumptions. First, we have assumed that the marginal propensity to consume remains constant throughout as the income increases in various rounds of consumption expenditure. However, the marginal propensity to consume may differ in various rounds of consumption expenditure.

But this constancy of marginal propensity to consume is a realistic assumption, since all available empirical evidence shows that marginal propensity to consume is very stable in the short run. Secondly, we have assumed that there is a net increase in investment in a period and no further indirect effects on investment in that period occur or if they occur they have been taken into account so that there is a given net increase in investment.

Further, we have assumed that there is no any time-lag between the increase in investment and the resultant increment in income. That is, increment in income takes place instantaneously as a result of increment in investment. J.M. Keynes ignored the time-lag in the process of income generation and therefore his multiplier is also called instantaneous multiplier. In recent years, the importance of time-lag has been recognized and concept of dynamic multiplier has been developed on that basis.

Another important assumption in the theory of multiplier is that excess capacity exists in the consumer goods industries so that when the demand for them increases, more amounts of consumer goods can be produced to meet this demand. If there is no excess capacity in consumer goods industries, the increase in demand as a result of some original increase in investment will bring about rise in prices rather than increases in real income, output and employment.

As we shall see later, Keynes' multiplier was evolved in the context of advanced capitalist economies which were in grip of depression and in times of depression and there did exist excess capacity in the consumer goods industries due to lack of aggregate demand. The Keynesian multiplier effect is very small in developing countries like India since there is not much excess capacity in consumer goods industries.

In our above analysis of the multiplier process we have taken a closed economy, that is, we have not taken into account imports and exports. If ours were an open economy, then a part of the increment in consumption expenditure would have been made on imports of goods from abroad.

This would have caused increment in income in foreign countries rather than within the country. This will reduce the value of the multiplier. Imports are important leakage from the multiplier process and we have ignored them in our above analysis for the purpose of simplicity.

It is worth noting that multiplier not only works in money terms but also in real terms. In other words, multiple increment in income as a result of a given net increase in investment does not only take place in money terms but also in terms of real output, that is, in terms of goods and services.

When incomes increase as a result of investment and these increments in income are spent on consumer goods, the output of consumer goods is increased to meet the extra demand brought about by increased incomes. Therefore, real income or output increases by the same amount as the increment in money incomes, since the prices of goods have been assumed to be constant.

Of course, we have assumed, that there exists excess productive capacity in the consumer goods industries so that when the demand for consumer goods increases, their production can be easily increased to meet this demand. However, if due to some bottlenecks output of goods cannot be increased in response to increasing demand, prices will rise and as a result the real multiplier effect will be small.

Diagrammatic Representation of Multiplier:

The level of national income is determined by the equilibrium between aggregate demand and aggregate supply. In other words, the level of national income is fixed at the level where C + I curve intersects the 45° income curve. With such a diagram we can explain the multiplier.

The multiplier is illustrated in Fig. 9.1. In this figure C represents marginal propensity to consume. Marginal propensity to consume has been here assumed to be equal to 1/2 i.e., 0.5. Therefore, the slope of the curve C of marginal propensity to consume curve C has been taken to be equal to 0.5. C + I represents aggregate demand curve.

It will be seen from Fig. 9.1 that the aggregate demand curve C + I which intersects the 45° line at point E so that the level of income equal to OF, is determined. If investment increases by the amount EH we can then find out how much increment in income occur as a result of this. As a consequence of increase in investment by EH, the aggregate demand curve shifted upward to the new position C + I'.

This new aggregate demand curve C + I intersects income line at point F so that the equilibrium level of income increases to OF As a result of net increase in investment equal to EH. the income has increased by Y_1Y_2It is seen from the figure that F, Y_2 is greater than EH. On measuring it will be found that Y_1 Y_2 is twice the length of EH. This is as it is expected because the market propensity to consume is here equal to and 1/2 therefore the size of multiplier will be equal to 2.

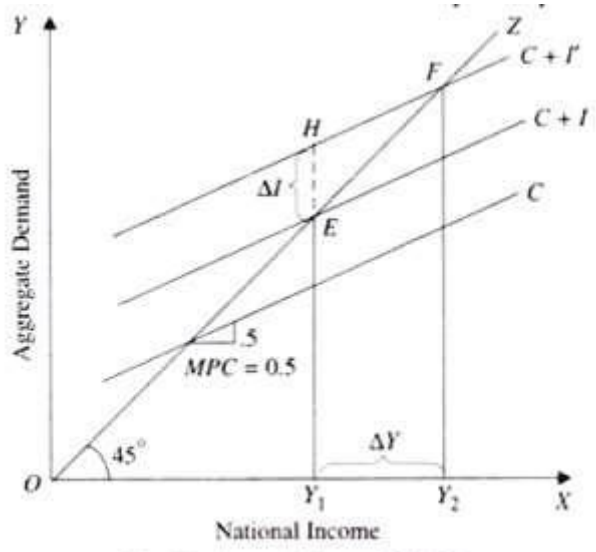

Fig. 9.1. *Keynes's Income Multiplier*

The multiplier can be illustrated through savings investment diagram also. The multiplier can be explained with the help of savings investment diagram, as has been shown in Fig. 10.2. In this figure SS is the saving curve indicating that as the level of income increases, the community plans to save more. II is the investment curve showing the level of investment planned to be undertaken by the investors in the community. The investment has been taken to be a constant amount and autonomous of changes in income.

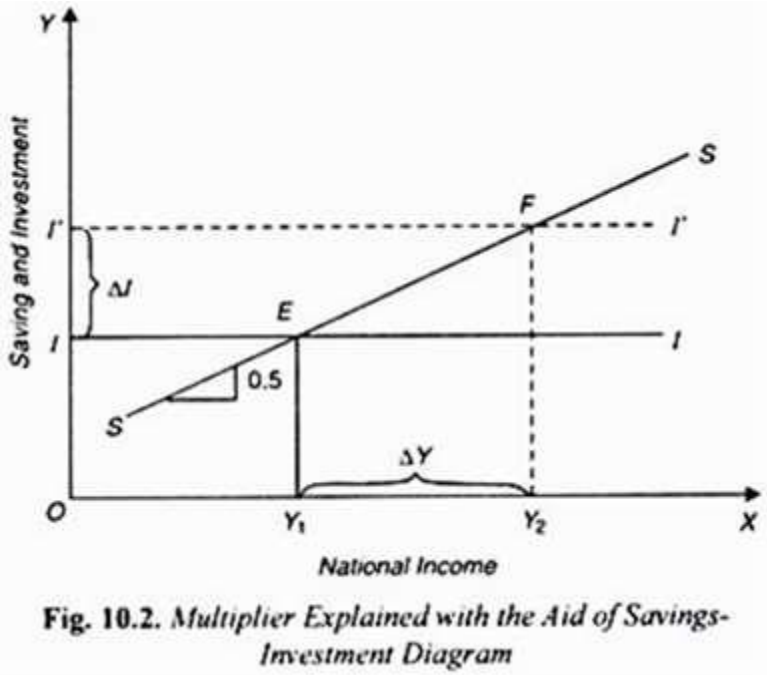

Fig. 10.2. *Multiplier Explained with the Aid of Savings-Investment Diagram*

This investment level OI has been determined by the marginal efficiency of capital and the rate of interest. Investment being autonomous of income means that it does not change with the level of income. Keynes treated investment as autonomous of income and we will here follow him. It will be seen from Fig. 10.2 that saving and investment curves intersect at point E, that is, planned saving and planned investment are in equilibrium at the level of income OY_1Thus, with the given saving and investment curves level of income equal to OY_1 is determined.

Now suppose that there is an increase in investment by the amount II". With this increase in investment, the investment curve shifts to the new dotted position TF. This new investment curve II intersects the saving curve at point F and a new equilibrium is reached at the level of income OY_2 A glance at Fig. 10.2 will reveal that the increase in income Y_1 Y_2 is greater than the increase in investment by II". On measuring these increments in income and investment it will be found that the increment in income Y_1 Y_2 is two times the increment in investment II. This is because we have here assumed that propensity to save is equal to 1/2 (Or marginal propensity to consume is equal to 1/2) Therefore, the slope of the saving curve has been taken to be equal to 1/2 or 0.5 Thus in this case multiplier is equal to 2.

Multiplier = $\Delta Y/\Delta I = Y_1 Y_2/II$, 1/MPS =2

Since marginal propensity to save is here equal to1/2 the multiplier on the basis of our above formula, namely, k =1/ MPS will be equal to 2.

Leakages in the Multiplier Process:

We have seen above that as a result of increase in investment, the level of income increases by a multiple of it. In our above analysis, saving is a leakage in the multiplier process. Had there been no saving and as a result marginal propensity to consume were equal to 1, the multiplier would have been equal to infinity.

In that case as a result of some initial increase in investment, income would go on rising indefinitely. Since marginal propensity to consume is actually less than one, some saving does take place. Therefore, multiplier in actual practice is less than infinity.

But besides saving, there are other leakages in the process of income generation which reduce the size of the multiplier. Therefore, the increase in income as a result of some increase in investment will be less than warranted by the size of the multiplier measured by the given marginal propensity to consume. We explain below the various leakages that occur in the income stream and reduce the size of multiplier in the real world.

Paying off debts:
The first leakage in the multiplier process occurs in the form of payment of debts by the people, especially by businessmen. In the real world, all income received by the people as a result of some increase in investment is not consumed. A part of the increment in income is used for paying back the debts which the people have taken from moneylenders, banks or other financial institutions.

The incomes used for paying back the debts do not get spent on consumer goods and services and therefore leak away from the income stream. This reduces the size of the multiplier. Of course, when incomes received by the moneylenders, banks or institutions are again lent back to the people, they come back to the income stream and enhance the size of multiplier. But this may or may not happen.

Holding of idle cash balances:
If the people hold apart of their increment in income as idle cash balances and do not use it for consumption, they also constitute leakage in the multiplier process. As we have seen, people keep part of their income for satisfying their precautionary and speculative motives, money kept for such purposes is not consumed and therefore does not appear in the successive rounds of consumption expenditure and therefore reduces the increments in total income and output.

Imports:

In our above analysis of the working of the multiplier process we have taken the example of a closed economy, that is, an economy with no foreign trade. If it is an open economy as is usually the case, then a part of increment in income will also be spent on the imports of consumer goods. The proportion of increments in income spent on the imports of consumer goods will generate income in other countries and will not help in raising income and output in the domestic economy.

Therefore, imports constitute another important leakage in the multiplier process. Suppose marginal propensity to save of an open economy is 1/4, i.e., marginal propensity to consume is 3/4. Suppose further that marginal propensity to import is 1/4 , the size of the multiplier without imports will be equal 4 to equal to 4 but the size of the multiplier with the marginal propensity to import equal to 1/4 and the marginal propensity to consume equal to 3/4 will be smaller.

Multiplier in an Open Economy = 1/ 1 -(MPC-MPI) = 1/1 – MPC + MPI

where MPC stands for marginal propensity to consume and MPI for marginal propensity to import.

In our example quoted above, where marginal propensity to consume is equal to 3/4 and marginal 3/4 propensity to import is equal to 1/4, the multiplier is:

K = 1/1- (3/4 – 1/4) = 1/1/2 =2

We, therefore, see that the size of multiplier instead of being equal to 4, as it would have been in the case of a closed economy, is equal to 2 in the open economy with — as the marginal propensity to import.

Taxation:
Taxation is another important leakage in the multiplier process. The increments in income which the people receive as a result of increase in investment are also in part used for payment of taxes. Therefore, the money used for payment of taxes does not appear in the successive rounds of consumption expenditure in the multiplier process, and the multiplier is reduced to that extent.

However, if the money raised through taxation is spent by the Government, the leakage through taxation will be offset by the increase in Government expenditure. But it is not necessary that all the money raised through taxation is spent by the Government as it happens when Government makes a surplus budget.

No doubt, if the Government expenditure increases by an amount equal to the taxation, it would not have any adverse effect on the increases in income and investment and in this way there would be no leakage in the multiplier process.

Increase in Prices:
Price inflation constitutes another important leakage in the working of the multiplier process in real terms. The multiplier works in real terms only when as a result of increase in money income and aggregate demand, output of consumer goods is also increased.

When output of consumer goods cannot be easily increased, a part of the increases in the money income and aggregate demand raises prices of the goods rather than their output. Therefore, the multiplier is reduced to the extent of price inflation. In developing countries like India the extra incomes and demand are mostly spent on food-grains whose output cannot be increased so easily.

Therefore, the increments in demand raise the prices of goods to a greater extent than the increase in their output. Besides, in developing countries like India, there is not much excess capacity in many consumer goods industries, especially in agriculture and other wage-goods industries.

Therefore, when income and demand increase as a result of increase in investment, it generally raises the prices of these goods rather than their output and therefore weakens the working of the multiplier in real terms. Thus, it was often asserted in the past that Keynesian theory of multiplier was not very much relevant to the conditions of developing countries like India. However, we shall discuss later that this old view about the working of Keynes' multiplier is not fully correct.

The above various leakages reduce the multiplier effect of the investment undertaken. If these leakages are plugged, the effect of change in investment on income and employment would be greater.

Problem 1:
Suppose the level of autonomous investment in an economy is Rs. 200 crores and consumption function of the economy is:
$C = 80 + 0.75Y$

(a) What will be the equilibrium level of income?

(b) What will be the increase in national income if investment increases by Rs. 25 crores.

Problem 2:
Suppose in a country investment increases by Rs. 100 crore and consumption is given by C = 10 + 0.6Y (where C = consumption and Y = income). How much increase will there take place in income?