# Consumption and Investments as Determination of Aggregate Demand

# 3

**Unit highlights:**

- ⇒ **Relationship between income and consumption**
- ⇒ **MPc, APc**
- ⇒ **Life-cycle hypothesis**
- ⇒ **Permanent income hypothesis**
- ⇒ **Non-income determinants of consumption**
- ⇒ **Salient features of investment**
- ⇒ **Descounting and present value of**

## Lesson 1: Consumer Spending and Income are closely related

**Lesson objectives:**

After studying this lesson, you will be able to

- see why understanding consumer behavior is important for shortrun stabilization as well as for long run growth.
- understand why high-income families on the average save more than low-income families.
- see what MPC and MPS measure and how they are related to each other.
- interpret the saving function in relation to the consumption function.

## Lesson 1: Consumer Spending and Income are closely related

*Studying the determinants of consumer spending is important for short run stabilization*

Macroeconomics is a policy science. One kind of policy has to do with short-run stabilization i.e. to keep the national output and employment as close as possible to their potential levels. The system of national income accounts provides us with the data necessary to see whether and how far the national product has deviated from the potential (full employment) output in particular years. Having seen what has happened, the task of theory is to provide an explanation so that appropriate policies may be initiated wherever necessary. Where to look for an explanation? The natural starting point would be to look at the GDP identity from the expenditure side.

$$GDP = C + I + G + NX$$

*How income is divided between consumption and saving is important for long term growth*

There are four component on the right-hand side of the above identity, representing together the aggregated demand for GDP produced in a given period. Now it is easy to imagine that change in aggregate demand will definitely have something to do with changes in output and employment. If we want to understand why the GDP tends to fluctuate about its potential level, we must analyze the behavior of consumers (for c), investors (for I), government (for G) and foreigners (for NX). Of these four, the consumers behavior is by far the most important, because consumption spending accounts for a very sizeable proportion of total expenditures (about 66% for US in the 1990's).

Studying consumer behavior is also important from the longrun macroeconomic perspective. As we know already, in the long run, the macroeconomic concern is that of achieving decent rates of economic growth to ensure rising standards of living. The long run growth prospects fundamentally depend on how the current national output is devided between consumption and investment. Countries (like

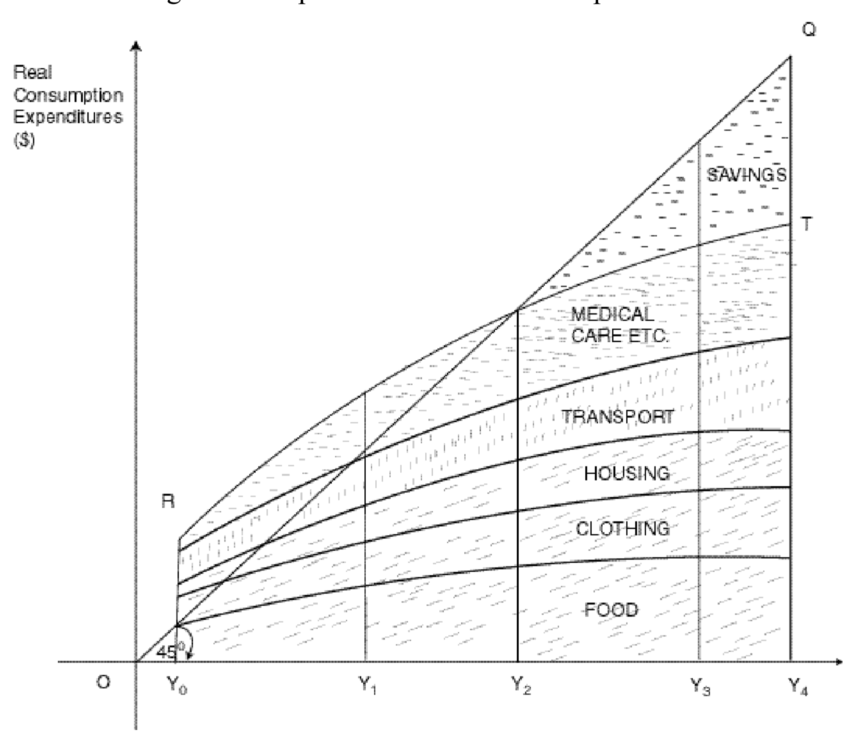
Japan, Korea, Honkong) which save and invest a larger proportion of current output have achieve higher rate of growth than those (like USA and UK) which save and invest a smaller proportion of their current output.

**Income and consumption at the household level**

What factors determine the level of consumer spending? There is a close and powerful relationship between aggregate real consumption and aggregate real disposable income. To understand why it is useful to look at the question at the micro-level to start with. We want to know how households on the average respond to changes in their disposable incomes. Without much risk of error, we can assert that no two families spend their disposable incomes in exactly the same way. Family budget studies, however, suggest a remarkably stable pattern in the allocation of family expenditures among food, clothing and other major items. A picture of this pattern is provided in Fig. 3-1. Two things may be noted about the income consumption relationship.

The first relates to the proportion of income spent on basic necessities. This declines progressively as average household income goes up. The other is the behavior of savings as incomes vary. To continue with the first, we see that low-income families limit their spending mostly to necessities of life- food, clothing and shelter. Despite this, the incomes of the poorer families often are not.

Fig 3-1: Composition of Household Expenditures




Real Disposable Income of the Average Family ($)

sufficient to make the necessary purchases. For instance, families with an average income of less than $Y_2$ spend more than their incomes. This can be measured by the vertical distance between the total consumption line RT and the 45 line OQ (also called the zero saving line for obvious reasons). Living beyond current income is made possible by borrowing, or drawing on past savings, especially by poor, older people who tend to sell-off their assets accumulated during their working lives to finance consumption in the old age.

*(Average family expenditure on basic necessities declines as income rises. Low income families usually dissave)*

As the average family income rises, the amount of dissavings declines. The break-even point comes at an income of $Y_2$. Beyond this income level, families spend less their incomes and build up savings. This kind of relationship-lower-income people dissaving and higher income people saving; the proportion of income devoted to basic necessities declining as income goes up - is something we expect from microeconomic theory where the relationship is know as the Engel curve. It shows how expenditure on a good changes as income rises, but the price remains unchanged. The RT curve in Fig 3-1 is nothing but this relationship obtained from family budget studies which can observe household consumption at a point in time when most people face the same price.

**Income and Consumption at National level**

In the previous section, we have been talking about consumption behaviour of average families at different levels of income. We must now address the relationship at the aggregate level for the country as a whole. The relationship that we have found to be true at the family level can be aggregated to yield a similar relationship at the macro level under certain simplifying assumptions. But we will not pursue this methodological point here.

*Aggregate real consumption depends on aggregate real disposable income*

J.M. keynes put a great deal of emphasis on the relationship between aggregate real consumption and aggregate real disposable income in his theory of employment and output. He posited that consumption expenditures vary directly with disposable income. This relationship is known as the Consumption Function. It shows how aggregate real consumption varies as aggregate real disposable income varies, other things remaining constant. The mere assertion that such a relationship exists is not very helpful. More should be, and has been, said about the relationship. For this, we have first to define two characteristics of the relationship.

### 1. The Marginal Propensity to Consume (MPC)

It is defined as the ratio of change in consumption to the change in income which caused it. Symbolically, it can be expressed as

$$MPC = \frac{\Delta C}{\Delta Y_d}$$

*MPC shows the proportion of additional income consumed*

where ΔC denotes change in real consumption and ΔY change in real disposable income. For example, if MPC = 0.8, we can say that the consumers spend 80% of their additional income for consumption. Since the relationship between C and $Y_d$ is assumed to be direct, ΔC and $\Delta Y_d$ both move in the same direction (rising or falling together). Therefore, the marginal propensity to consume, showing the proportion of additional income spent for consumption, is positive.

### 2. The Average Propensity to Consume (APC)

It is the ratio of real consumption (C) at a given level of real disposable income (Yd) to that income level. In symbols,

$$APC = \frac{C}{\Delta Y_d}$$

From APC we know what percentage of the real disposable income is spent for consumption, for example, if APC = 0.70 we can say that 70% of the income is devoted to consumption.

*APC measures the proportion of income consumed*

With respect to these two characteristics, the followings points have often been asserted, especially by Keynes:

a) The marginal propensity to consume (MPC) is positive but less than unity (ie o<MPC<1)

b) The MPC is less than APC, implying that APC declines as income rises.

*Two propositions about consumption function*

These two features of the consumption function have been illustrated with hypothetical figures given in Table 3-1. The relationship can be expressed algebraically as

$$C = 100 + 0.8Yd$$

For the data given in Table 3-1, the MPC is positive but less than unity (= 0.8) and has been assumed constant at all income levels. The APC declines as income rises. Also the MPC < APC at all income levels.

**Table 3-1: Consumption-Income and Savings-Income**
Relationship (Constant Prices; billions of dollars)

| Income ($Y_d$) | Consumption (C) | MPC $=\Delta C/\Delta Y_d$ | APC=C/$Y_d$ | Saving $S=Y_d-C$ | MPS $=\frac{\Delta S}{\Delta Y_d}$ =1-MPC |
|---|---|---|---|---|---|
| 500 | 500 | | 1.00 | 0 | |
| | | 0.8 | | | 0.2 |
| 600 | 580 | | 0.97 | 20 | |
| | | 0.8 | | | 0.2 |
| 700 | 660 | | 0.94 | 40 | |
| | | 0.8 | | | 0.2 |
| 800 | 740 | | 0.93 | 60 | |
| | | 0.8 | | | 0.2 |
| 900 | 820 | | 0.91 | 80 | |
| | | 0.8 | | | 0.2 |
| 1000 | 900 | | 0.90 | 100 | |
| | | 0.8 | | | 0.2 |
| 1100 | 980 | | 0.98 | 120 | |

From the algebraic relationship C= 100 + 0.8 $Y_d$, the MPC can be read off as the co-efficient of $Y_d$. The same is not true of APC. For APC we can write

$$\frac{C}{Y_d} = \frac{100}{Y_d} + \frac{0.8Y}{Y_d}$$

$$\text{or, APC} = 0.8 + \frac{100}{Y_d}$$

which shows that APC declines as $Y_d$ rises, as we should expect. It also shows that for $Y_d$>o, MPC(=0.8) is less than APC.

**Income - Consumption Relationship Graphically**

A graphical representation of the consumption income relationship typical of the one shown in Table 3-1 is given in Fig 3-1(a). As drawn, the slope of the consumption function is positive, but less than one. We know this from the fact that the consumption function KM has a positive vertical intercept of OK (=100). The slope measures the marginal propensity to consume (MPC), while the intercept shows what is known as autonomous consumption.

*(Graphically, the slope of the consumption function represents MPC, white the vertical intercept shows the autonomous consumption)*

The reason for calling it autonomous is that this component of total consumption has nothing to do with income. When Yd = o, c = OK =100. This amounts to the dissaving by the nation as a whole. Geometrically, the APC can be calculated easily. Take any point such as G on the consumption function and join it to the origin O. The slope of line OG is $GY_O/OY_O$ which is nothing but APC by definition (at income level, Yo). In this way, we can calculate APC geometrically for any level of income. At income level Yo, APC = 1 (become OYo = GYo). A little reflection will show that as income rises above Yo, APC declines, while as income falls from Yo, APC rises. But overall,

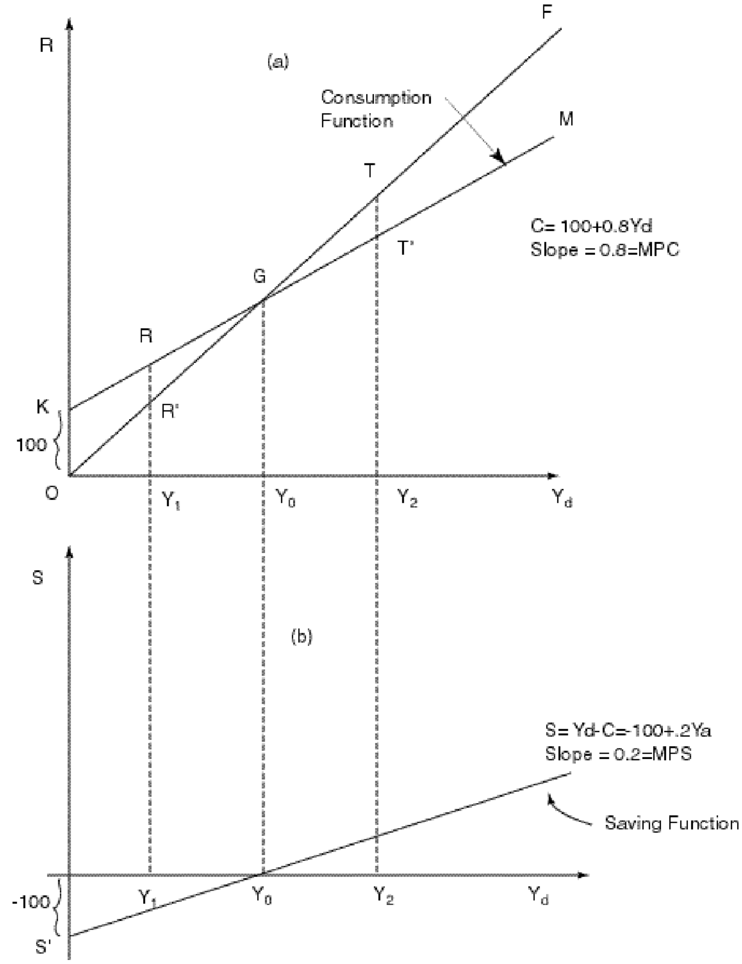



Fig 3-2: Graphical Representation of Consumption & saving Functions

Note: Yd = Real Disposable Income

C = Real Consumption

S = Real Saving

it remains true that APC declines with rising income.

The $45^o$ line (or the zero - saving line) in Fig 3-(a) helps us to read off the amount of saving at each level of income visually. For example, by construction $OY_2$ = $T'Y_2$, and consumption at income $OY_2$ is $T'Y_2$. Therefore, saving at this level of income is $OY_2$ - T'Y2 = $TY_2$ - $T'Y_2$ = TT', which we can see straightway from the diagram. The consumption line KM intersects the $45^0$ line (OF) at point G. This implies that at income $Y_o$, $Y_d$ = C, so that saving (S) is zero, To the left of

G, the consumption line is above the zero saving line (OF) and, therefore, the saving is negative. To the right of G, the consumption line is below OF, implying positive savings. Or, stated differently, for Y>Yo, S is positive, for Y = Yo, S = O and for Y< Yo, S is negative.

### The Saving Function

By definition, saving equals income minus consumption (as shown in Table 3-1). Consumption depends on income; saving is whatever is left of income after consumption. Thus saving is also a function of income. Obviously, the two functions are not independent because

*( The saving function shows how saving varies with income)*

$$Y = C + S$$

where S = saving out of Y. Two features of the saving function may be noted. **First**, it is an increasing function of income: at higher incomes more savings will be forthcoming. **Second**, its slope, representing the marginal propensity to save (MPS), is positive and less than unity. The slope of the consumption function (MPC) and the slope of the saving function (MPS) are clearly related.

Since any increase (or decrease) in income can be used for consumption and saving, we have

$$\Delta Y = \Delta C + \Delta S$$

or, $$\frac{\Delta Y}{\Delta Y} = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

or, $$\frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y} = 1$$

or, $$MPC + MPS = 1$$

or, $$MPS = 1 - MPC$$

In Fig 3-2(b) the saving function (SS') corresponds to the consumption function KM in Fig 3-2 (a). The slope of the saving function is 0.2 because the slope of the saving function is 0.8. As we have seen earlier, if

*MPC and MPS are interrelated*

$$Y_d > Y_o,\ S > O$$

$$Y_d = Y_o,\ S = O$$

$$Y_d < Y_o,\ S < O$$

When these features incorporated, the saving function must cross the horizontal axis ($Y_d$) at $Y_d$ = Yo, lie above it for $Y_d > Y_o$, and below it for $Y_d < Y_o$.

**Questions for review**

**MCQ'S (Tick the correct/Most nearly correct answer)**

1. Suppose autonomous consumption increases. What effect will this have on the saving function?
   A. The savings function shifts upward parallel to itself
   B. The saving function shifts downward parallel to itself
   C. The slope of the saving function increases
   D. The saving function is not affected at all.
2. Suppose the MPC rises at all levels of income, but the autonomous consumption remains unchanged. How will the saving function be affected by this?
   A. It is unaffected.
   B. The marginal propensity to save (MPS) declines
   C. The marginal propensity to save (MPS) increases
   D. The saving function shifts to the right.
3. If the consumption function becomes flatter, what will be its effect on the marginal propensity to save (MPS)?
   A. MPS will fall
   B. MPS will rise
   C. MPC will remain unchanged
   D. None of the above
4. The saving function associated with the consumption function $C = 50 + 0.90\ Y_d$ is
   A. $S = -50 + 0.2\ Yd$
   B. $S = -50 + 0.1\ Yd$
   C. $S = 0.1\ Yd$
   D. $S = 150 - 0.9\ Yd$
5. If the consumption function is a straight-line through the origin, then MPC is
   A. less than APC
   B. Greater than APC
   C. Equal to APC
   D. None of the above.
6. Suppose that $APC = 0.8 = \frac{100}{Yd}$ . As Yd rises, we should expect APC to
   A. rise
   B. fall
   C. remain constant
   d. equal MPC
7. If APC = 1, the proportion of income spent for consumption is
   A. 80%
   B. 10%

C. 100%
D. 110%

**Short Questions**

1. Define MPC and APC. If the consumption function can be written as $C = Co + c\ Yd$, where $Co > o$ and $o < c < 1$, how is APC related to MPC?
2. Define MPS, what does it measure? How is it related to MPC?
3. What is autonomous consumption? Why is it positive?
4. What happens to the consumption function if MPC rises at all income levels, but the autonomous consumption is unchanged. Use diagram for your answer.
5. With respect to question No. 4 above, how is the slope of the saving function affected? Use diagram for your answer.
6. Explain the meaning of consumption function and the basic ideas underlying its formulation.

   E. Explain how the consumption and saving functions are interrelated.

**Questions**

1. Explain why understanding the determinants of consumer spending is important for shortrun as well as long run macroeconomic policy.
2. What kind of income consumption relationship have the family budget studies discovered? Explain.
3. Why is aggregate real disposable income singled out as a primary determinant of aggregate real consumption? Discuss.

**Answer (MCQ'S)**

1. B, 2. B, 3. B, 4. B, 5. C, 6. B, 7. C

## Lesson 2: Modern Theories of Consumer Behavior: The Life-Cycle and Permanent Income Hypotheses

### Lesson Objectives:

After studying this lesson, you will be able to

- See what empirical evidence says about the form of the consumption function;
- Understand why current income is not a very good determinant of consumption;
- appreciate why wealth can have an independent influence on consumption
- Understand how the modern theories have managed to reconcile the apparently contradictory empirical findings.

### Modern Theories of Consumer Behavior: The Life-Cycle and Permanent Income Hypotheses

### Introduction

*Keynesian consumption function is not based on sound empirical evidence*

The theory of consumption function presented in Lesson 1 of this unit is basically Keynesian in content and flavour. The assertion that MPC is positive and less than unity, while MPC < APC seem intuitively plausible. However, no convincing evidence was advanced in support of these conclusions. Keynes referred to bits and pieces of statistical evidence in his discussion of the consumption function. Never the less his hypothesis is mostly based on what he called "fundamental psychological law".

He was shaky even on this ground. He failed to provide detailed a priori arguments which would lead logically to the income- consumption relationship that he postulated. You may recall the budget studies referred to in Lesson 1, which tend to give support to the Keynesian position. But these studies can hardly provide any strong evidence. There are serious methodological problems of transferring the relationship based on household studies to a relationship that could be said to be valid at the aggregate level.

*Later studies reveal contradictory evidence*

Later, especially in the post war period, attempts have been made to carefully estimate the income consumption relationship empirically from aggregate time series data. The results have puzzled the economists, because they were apparently contradictory. One type of evidence suggests that the relationship is non-proportional (MPC<APC), as Keynes suggested. This evidence is based on short time series data. The second type of evidence provided by Simon Kuznets on the

basis of long time series data shows that the relationship is proportional (MPC = APC). The challenge before theorists is to reconcile the apparently contradictory findings: why does the relationship appear to be non-proportional in the short run? Why is it proportional in the long run? Is one type of relationship correct while the other is wrong? Modern theories of consumption-the Life Cycle Theory and the Permanent Income Theory are attempts at this reconciliation. The key point here is that wealth and permanent income play their roles in influencing consumption behaviour in addition to current income.

**The Life Cycle Theory of Consumption and Saving**

The Keynesian (or Keynesian type) consumption function is based on the idea that consumption in a period is related to income of that period. The life cycle theory (LCT) take a different view. It assumes that a consumer takes into account his lifetime income to smooth out the consumption flow over the life time. This means that he will save during his working life so that he can use his savings to finance consumption when his income are low or none-existent (as when he is out of work, or in retirement). The consumption function based on LCT is of the form

*The consumer tries to have a smooth profile of consumption based on lifetime income*

$C = a' W_r + b' Y_L$ ..................(1)

where $W_r$ = real wealth of the consumers

$Y_L$ = consumers labour income

$a'$ = Marginal propensity to consume out of wealth

$b'$ = Marginal propensity to consume out of labour income.

To see how the relationship (1) is arrived at, we make a few assumptions about a typical consumer. He expects to live for t* years. His earning life consists of $t_i$ years during which he expects to earn $Y_L$ per years. He begins planning his consumption from the year he starts working. In that sense, year 1 is his first year of work. He will then spend ( t*-ti) years in retirement. Our individual now faces the following questions:

*The consumers' lifetime budget constraint says that lifetime consumption must not exceed lifetime income*

(a) What are the lifetime consumption possibilities?

(b) How to distribute total income smoothly for consumption over the life time?

To answer question (a), let us assume initially that he has no income from assets (ie his entire income is labor income). Then his lifetime income is $Y_L t_i$ (annual income times the number of working years). This implies that his lifetime (total) consumption cannot exceed $Y_L t_i$ . As for question (b), assume for simplicity that the consumer wants to spend at a constant rate, C, annually during his lifetime.

His lifetime consumption is, on this assumption, $\hat{C}t^*$ (annual consumption times the number of years he expects to live from the year he started working). Now assuming that he has no beguest to augment his labour income, we can wite his life time budget constraint as

$$\hat{C}t^* = Y_L t_i \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

(life time consumption = lifetime labour income)

During through by t*, we can write (2) as

$$\hat{C} = \left(\frac{t_i}{t^*}\right) Y_L \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

*Saving equals a constant fraction of annual income*

This says that the planned per period consumption ($\hat{c}$) is proportional to labour income per period, the constant of proportionality being the fraction of lifetime spent to earn income (ti/t*).

**The Saving Function**

We can now easily deduce the saving function, using (3). Since saving is income minus consumption in any period, we have, writing S for saving per period,

$$S = Y_L - \hat{C} = Y_L - \left(\frac{t_i}{t^*}\right) Y_L$$

$$\text{or,} \qquad S = Y_L \left(1 - \frac{ti}{t^*}\right) = \left(\frac{t^* - t_i}{t^*}\right) Y_L \ldots\ldots\ldots\ldots (4)$$

Equation (4) says that during the working life of the individual, his saving is equal to a constant fraction $\left(1 - \frac{ti}{t^*}\right)$ of his annual income.

**Influence of Wealth on Consumption**

*Wealth influences consumption independently of income*

It is now easy to introduce the effect of wealth into the consumer's consumption function. Suppose that our individual is in his q-th year of working life and has a stock of inherited real wealth worth $W_r$. He begins his lifetime consumption planning in the q-th year. His labour income for the remaining years of his working life is $(ti-q)Y_L$. If we add this to his inherited wealth ($W_r$), his total resources to be spent on consumption amounts to $(ti-q)\ Y_L + W_r$, which he will spend in (t*-q) year (he leaves no bequest). Thus his lifetime budget constraint can be expressed as

$$\hat{C}\,(t^{*} - q) = Wr + (ti - q)\,Y_L$$

or, $$\hat{C} = \frac{1}{t^{*}-q}\,Wr + \frac{ti-q}{t^{*}-q}\,Y_L$$

or, $$\hat{C} = a'\,Wr + b'Y_L \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

which is identical with (3), noted above. In (5),

$a' = \frac{1}{t^{*}-q}$ = marginal propensity to consume out of wealth, and

$b' = \frac{ti-q}{t^{*}-q}$ = marginal propensity to consume out of labour income.

To gain a better understanding of what (3) and (5) imply let us work with some illustrative members. Assume that an individual expects to live for 75 years ($t^{*}$ = 75) and that his working life lasts for 40 years (= $t_i$). If his annual labour income is \$ 30,000, his total lifetime income will be (\$ 30,000 × 40=) \$ 1,2,00,000 (= Mti) which he will consume uniformly in 75 (= t*) years. This makes his annual consumption ( $\hat{C}$ ) equal to (\$ 1,200,000 ÷75+) \$ 16,000.

*A numerical example of the combined effect of income and wealth.*

Now suppose that he in the 15th year of his working life (i.e. he has still 25 years of working life left) with a real wealth of \$ 300,000. His labour income for the remaining 25 years is (\$ 30,000 ×25 =) \$ 750,000. This together with his wealth stands at (\$ 750,000 + \$ 3000,000 =) \$ 1, 050,000. This amount he will spend equally in (75 - 15) = 60 years. Therefore, his annual consumption expenditure will be (\$ 1,050,000 ÷60 =) \$ 17,500. Notice that due to the dominant effect of wealth, (which is more than his savings for 15 years ie, \$ 210,00, his annual consumption has gone up by (\$ 17,500-\$ 16,000=) \$ 1,500. In this case, the MPC out of wealth a' = $\frac{1}{75-15}$ = 0.0167, while the MPC out of labour income, b' = $\frac{40-15}{60}$ = 0.4167. The consumption function (5) can be written as $\hat{C} = 0.0167\,W_r + 0.4167\,Y_L$

$$(17{,}500) = (5{,}000) + (12{,}500)$$

*Wealth and transitory income rise have similer effects*

The MPC out of wealth (0.0167) is much smaller than the MPC out of labour income (0.4167). This is what is to be expected. In this respect, wealth's influence on consumption is like that of any transitory component of income. In the example above, suppose that the individual is given a salary raise of \$ 300,000 for one year (his 15th year of service). The MPC out of this temporary raise will be the same as the MPC out of an equal amount of wealth. The reason is that spending out of transitory income, like spending out of wealth, will be spread out over the remaining years of his life.

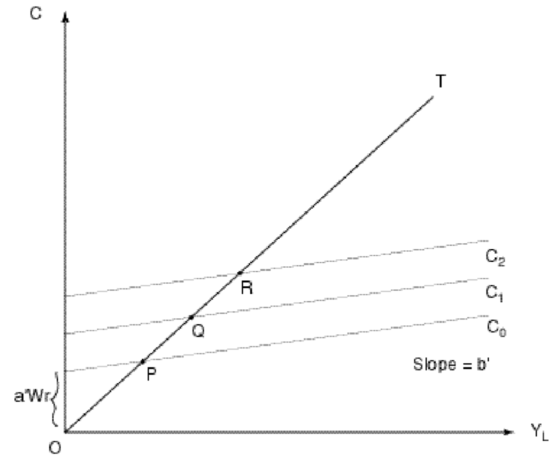



Figure 3.3: Life Cycle Hypothesis

The proportionality non proportionality puzzle referred to at the beginning of this lesson can be explained with the help of the life cycle hypothesis. In Fig 3-3 are shown several short term consumption functions showing the relationship between consumption and labour income. Each is based on relationship of the type shown in equation (5). The slope of $C_O$, for example, shows the MPC out of labour income. The intercept, on the other hand, represents the first term of equation (5) i.e, the independent inflence of wealth on consumption. In the short run, the wealth effect is more-or-less constant.

*The life cycle hypothesis throws light on the controversy*

Therefore, whatever change in consumption is observed would be mainly due to changes in labour income. In the short run, MPC<APC. Over time, however, assets will grow, causing upward shifts in the short term consumption functions like $C_O$ in Fig 3-3. As a result, we expect to observe points like P, Q, R which lies on line OT through the origin. So, even though in the shortrun (i.e over the cycle), we see that MPC < APC, in the long run, we expect to see APC = MPC. Besides the longrun MPC (and APC) is likely to be higher (as can be seen by comparing the slopes of line $C_O$ and OT). Therefore, the life cycle theory accomplishes the required reconciliation between the two apparently contradictory pieces of evidence, and this is accomplished by emphasizing that consumers behavior is geared to long run consumption opportunities consisting of lifetime income and wealth.

*Permanent consumption is proportional to permanent income*

**The Permanent Income Theory**

This is another attempt at reconciliation. Like the life cycle theory, this theory too argues that consumption is related not to current but to a long-term estimate of income. Milton Mriedman, a Nobel laureate, who originated this theory, call this theory, 'permanent income'. A consumer's current income consist of permanent income (Yp) and a transitory component (Yt). Roughly speaking, the permanent income is what consumers expect to get over a long period of time (e.g. their salaries). On the other hand, the transitory income (which may be positive or negative) may be occasional receipts (tips) or payments (fines for violating traffic rules). Simply stated the permanent income theory states that

$$C_p = bY_p$$

where Cp is permanent consumption (stripped of the element caused by transitory income), and b is the MPC out of permanent income. If we relate consumption to permanent income, a fixed proportional relationship will emerge, irrespective of the distribution of permanent income. But when we relate current consumption to current income, we should expect to get a non- proportional relationship (MPC < APC). In the case of non-proportional relationship, high-income groups save, while the low-income groups dissave. This is due to the fact that the high income groups, on the overage, ¶ tend to have positive transitory income (most of which they save). On the other hand, low-income group's measured income contains negative transitory components;

*(why the shorten relationship appears non-proportional)*

Therefore, they tend to dissave in order to protect their permanent consumption. This is how the permanent income theory accomplishes the necessary reconciliation between short run non-proportionality and long-term proportionality controversy.

*The two approaches are similar in spirit*

Before we end, we must emphasize that there is a great deal of similarity between the approaches of the life cycle theory and permanent Income theory. Both argue that consumption should be related not to current income but to expected long-term income. However, the life cycle theory pays more attention to the motives of saving, while the permanent Income Theory lays more emphasis on the way consumers form their expectation about their future incomes.

**Questions for Review**

**MCQ'S (Tick the correct answer)**

1. There is proportional relationship, when
   A. APC is the same at all income levels
   B. The consumption function is a straight line through the origin
   C. MPC and APC are equal at all levels of income
   D. Any of the above applies.

2. A non- proportional income-consumption relationship implies that
   A. MPC = APC
   B. The consumption function is a straight line through the origin
   C. The consumption is a straight-line with a positive intercept on the consumption axis
   D. None of the above is true.

3. According to the Permanent Income Hypothesis, permanent consumption is
   A. proportional to permanent income
   B. not proportional to permanent income
   C. proportional to temporary income
   D. unrelated to permanent income

4. According to the life cycle hypothesis, consumption is related to
   A. current income
   B. past peak income
   C. expected lifetime income
   D. price expectations over one's lifetime.

5. The marginal propensity to consume out of wealth is likely to be
   A. larger than MPC out of labour income
   B. smaller than MPC out of labour income
   C. equal to MPC out of labour income
   D. none of the above

**Short Questions**

1. What do you mean by proportionality and non-proportionality of income-consumption relationship?
2. How does the wealth effect on consumption help explain long-run constancy of the average propensity to consume?
3. Give an intuitive interpretation of MPC out of wealth and MPC out of labour income.
4. Show that equations (3) and (5) in the text are consistent for an individual who started life with zero wealth and has been saving for `q' years.
5. In terms of Permanent Income Hypothesis, would you consume more of your festival bonus if

   a) you knew that there was a bonus every year,

   b) This was the only year your bonuses were given out.

**Broad Question**

1. In what respects is Keynes' consumption theory unsatisfactory? Explain.
2. How does the life cycle theory explain long-term proportionality of income consumption relationship?
3. The permanent income theory and the life cycle theory are similar in their definition of the appropriate measure of income for explaining consumption." Do you agree? Give reasons for your answer.

**Answer (MCA'S)**

1. D, 2. C, 3. A, 4. C, 5. B

**Lesson 3: Non-Income Determinants of Consumption**

**Lesson Objectives:**

After studying this lesson, you will be able to

- See what factors other than income can influence consumer spending
- Understand why the influence of the rate of interest is likely to be weak at the aggregate level
- Appreciate why liquid assets can be an important determinant of consumption in times of changing price level
- Know why more equal income distribution may not always stimulate aggregate consumption
- Understand why institutional saving schemes like private pension funds can weaken the effect of income on consumption.

## Non-Income Determinants of Consumption

*The strength of income-consumption relationship seems to depend on the time period considered*

**Introduction:** Aggregate real disposable income is by far the most prominent influence on consumption, though the appropriate notion of income may not, as we have seen, be current income, but rather lifetime income or permanent income. The strength of this relationship seems to depend on the time period for which the relationship is considered. Empirical studies suggest that in quarterly relationships some other factors appear to be more important than in relationships spanning years and decades. On the other hand, some influence, while insignificant in short-run relationship, may acquire significance as long-term determinants. In this Lesson, we try to discover what some of these `other' factors are and how they tend to affect consumption.

**Rate of Interest**

It stands to common sense to argue that people would like to consume less out of a given income (ie save more) when the rate of interest is high than when it is low. People consume less (and save more) so that for a unit of consumption sacrificed (because of saving) at present he can enjoy more than a unit of consumption in the future. The additional future consumption represents the reward for saving, which is the rate of interest by another name. The higher the reward (i.e; the higher the rate of interest), the argument goes, the higher the saving (the lower the consumption).

Let us examine this plausible- sounding argument a bit more closely. When the interest rate goes up, the typical consumer is subject to two types of influences, technically called substitution effect and income effect. The kind of effect described above is the substitution effect; he substitutes future consumption more for present consumption if the rate of interest is higher than otherwise. This inclines him to save more. The income effect, however, work in the opposite direction. The higher interest rate increases his future income relative to his current income. If he feels richer in the future, he may choose to consume more at present. Which tendency is stronger? If it is the substitution effect, he will save more on balance, as the rate of interest goes up (as we uncritically like to believe).

*(The income and substitution effects of a rise in interest rate pull in opposite directions)*

Think of low-income people who save only a relatively small fraction of income even at high rates of interest. For them, the substitution effect is likely to be stronger, and therefore, their saving can be expected to vary directly with the rate of interest. The same cannot be said of high-income people who save a relatively large fraction of their income. The income effect for them may outweigh the substitution effect, especially at sufficiently high rates. And, in that case, a further rise in interest rate may cause saving to fall (rather than to rise). This is what is known as the backward bending supply curve of saving.

*(The relationship between consumption and interest rate appears quite weak at the aggregate level)*

All that we have said so far relates to the behavior of individuals or particular families. What we must know is: what happens on balance when we add up the savings of all people for each rate of interest? Should we expect a direct relationship between aggregate savings and the rate of interest (so that they rise or fall together)? No one really knows, because theory can give no categorical answer. The issue can be settled in particular settings only emperically. And many of the empirical stdies on this issue seem to indicate that the overall impact of interest rate changes on savings (and hence on consumption) is negligible, which is presumably because offsetting forces-income and substitution effects- really cancel each other out in the aggregation process.

**Wealth**

*The stock of wealth can influence consumption positively*

How much wealth a consumer has is claimed to have some bearing on his level of consumption (and in a sense distinct from the one implied by the life cycle Hypothesis). Why? The larger the stock of wealth, the lower its marginal utility. Therefore, a consumer with a lot of wealth feels less inclined to add to his future wealth at the cost of current consumption.

In other words, other things constant, the more wealth a person has, the less his desire to accumulate more (and hence the more his desire to consume out of current income). Imagine two friends-Harun and Arun- each with an annual disposable income of $ 20,000. They have the same tastes and preference. However, Harun is wealthier with wealth worth $ 200,000 than Arun who has a meager & 50,000 worth of assets. If the argument above holds, Harun should save more than Arun, not just because of his being wealthier per se, but also because of his confidence that he can count on his wealth to meet any future contingency, should it arise.

**The price level**

Part of consumer's wealth is in the form of goods, land, buildings and equities. The prices of all these can be expected to change in line with changes in the general price level (both in direction and magnitude). Therefore, their real value is unaffected by price changes. But there are other types of wealth whose values are fixed in terms of money. Cash, of course, is the most obvious example. But there are others such as government bonds, corporate bonds, and savings accounts. These are all assets with face values fixed in terms of money . A deflation of prices will raise, while inflation will lower, the real value of these assets.

*Price level changes can affect real value of wealth having fixed money value, and hence may influence consumption*

If the price level doubles, a $ 1000 government bond will buy only half of what it used to buy in terms of goods and services. In other worlds, the real value of the bond has been cut by a half. And with the real purchasing power of the bond eroded, its holder is expected to cut down on his real consumption. The opposite might happen, when the price level rises. In short, higher prices lower consumption by reducing the value of consumers wealth, while lower prices stimulate consumption by raising the value of wealth.

Thus, the price level is yet another variable that can shift the entire consumption function. Higher price leads to lower consumption at any given level of real disposable income. Conversely, a lower price level can cause increased consumption at each level of real disposable income. An important thing should be carefully noted here, because it is often the source of avoidable confusion. When the price level changes, the real disposable income (e. g. for any given normal income) rises or fall's. As a result, real consumption too rises or falls. These effects can be represented by movement along a given consumption function. However, any increase or decrease in real wealth caused by price level changes will shift the entire consumption function upward of downward, depending on the direction of price changes. These shifts are due to real wealth changes, not due to real income changes. In short, we can say that in so far as the price level changes shift the consumption function, they work through changes in real wealth, not in real income.

*The price level changes can shift the consumption function through wealth effect*

**Inflation Rate**

Prices may be rising slowly from a high level, or they may be rising rapidly from a low level. The former is the case of low inflation with high general price level, while the latter is one of high inflation with low price level. It may be asked whether the rate of inflation, independently of the level of prices, can influence consumption, one way or the other. The issue has something to do with how people form expectations about future inflation. Will inflation continue? If so, will it slow down or accelerate? It is sometimes suggested that if people expect inflation to continue, or, worse still, to accelerate, they may like to spend more out of current income than otherwise. They may be swayed by the feeling that `now' is the best time to buy. Equally sensibly, others may think that inflation will slow down and, therefore `now' is a bad time to buy.

*Inflation may affect consumption through expectation, but empirically its influence appears weak*

So, what is likely to be net effect of inflationary expectations on current purchases? Again, no unambiguous theoretical answer is possible. Keynes appears to have felt that expectations could be ignored in the analysis of aggregate consumption, because such expectations may cancel out. Unfortunately, the empirical evidence on people's tendency to `beat' inflation or gain from it is mixed. Economists therefore, usually ignore the effect of rate of inflation as a determinant of consumption in the construction of their macroeconomics models.

**Distribution of Income**

A given level of aggregate disposable income may be distributed among income classes more equally or less equally. In general the more equal the distribution, the larger is supposed to be the fraction of income consumed out of a given disposable income. Imagine two scenarios. In one, 30% of the highest income families enjoy 50% total income, while the lowest 30% have only 10% of the total. In the other, the lowest 30% of the families get 50% of the income, while the richest 30% get 20% of the total. It has been clamid that in the latter scenario, a larger fraction of any given level of disposable income will be consumed.

*The more equal distribution of income may not increase consumption significantly in the shortrun.*

Why is this likely? Because low-income families, as family budget studies show, tend to consume a larger proportion of there incomes than their richer counterparts. The argument, however, is not wholly convincing, because it seems to confuse high average propensity to consume with high marginal propensity to consume. The average propensities may well vary across income groups. But there is some evidence to suggest that the marginal propensity may be the same at all levels of family income. In that case, a redistribution of income from the richer to the poorer households would have virtually no effect on aggregate consumption. There is another point which seems relevant here. It is about the appropriate concept of income to be related to consumption. For example, if one believes in the life cycle hypothesis about consumption, then any redistribution of current income will insignificantly affect lifetime income and hence the profile of lifetime consumption.

**Demographic Factors**

Changes in composition of the spending units in the total consumer population can presumably have some effect on aggregate consumption. And this effect is likely to be independent of changes in aggregate income (or of any other variable considered so far). Consider all families at any given income level. Not all of them will be expected to consume the same amount of their income because they may differ in various demographic characteristics. What are some of these characteristics? We can immediately think of a few. First, some families may have fewer members than others; other thing equal, the latter are likely to spend more. Second, even two families with equal number of members may differ in their age and gender composition; the family with more young people, possibly children and students, may spend more.

*Several demographic characteristics like age composition may influence consumption, though weakly*

Third, families may differ by place of residence; urban dwellers are likely to spend more than their rural counterparts. Fourth, families may vary with respect to racial or ethnic characteristics; non- whites save more than whites at any given income level. We may come up with other distinguishing features which can influence family consumption behavior in some ways. But whatever the merits of these difference in terms of their ability to cause consumption differences, they should not be overemphasized. On the average and for the whole population, these factors change quite slowly. Therefore, these factors can safely be ignored in an analysis of short run aggregate consumption behavior.

**Other Factors**

We have already talked about price expectation as a possible influence on consumption. But expectation need not be confined to price alone. For many families, expectations with respect to future income levels may be an important factor in their consumption plans. Likewise consumer expectations with respect to economic, social and political circumstances can affect real consumption in any period. Easy consumer credit terms can stimulate consumer spending, especially on consumer durables like cars, televisions etc. Moreover, the saving patterns of many families have undergone important changes with the arrival of long term saving commitments through life insurance policies, private pension plans and so on. Once committed to any of these schemes, savings become almost automatic and hence less sensitive to changes in family disposable incomes.

*Easy consumer credit and future income expectation can sometimes be important*

**Questions for Review**

**MCQ'S (Tick the correct/most nearly correct answer)**

1. Seasonal factors like festival purchases are likely to be more important for
   A. Shortrun variability in consumption
   B. Longrun variability in consumption
   C. Longrun growth prospects
   D. Control of inflation

2. At the level of an individual consumer, the income and substitution effects of a rise in interest rate work
   A. in the same direction
   B. in opposite directions
   C. towards achieving equilibrium in the money market
   D. work independently of what the consumer prefers

3. At the aggregate level, the effect of interest rate on saving seems weak, because substitution and income effects
   A. reinforce each other
   B. approximately cancel each other out
   C. have no bearing on the question
   D. are independent of the savers time preferences

4. Price level changes can shift the consumption function through changes in
   A. real income
   B. real wealth
   C. interest rate
   D. wage rate

5. Theoretically speaking, a more equal distribution of income can stimulate consumption, because of difference in
   A. size of families
   B. age composition of members of the families
   C. location of residence of families
   D. all of the above

**Short Questions**

1. Explain why you would expect the effect of interest rate changes on savings at the aggregate level to be quite small.
2. The real value of which form of consumers wealth is affected by changes in the price level? Why?
3. "In evaluating the effect of more equal income distribution on consumption, one has to be careful about distinguishing between marginal and average propensities to consume. "Why?
4. Why are demographic factors likely to be of some importance when one tries to predict consumer spending?
5. Do you think institutional saving schemes like private pension funds have weakened the relationship between income and consumption for middle income families? Give seasons for your answer.

**Broad Questions**

1. Discuss how the rate of interest can influence the volume of consumer spending.
2. “The redistribution of income towards poorer families can stimulation overall consumption, but the effect is unlikely to be empirically significant" Do you agree? Give reasons.
3. “The price level changes can affect consumption by changing real income as well as real wealth." Explain how.

**Answers (MCQ'S)**

1. A, 2. B, 3. B, 4. B, 5.D

## Lesson-4: Investment spending: The Discounted Present Value Approach.

### Lesson Objectives

After studying this lesson, you will be able to

- Explain the instability of investment spending
- see the distinction between gross and net investment and why the distinction is important in the theory of investment;
- appreciate why an investment decision involves weighing of costs and potential benefits
- Understand why discounting of future benefits is needed and how it is done
- see why the rate of investment depends, inter alia, on the market rate of interest.

### Investment Spending: The Role of Interest Rate

#### Introduction

In Lesson 1 of this unit, it was argued that consumption is by far the largest component of aggregate demand. Therefore, a study of how consumer spending is determined is important to understand the reasons for fluctuations in output and employment the moderation of which is the primary task of stabilization policies. In fact, if the average propensity to consume (APC) were to decline as income rises, total savings must also grow as income grows. If private investment are not enough to equate savings and investment at the full employment level, the government will have to step in to remove the deficiency. In other words, the government will have to take larger and larger roles in the economic life of the nation. Otherwise the so-called secular stagnation will result. As we have seen, modern theories of consumption do not support the Keynesian argument that in the long run the APC will be declining with increase in income. Therefore, the secular problem of inadequate demand is no longer considered to be a serious problem which cannot be tackled with conventional tools.

*Investment spending is quite volatile, though a relatively small component of aggregate demand*

Another important argument of Keynes is that the capitalist market economy is inherently unstable. It is unstable in the sense that output and employment can often fluctuate, creating alternate periods of booms and depressions. In this instability argument, investment holds the center stage which makes a careful study of business investment all the more important. In contrast to the stagnation argument, Keynes has proved remarkably right in his emphasis on investment behavior as a source of instability. Investment demand, though less than a quarter of the aggregate demand, has historically proved to be quite volatile. There is a wide agreement among economists that this volatility arises from the uncertainty about the expected returns from investments, expectations regarding future returns being fragile.

Expectations about future returns may be fragile for several reasons. For example, the investor does not know with any degree of certainty the exact working life the machine he intends to buy. The machine may last for fewer years than anticipated. More important is the possibility of technological obsolescence. The machine may become outdated before its physical life is fully exhausted. Will consumers' taste for the product (the machine is to produce) change in such a way that sales will fall off rapidly, rendering the machine useless? Will consumers behave in the way predicted? Will the tax policies change? Will input prices rise too much? One could mention many more sources of uncertainties like these, but the point is that when so many things can go wrong in the future, the profitability of an investment that is to yield returns for a number of years in future can only be estimated with a large margin of error, one way or the other.

*The reasons why expectations about future yields are fragile*

**Salient Features of Investment**

Before we proceed further, let us be clear about what economists to mean by investment. **First,** in popular usage, investment often refers to buying financial (e.g. stokes, bonds) and existing physical (e.g. an old house) assets. In macroeconomics, investment has a very specific and well-defined meaning. Investment is the value of that part an economy's output in a period which takes the form of new structures, new machines or equipment, and changes in inventories. In national income accounts, investment is often shown as composed of (a) business fixed investment (such as plant and machinery), (b) construction (new residential houses), and (c) changes in inventories. Of these, the business fixed investment is the largest component, and our discussion here will be confined to this component only. **Secondly,** it may be recalled that investment is a flow (so much per period), while capital is a stock (so much at a point in time). The capital stock of a country consists of machines, equipment, structures etc. at a point in time (say, December 31, 2000) accumulated over the past years. Capital (stock) and investment (flow) are obviously related. The capital stock changes only when the flow of investment changes. **Finally,** a distinction has to be made between gross investment and net investment. Some investment is required to make up a part of the capital stock used up in the production process during the period. This

*Investment is addition to the nation's productive capacity. Investment is a flow, while capital is a stock variable*

part of investment is called replacement investment. Another part of investment is aimed at expanding the productive capacity of the economy. This is called net investment. Therefore, gross (or total) investment (Ig) equals the sum of replacement investment (Ir) and net investment (In). So we can write

$$Ig = I_r + I_n$$

*Distinction between gross and net investment*

It is easy to see from this identity that if gross investment is limited to replacement investment only, the total capital stock is unchanged. Capital stock will grow only if net investment is positive in the given period.

**Cost & Benefits of Investment**

Before a firm decides to invest for example, in a new machine it has to balance gains against costs. Costs are of two types.

1. The cost of buying and installing the machine. Let this be denoted by C.

2. The interest costs of funds needed to finance purchase of the machine. These costs are relevant even when the firm uses its internally generated funds. Such funds can alternatively be used to buy an existing asset (e.g. fixed interest bearing government bond). The interest forgone by not buying the bond is the opportunity cost of funds used to buy the machine. In other words, whether or not the money is actually borrowed or comes from own resources interest cost of funds remain relevant. We will represent the rate of interest by `i' For instance, if i=10% annually, the borrower pays every year $ 10 for every $ 100 borrowed.

*Interest costs remain relevant, even when funds are from internal source (not borroweds*

Against the interest cost of the funds required to buy the machine, there are prospective benefits. These will come as a stream of net revenues over the life of the machine from the sale of products it will be used to produce. Assume that the machine lasts for ‘n’ years and that at the end of the n-th year it becomes useless (it has no scrap value).

*Prospective yields have to be discounted to make them comparable*

Now we are faced with the problem of calculating the total net revenue over the useful life of the machine. We need this number in order to find out how profitable the investment is likely to be. Let $R_i$ be the net revenue for the i-th year (i=1, 2, ......n). We cannot just sum up the $R_i$' s and divide the sum by the purchase price of the machine to arrive at the rate of return (over cost) on investment. The outlay on the capital good (here a machine) is made in one lamp sum in the current year, but the revenues are spread over ‘n’ years. The problem is that revenues at different time periods are not strictly comparable, and so we cannot meaningfully add them together. To be meaningful, the $Ri^s$ must be adjusted for time differences and only then we can add them up. For this, we first have to discount the Ri's to put them on a common basis. We illustrate below how this discounting is done and why it makes sense.

**Discounting and Present Value of an Asset**

If you lend \$ 100 at an annual rate of interest of 4% at the end of the year you will get back \$ 104, \$ 100 (principal) plus the interests earned \$4. We can write this as;

$$\$104 = \$\ 100 + \$\ 100 \square\square 0.04$$

(Principal) (Interest on principal)

Let us represent the amount due at the end of the t-th year by $P_t$ (t=1,2,.....n) and the annual rate of interest by i (as a percentage). In line with the example above, we can, therefore, write:

$$P_1 = p_0(1+i) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

where $P_o$ is the original principal (\$100 in the previous example). If $P_o$ is invested for the second year, the amount due at the end the second year,

$$P_2 = P_1\ (1+1)$$

Since $P_1 = P_o$ (1+i) from equation (1), we can write

$$P_2 = P_o\ (1+i)(1+i)$$

$$P_2 = P_0\ (P_0\ (1+i)^2 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

If $P_2$ is again invested for the third year, then

$$P_3 = P_2\ (1+i)$$

or $$P_3 = P_0\ (1+i)^2\ (1+i)$$

or $$P_3 = P_0\ (1+i)^3 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

Proceeding in this way and generalizing, we can write

$$P_t = P_0\ (1+i)^t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

which says that an amount of \$ Po invested today at an annual compound interest rate of i% will give a total yield (principal plus interest) of \$ $P_t$ at the end of the t-th year.

We now ask the question which is vital for our purpose. What is the value of \$ $P_t$ at present (i.e at the beginning of the period 1). To answer this question, let us go back to equation (1) and ask if we were to sell the claim of \$ P1 today how much we can expect to get. The answer is to solve equation (1) for $P_o$. We therefore, get

$$P_0 = \frac{P1}{1+i} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

That is, $P_o$ is the present value of $P_1$

To verify that this is, in fact, the case, let Po = \$ 100 and

i = 4% = 0.04. then

$$P_0 = \frac{P1}{1+1}$$

$$(\$100) = \frac{\$104}{1.04}$$

*Discounting is the reverse process of interest compounding*

We want to calculate the present value of the amount due in each period of time. To facilitate this, we need to introduce a few new notations for present values. Let $E_1$, $E_2$, $E_3$ ... ... ... … … $E_n$ be the present value of $P_1$, $P_2$, $P_3$, ... ... ... … $P_r$ respectively. We have already found the value of $E_1$ from equation (5). In keeping with the new notation (5) can be written as

$$E_1 = \frac{P1}{1+i}$$

Using equations (2) & (3), we have

$$E_2 = \frac{P2}{(1+i)^2}$$

$$E_3 = \frac{P_3}{(1+i)3}$$

In general, using (4)

$$E_t = \frac{P_t}{(1+i)t} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

*Why discounting makes sense*

Does all this make sense? Yes, eminently. Let us see why. Refer back to equation (6). If you invest \$ $E_t$ ¶ today at an annual rate of interest (compounded annually), you will get \$ $P_t$ at the end of the t-th year. If you try to sell the claim of \$ $P_t$ today, nobody will be willing to pay you more than \$ $E_t$. It would be foolish for you to pay more than \$ $E_t$, because any amount larger than \$ $E_t$, if lent at the given rate of interest, will yield more than \$ $P_t$ at the end of the t-th year. Nor will you accept less than \$ $E_t$, because any amount less than \$$E_t$ will bring you less than \$ $P_t$ at the end of the t-th year. Therefore, the present value of \$ $P_t$ will be \$ $E_t$

**Calculation of Present Value of Prospective Yields**

Now we are ready to find the present value of all net revenues (Ri) to be secured by the firm which intends to buy the machine. Let υi be the present value (discounted) of Ri (the net revenue of the ith year). Therefore,

$$\upsilon_i = \frac{R_1}{1+i}$$

$$\upsilon_2 = \frac{R_2}{(1+i)^2}$$

$$\upsilon_t = \frac{R_t}{(1+i)t}$$

Summing up, we can write

$$V = \sum_{i=1}^{w} \upsilon_i = \frac{R_1}{1+i} + \frac{R_2}{(1+i)^2} + \dots\dots\dots + \frac{Rn}{(1+i)^n} \dots\dots\dots\dots \quad (7)$$

where V, as before, is the sum of present values of net revenues in each year of life of the machine.

*Discounted present value depends on the prospective yields as well as the discount rate*

Notice how the discounted present value(V) in equation (7) is related the series of net sevenues ($R_i$s) and the rate of interest (i). For any given set of $R_i$s, the higher the rate of interest, the lower the discounted present value (V). On the other hand for any given interest rate, the larger the values of net revenue, the higher the present value. Some illustrations of these relationships have been presented in Table 3-2. We have assumed that the machine lasts for five years and that the yearly revenues are constant. Thus, when $R_i$ = R = \$500 and the rate of interest is 5% per annum, υ= \$ 2165; but if the rate of interest drops to 3%, the present value goes up to \$ 2289. Again, at 5% rate of interest, the value of V for $R_i$ = R = \$600 is \$ 2597. This illustrates the fact that for any given i (=5%) the larger Ri (=\$600) results in larger present value (\$2597 instead of \$ 2165).

In equation (7), there are where sets of variables the $R_i$, i and V. Assuming that i and $R_i$'s are known, we can find the value of V. We also know that for given $R_i$'s, the present value (V) will rise, if a lower interest rate is used; the opposite is true if a higher interest rate is applied for discounting. Therefore, we can convince ourselves that there must be a rate of interest (r) which will make the present value (V) equal to the cost of the machine (C). That is there is a discount rate (which is not necessarily equal to the market rate of interest, i) such that

$$C = \frac{R_1}{1+r} + \frac{R_2}{(1+r)2} + \ldots\ldots\ldots + \frac{R_n}{(1+r)n} \quad \ldots\ldots\ldots\ldots (8)$$

**Table 3-2: Calculation of Discounted Present Value of Revenue streams**

| Year | Net Revenue at year t | Present value (V) of $R_t$ at | | Net Revenue at year t | Present Value (V) of $R_t$ at | |
|---|---|---|---|---|---|---|
| t | (Rt) | 3% | 5% | (Rt) | 3% | 5% |
| 1 | $ 500 | $ 431 | $392 | $ 600 | $ 518 | 470 |
| 2 | 500 | 444 | 411 | 600 | 533 | 494 |
| 3 | 500 | 458 | 432 | 600 | 549 | 518 |
| 4 | 500 | 471 | 454 | 600 | 566 | 544 |
| 5 | 500 | 485 | 476 | 600 | 583 | 571 |
| Total | - | $2,289 | $ 2,165 | - | $2,749 | $2,597 |

*Marginal efficiency of capital defined*

The rate (r) is clearly the rate of return on investment we have been looking for. Keynes called this rate the marginal efficiency of capital (MEC). MEC is therefore the ↕ rate of discount (or interest) which, when applied to the prospective yields from an investment project, will make their discounted present value (V) equal to the cost of the investment project (C). Notice that if

V = C, r = i

V > C, r> i

V< C, r < i

**Investment Decision Rule and Investment Function**

*Investment is profitable if the MEC is greater than the market rate of interest*

Finally, we are ready to establish the rule for investment decision by a profit maximizing firm (assuming away or adjusting for all the risks and uncertainties mentioned earlier). Not surprisingly this is quite straight forward: the firm

| | | |
|---|---|---|
| (i) Should invest | if r> i | (i.e V> C) |
| (ii) Should not invest if | if r< i | (i.e V< C) |
| (iii) Will be indifferent if | r = i | (i.e V= C) |

The investment rule is usually in terms of the market rate of interest (i) and the rate of return on investment (r of MEC). This when r>i, investment is profitable. On the other hand, if r<i, the investment is not worthwhile. Intuitively, this comparison makes good sense. For example, if the market rate of invest is 10%,

while MEC is 8%, investment is More productive in an existing asset (e.g.a bond) than in a new machine.

**Demand Schedule for Investment**

At any point in time a firm is confronted with a number of possible investment projects, and they can be ranked in decreasing order of their profitability (i.e, MEC = r). Fig. 3-4 shows the situation for a typical firm. the firm's most profitable project is A which yields a return of 10% and the least profitable is project D which brings only 4%. If the market rate of interest is 8%, project A and B can be profitably be undertaken and then total investment will be $1500. Project C and D are not profitable at 8% rate of interest. However, if the market rate of interest drops to 6% project C becomes worthwhile along with project A and B. As a result, total investment rises from $15,000 to $29,000. Clearly there is an inverse relationship between the market rate of interest and the firm's investment demand: the lower the rate of interest, the higher is investment and vice versa. The investment demand schedule of our firm looks like a stair-step (the solid line PQRT in Fig 3-4), because investment projects are lumpy. But if the MEC schedules of all firms in the economy are horizontally added up, we can expect to get continuous downward sloping MEC schedule, because kinks are likely to be smoothed out in the aggregation process.

*Firm's investment demand schedule is inversely related to the market rate of*

It is important to note a qualification about the aggregate MEC schedule referred to above. This should not be interpreted as the investment demand schedule for the economy as a whole. The reason is that when, for example, the rate of interest falls and firms try to buy more capital goods, capital goods price may rise, at least in the short run. When the cost of the machine

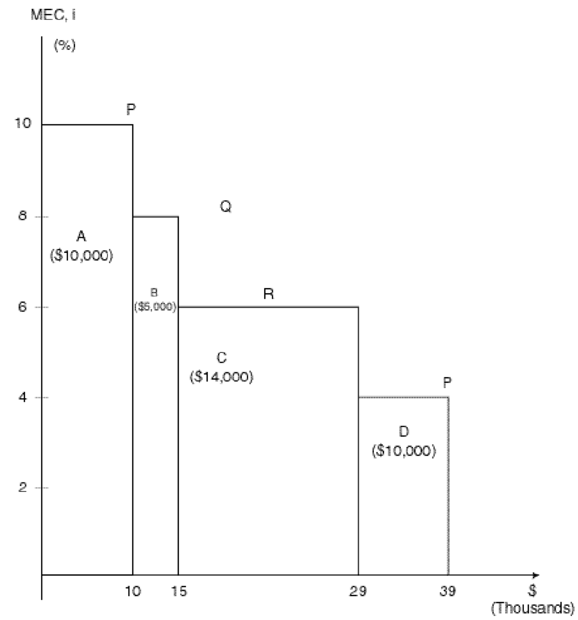



Fig 3-4: MEC Schedule for a Firm
New Investment Expenditures

**Investment Demand for the Economy**

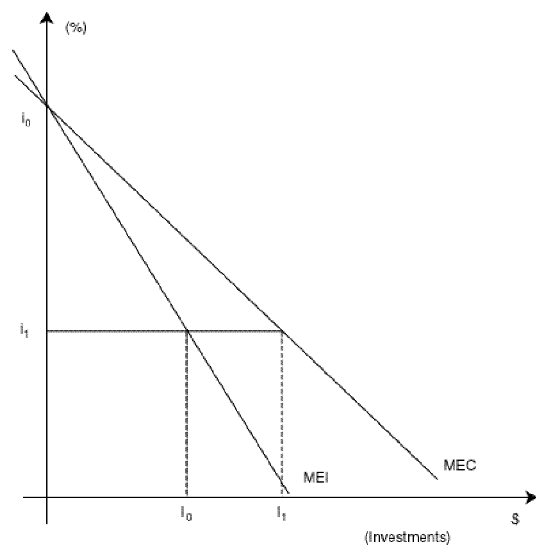



Fig 3-5: Investment Demand for the Economy

(the project) goes up, other things constant, MEC is likely to fall on all project for all firms. As a result, the rate of investment will decline at each MEC. In other words, the MEC will shift to the left as the prices of capital goods rise. The resulting curve is sometimes called the marginal efficiency of investment (MEI) curve as shows in fig, 3-5. The MEI schedule represents the investment demand schedule for the economy as a whole, and the curve is obviously negatively sloped.

**Question for Review**

**MCQ'S (Tick the correct answer)**

1. The opportunity cost of using funds to purchase a machine is
   A. The cost involved in setting up the machine
   B. interest forgone on loans that could have been made
   C. the cost of the machine
   D. none of the above.

2. A machine lasts for only one year and yields \$ 3000 for the year. If the rate of interest is 8% per annum, the present value of the machine will approximately be
   A. \$ 2500
   B. \$ 2,887
   C. \$ 2,768
   D. \$ 2, 778

3. The cost of a machine lasting one year is \$5,000 and the expected yield is \$5,300. The marginal efficiency of capital (MEC) will be
   A. 5%
   B. 5.3%
   C. 6%
   D. 8.3%

4. When the MEC exceeds the rate of interest, the
   A. Cost of the machine exceeds the present value of yields
   B. cost of the machine is less than the present value of yields
   C. investing in the machine is unprofitable
   D. rate of interest is too low.

5. If the present value is greater than the price of the capital good, we can conclude that
   A. investment is not profitable
   B. MEC is less than the rate of interest
   C. MEC is more than the rate of interest
   D. none of the above is true.

6. If the price of the product that the new machine is expected to produce falls, the
   A. MEC will fall
   B. MEC will rise
   C. MEC will remain unaffected
   D. interest rate will fall

**Short Questions**

1. Explain briefly why investment spending is likely to be unstable.
2. How is investment defined by economists? Mention two important attributes of investment.
3. Distinguish between gross and net investment. Why is the distinction necessary?
4. Explain why the interest costs remain relevant for investment decision, even when the funds to buy a new capital good come from firm's own resources (i.e, not borrowed).
5. What is discounting? What does the discounted present value of future yields?
6. 'Comparing the MEC with the rate of interest for investment decision is equivalent to comparing the discounted present value with the cost of the project.' Do you agree? Explain.
7. Show that the discounted present value varies directly with the series of prospective yields and inversely with the market rate of interest.

**Broad Questions**

1. Discuss a firm's investment decision rule. Show that a firm's investment expenditures and the market rate of interest move in opposite directions, if this rule is followed.
2. Explain why the aggregate investment function for the economy as a whole cannot be obtained simply by horizontally adding individual firm's MEC schedules. In this connection, explain how such a function is derived.

**Answers: (MCQ'S)**

1. B, 2. D, 3. C, 4. B, 5. C, 6.A

## Lesson 5: Investment Spending: The Neoclassical Stock Adjustment Approach

### Lesson objective

After studying this lesson, you will be able to

- see why output changes are necessary for continued net investment.
- how a firm determines its optimal capital stock
- why, along with the rate of interest, expected inflation rate and depreciation charges should be included in the cost of capital.
- how government policies can influence investment behavior of firms.
- how firms adjust their actual stock of capital toward the desired level over a period of time.
- why the MEC-based explanation of investment is implicit in the neoclassical theory of investment.

### Investment Spending: The Neoclassical stock Adjustment Approach

### Introduction

*Net investment ceases when the actual and the desired capital stocks are equal.*

In Lesson 3 of this unit, we have shown investment as a function of the rate of interest. This is not a wholly satisfactory explanation of investment behavior, because it ignores other factors which influence investment decisions by firms. The analysis is static, and the process through which interest is supposed to influence investment may even be misleading. When the market rate of interest equal the marginal efficiency of capital, the firm has attained its desired stock of capital. At this point, firm's actual stock of capital becomes equal to the optimal stock. Once this level is reached, there is no incentive for the firm to undertake any net investment. In other words, the net investment is zero. The need for fresh investment will arise when (a) the rate of interest falls, and/or (b) when the demand for capital stock rises above the existing stock.

*To determine the optimal stock, firms compare the productivity of capital with the cost of capital.*

The neoclassical stock adjustment approach to investment spending explains why the desired capital stock changes, and how the gap between the desired and the actual stock is gradually closed over time through net investment. The new approach naturally begins with the question of what determines the optimal capital stock of a firm. Firms produce any given level of output using capital and labor (and other inputs) and employing the best available technology so that the cost of production is the lowest possible. In order to decide how much capital to use to produce its output, the firm must compare the contribution that additional capital makes to profit with the cost of using that capital. The contribution is measured by the value of the additional output produced.

The cost of using additional capital which is called the rental cost of capital consists of several elements to which we will return later. A profit maximizing firm will continue to add to its capital (ie-invest) as long as the value of the marginal product of capital is higher than the rental cost. In equilibrium, therefore, value of the marginal product = rental cost of capital.

**The Marginal Product of Capital**

*The marginal product of capital declines as more capital is used, other thing equal.*

Given the neoclassical from of the production function, a firm can produce a particular level of output with. many different combinations of labor and capital. This means that the firm can substitute capital for labour and vice versa. The combination of capital and labour actually chosen depends on the wage-rental ratio. As the wage rate goes up (ie, the wage-rental ratio rises), the firm will use (in order to minimize the cost of producing any particular level of output) more capital and less labour. As a result, the ratio of capital to labour will go up. How is the marginal product of capital affected by the increase in capital-labor ratio (K/L)? The answer comes from the law of diminishing return: It tells us that the marginal product of capital (MPK) will fall as more and more capital is used with a fixed amount of labour. In this case, more capital is being used with smaller amount of labour, therefore, the marginal product of capital will fall even more. We should then expect the MPK to fall as increasing amounts of capital is used to produce a given output level, as shown in fig, 3-6.

The curve $Y_o$ in Fig, 3-6 shows how the MPK behaves as the firm uses more and more capital (Such as $K_1$, $K_o$, $K_2$) to produce a given output level, $Y_o$. Which level of capital should is used to produce $Y_o$ depends on the rental cost of capital (relative to the wage rate). For example if the rental cost is $\hat{r}_a$, the optimal of desired capital stock is $K_o$, because only at this level the rental cost equal the marginal product of capital.

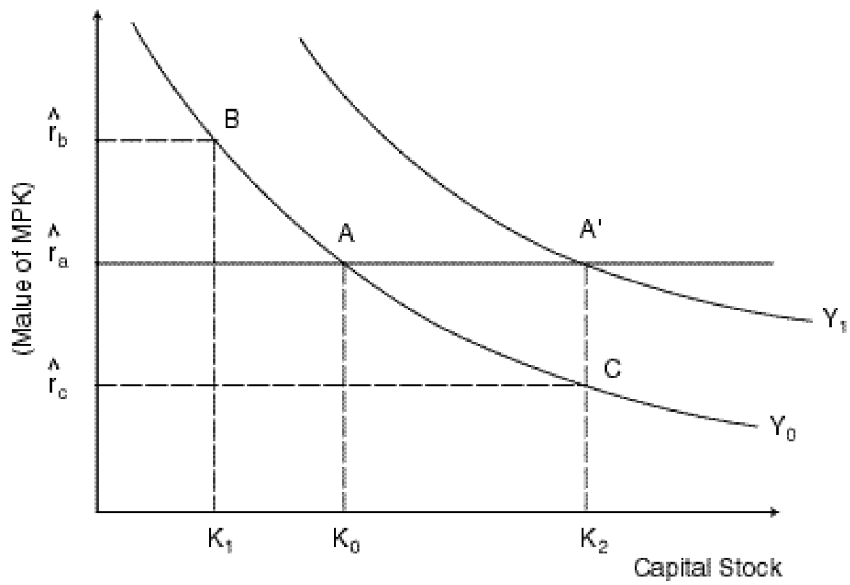



Fig. 3-6: Relationship between the capital stock and MPK

If the rental cost were to rise to say $\hat{r}_b$, the firm must be compensated for this by an increase in MPK. This will happen at point B as the firm tries to use less capital (which is now relatively more expensive) and more labour (which is now relatively less expensive). Therefore, one determinant of the optimal (desired) capital stock that a firm will like to have is the rental cost of capital ($\hat{r}$). The higher the rental cost of capital ($\hat{r}$), the lower the optimal capital stock (k*) and vice versa. However, the rental cost is not the only determinant. Another determinant, not surprisingly, is the level of output. To appreciate how, let us look Fig 3-6 again.

*For any given cost of capital, optimal capital stock rises with output level.*

The curve $Y_1$ represents a higher level of output than Yo. To produce more output, more capital (and more labour) is needed. As a result, for any given rental cost of capital, the optional capital cost will go up as output grows. For instance, at. $\hat{r} = \hat{r}_a$, the optimal capital stock is $K_o$ for output $Y_o$, but for $Y_1$ the optinal capital stock is higher ($K_2$). The general relationship among the optional capital stock (K*), the rental cost of capital ($\hat{r}$) and the level of output is given by

$K^* = f(\hat{r}, Y)$ $\qquad f_1 < o;\ f_2 > o$........(1)

*Optimal capital stock varies directly with output level and inversely with the rental cost of capital*

Equation (1) says that the optimal capital stock varies inversely with the rental cost of capital and directly with the level of output to be produced. It must be noted carefully that output Y in equation (1) is not the current, but the expected level of output which the firm thinks it will produce in future during the life of the capital good. The expected output can, of course, be influenced by the current output level.

### The Rental Cost of Capital

*Interest rate is an important element of rental costs, along with inflation rate and depiction*

It was mentioned earlier that the rental cost of capital is composed of several elements. Obviously the interest charge of buying (or hiring) a unit of capital is one element irrespective of whether the funds are borrowed or internally generated, as explained earlier. The other element is depreciation of the capital good during the relevant period. Why should depreciation be a cost? The simple answer is that to keep the machine as efficient in production as it was originally, repairs and maintenance costs have to be incurred and these must be regarded as part of rental costs. Therefore, by adding the depreciation charges (d) to the rate of interest, we can write

$$\hat{r} = i + d \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

where i = nominal rate of interest,

d = depreciation costs, and

$\hat{r}$ = rental cost of capital.

*The relevant interest rate is the real interest rate, which is nominal rate less the inflation rate.*

But equation (2) must again be modified to take account of inflation. The interest rate in equation (2) is the nominal interest rate, as agreed upon in the loan contract without any reference to future inflation. The nominal (money) value of the marginal product of capital (MPK) goes up with the rising price level, but the nominal interest rate agreed upon does not. It is therefore the expected (because future inflation can only be predicted imperfectly) real interest rate that should be relevant for calculation of the rental cost. The real interest rate is the nominal interest rate minus the rate of inflation. For example, if the nominal interest rate is 7%, while the rate of inflation is 2%, the real interest rate is 5%. Therefore, by modifying equation (2), we write

$$\hat{r} = i^* + d$$

or $$\hat{r} = i - \pi^e d \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

where $\pi^e$ is the expected rate of inflation,

$i^* = i - \pi^e$ = real interest rate, and

d = depreciation costs.

*Corporate income tax and investment tax credit can affect the investment behavior of firms*

Now in deriving (3), we have not considered the effect of government tax and subsidy policy on the rental cost of capital ($\hat{r}$). In fact, government tax and subsidy policy can significantly alter the rental cost and hence the optimal capital stock. Two main types of taxes that are directly relevant are corporate income tax and investment tax credit. Other things constant, if the corporate tax rate goes up, the after-tax marginal productivity of capital at any level of desired capital stock will fall. This may be seen as equivalent to a rise in the rental cost due (say) to a rise in the real interest rate with unchanged (pre-tax) marginal productivities. (To see why refer back to Fig 3-6 and stress your imagination a bit). The cost of capital rises when the corporate tax rate goes up. The story is different with investment tax credits under which a firm is allowed to deduct a certain percentage of its investment during a year from its taxes. The investment tax credit therefore reduces the cost of capital.

*A generalized demand for desired capital stock function*

Let us now bring together the factors which influence the desired capital stock of a firm. From equation (1), we know that the larger the expected output, the higher will be the stock of capital desired. From the same equation, we also know that the lower the rental cost of capital ($\hat{r}$) the higher the optimal capital stock. But from equation (3) we see that the rental cost vary directly with the real interest rate and the depreciation cost. In other words, the higher the real interest rate (i*) and depreciation cost (d), the lower the desired capital stock. Taking account of all these factors and their interrelationships we can write the demand for optimal capital stock at the aggregate level (through the process of aggregation) in the general functional form as:

K* = f (i*, d, y, t, tc) ... ... ... ... ... ... ... ... … … (4)

(-) (-) (+) (-) (+)

where t = corporate income tax rate

tc = investment tax credit, and

other variables are as defined before.

The positive and negative signs on the right hand side of equation (4) indicate in which directions K* is expected to change as the variable above the sign changes. The Plus sign indicates that K* varies in the same direction as the variable above the plus sign, while the minus sign indicates that K* and the variable above the minus sign move in opposite direction. For instance, K* and Y move in the same direction, while K* and t move in opposite directions.

**Adjustment Towards Capital Stock : The flexible Accelerator Model**

*Reason for partial adjustment per period*

The optimal capital stock given in equation (4) is unlikely to be equal to the actual capital stock at each point in time. Whenever the optimal stock is larger than the actual stock, the gap can be closed only through net investment. However, it is unlikely that the gap will be closed in one big increase in net investment. Why? Two factors stand out. One has to do with time. It takes time to conceive, plan and complete an investment project (e.g, you will not possibly promise to raise a ten-story building overnight). Secondly, the quicker the adjustment, the more likely it is that the cost of the project will be higher. For instance, a very rapid adjustment will call for an expensive crash programme with adverse effect on regular production schedules. Thus it is far more reasonable to assume that firms will adjust their capital stock in a step-by-step fashion over a period of time rather than in one big leap.

*In the flexible accelerator model, the wider the gap in capital stocks, the greater is the speed of adjustment*

Several hypotheses have been advanced to explain the speed at which the adjustment of the actual capital stock towards the desired stock takes place. One of them is the accelerator model. The older version of this model says that investment is proportional to national output. But this explanation has been found to be crude and deficient, and the model has since been extensively modified and refined. The model in its new incarnation is called the flexible accelerator model. The basic idea underlying this model is that firms decide to close a fraction of the gap between desired (optional) and actual stocks in each period and that the larger the gap the stronger is the urge to close the gap more quickly.

Denoting the capital stock at the end of the last period by $k_{t-1}$, the gap between the desired and actual capital stock is equal to $k^*- k_{t-1}$. The actual capital stock (k) at the end of the current period is, therefore,

$$K = K_{t-1} + \upsilon(K^*-K_{t-1}) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Where $\upsilon$ represents the fraction of the gap closed in each period. In other words, $\upsilon$ represents the speed of adjustment of the actual to the desired capital stock. Net investment is by definition the difference between actual stock at the end of the current and the previous period. Therefore, net investment in can be expressed as:

$$In = K-K_{t-1} = \upsilon\ (K^* - K_{t-1}) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (6)$$

A graphical illustration of adjustment of capital stock through investment is given in Fig 3-7 on the assumption that $\upsilon = 0.5$, actual capital stock at the end of period

*MEC- ba explanat investme embedde neoclass theory.*

zero, $k_O = \$\ 6{,}000$, and the optimal capital stock, $K^* = 12{,}000$. Since in each period one-half of the outstanding gap is filled, investment in period $1(t_1)$ is $I_1 = \frac{1}{2}(K^* - K_0 - I_1) = \frac{1}{2}\ \$(12000 - 8000) = \$\ 3000$. The gap outstanding at the end of period 1 ($t_i$) is $(k^* - k_O - I_1)$.Therefore, investment in period 2 = $I_2 = \frac{1}{2}(k^* - k_o - I_1) = \frac{1}{2}\ \$(3000) = \$\ 1{,}500$ Similarly $I_3 = \$\ 750$ and so on. As the process continues, the firms actual stock approaches the desired stock.

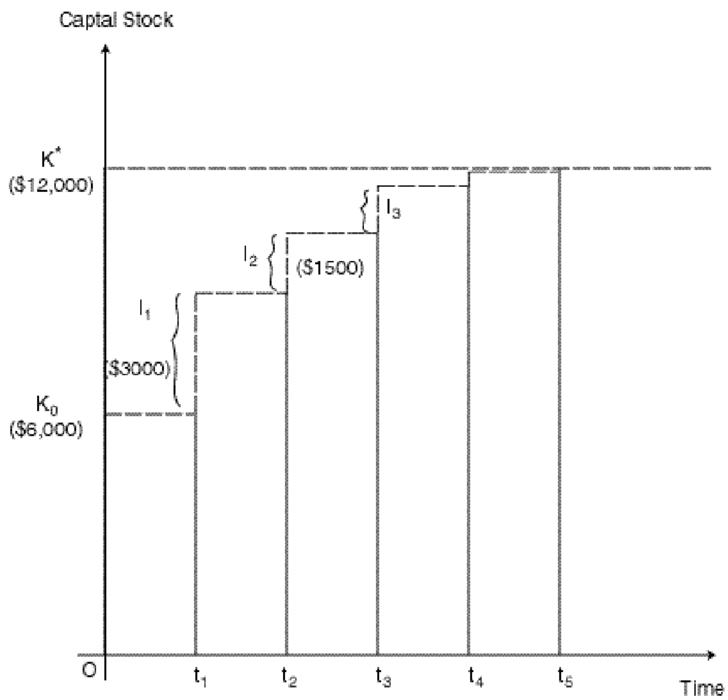



Fig 3-7: A Gradual Adjustment towards Optimal Capital Stock

*The role of fiscal and monetary policy in influencing investment*

We are now ready to see how the MEC-based explanation of investment links up with the neoclassical theory of investment which sees investment flows as the speed with which firms adjust their capital stock toward their desired levels. In equation (6), the factors that influence net investment can be put into two categories: (a) Those which affect the cost of capital (the real interest rate, depreciation changes, profit tax rate, investment tax credit rate etc) and (b) Those that affect the expected level of output. If the investment is shown as a decreasing function of the rate of interest (as in MEC-based explanation), then any increase in depreciation costs (d) or the tax rate (t), and any decrease in investment tax credit (tc) will lead to lower investment demand at any given rate of interest (i), because each tends to raise the cost of capital. These changes will cause a leftward shift of the investment function. On the other hand, any increase in the level of expected output should lead, other things equal, to an increase in the rate of investment at any given rate of interest (i.e. a rightward shift of the investment schedule). We therefore see that in the neoclassical theory of investment the basic nature of the relationship between the interest rate and investment spending is unaffected, but the neoclassical theory is richer in the sense that it lays hands on several other factors which influence the rate of investment. Finally, from the neoclassical explanation we can clearly see how monetary and fiscal policy affect investment spending. The monetary policy can influence investment via changes in the real interest rate, while the fiscal policy can do the same thing by manipulation its tax-subsidy policy, not to speak of the government's ability to influence firm's expected output through government expenditures.

**Review Questions**

**MCQ'S (Tick the correct answer)**

1. Which of the following will not reduce the rental cost of capital?
   A. Investment tax credit benefit is raised
   B. Corporate profit tax is lowered
   C. Accelerated depreciation is allowed for tax purpose.
   D. A 10% increase in nominal money supply causes a 10% increase in the expected rate of inflation
2. The real rate of interest is
   A. nominal interest rate plus the rate of inflation
   B. nominal interest minus the rate of inflation
   C. nominal interest rate plus depreciation
   D. nominal interest divided by the price level.
3. The optimal capital stock will rise if
   A. the rental cost of capital falls, for any given output level
   B. the output level rise, for any given rental rate
   C. inflation slows down
   D. either A or B holds
4. Net investment ceases when the desired capital stock is
   A. equal to the actual capital stock
   B. less than the actual capital stock
   C. greater than the actual capital stock
   D. none of the above.
5. When the corporate income tax falls, the rental cost of capital
   A. rises
   B. falls
   C. remains unaffected
   D. affects the expected rate of inflation.

**Short Questions**

1. Explain why output changes are necessary for continued net investment.
2. "The optional stock of capital is one which a firm will like to have in order to maximize profits". Do you agree? Give reasons for your answer.
3. Why is the marginal product of capital expected to decline when a firm uses more and more capital with given amounts of other inputs?
4. How is the marginal productivity of capital affected by an increase in the corporate income tax rate? Explain.
5. Explain how the investment behavior of firms can be influenced through monetary and fiscal policies.

**Broad Questions**

1. Discuss the flexible accelerator model of capital stock adjustment.
2. What are the various elements of the rental cost of capital? Elaborate.
3. Explain why firms usually choose to adjust their capital stock slowly over a period of time.

**Answer (MCQ'S)**

1. D, 2. B, 3. D 4. A, 5. B,