UNIT 5 INTERTEMPORAL CHOICE - I*

Structure

5.0 OBJECTIVES

After going through this Unit, you will be in a position to

- describe the concept of Secular Stagnation;
- explain the concept of Kuznets' puzzle;
- explain how a consumer optimises on consumption over time;
- construct intertemporal budget constraint;
- explain the impact of increase in income on consumption in an intertemporal set up; and
- analyse the impact of change in interest rate on consumption over time.

5.1 INTRODUCTION

In microeconomic theory (BECC-101) you learnt that consumption decision of a household or individual is based on prices of commodities and budget constraint. In microeconomics, the choice decision of the household is limited to a single time period. Individuals, however, continuously make choices regarding consumption, saving, borrowings, etc. When these choice decisions occur over time, it is called intertemporal choice decision. In this unit we focus on the consumption decision of households over time. As you are aware, consumption

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accounts for a large fraction of aggregate demand, more than all other sectors (such as investment, government expenditure and net exports) combined. Although fluctuations in consumption closely follow GDP fluctuations (in a business cycle), it is somewhat lesser in magnitude than in GDP. Because consumption of goods and services has direct implication on the utility people derive, at the aggregate level this has welfare implications for an economy.

Soon after Keynes proposed the Psychological Law of Consumption, economists began empirical testing of Keynes' conjectures. Although Keynesian consumption function met with early success, soon anomalies arose regarding his conjecture that average propensity to consume falls as income rises. Several economists tried to explain those anomalies through their advanced theories of consumption. Here in this Unit and the next one, we present the views of certain prominent economists, viz., Keynes, Simon Kuznets, Irving Fisher, Franco Modigliani, and Milton Friedman. We will also discuss the impact of Government's debt financing policy on household's intertemporal consumption decision.

5.2 KUZNETS' PUZZLE

As you have learnt in BECC 103, Keynesian consumption function has two main features. First, marginal propensity to consume (MPC = $\Delta c/\Delta y$) is between zero and one. Second, average propensity to consume (APC = c/y) falls as income rises. During the Second World War (WW II), Keynes' ideas were found to be different from empirical observations.

5.2.1 Secular Stagnation Hypothesis

During the WW II, as investment opportunities in the economy dried up, following Keynes' proposition, economists predicted that as income of the economy grows over time APC would be falling lower and lower. Simultaneously average propensity to save (APS) would be higher and higher but there will not be enough profitable investment opportunities to absorb the saving. In other words, these economists predicted that economy would experience a long depression of indefinite duration unless government expenditure increases at a faster rate than the aggregate income. This is called the *secular stagnation hypothesis.* The fear this hypothesis poses can be seen with the help of the following aggregate demand equation in real terms.

y (real income) = c (real consumption) + i (real investment) + g (real government expenditure)

Dividing both sides by 'y' we get

$$1 = c/y + i/y + g/y \qquad \dots (5.1)$$

In equation (5.1) notice that c/y is the APC. So, according to Keynes, as y increases over time, c/y keeps falling (conversely, APS = s/y keeps increasing). Due to the lack of profitable investment opportunity during the WW II, it was thought that i/y would not be rising as the economy grew. In other words, in equation (5.1), as y increases, c/y is falling and i/y is not rising. An implication of the above is that, g/y has to increase. Increase in g/y means, government expenditure increases at a faster rate than income (y). Otherwise, the economy will not grow; it will stagnate.

Fortunately, after the end of the WW II, economy did not go into another recession. Although the economy was experiencing higher income in the post-WW II period, it did not lead to large increases in the saving rate (s/y). Hence Keynes' conjecture that APC would fall as income rises did not hold. It implies that the secular stagnation hypothesis miserably failed.

5.2.2 Kuznets' Empirical work

Simon Kuznets (in 1946) studied consumption and income data for a fairly long period, from 1836 to 1938, for the US economy. Kuznets' data brought out two important features of long run consumption behaviour.

First, on an average, the long run APC (c/y) showed no downward trend as proposed by Keynes' consumption function. It remained fairly stable over long time period. The implication the above is that MPC = APC in the long run. Recall that on a Keynesian consumption function, we measured APC as the slope of the straight line connecting the origin and the concerned point on the consumption function. Thus APC keeps on decreasing as income increases. On the other hand, we measured MPC as the slope of the consumption function. Equality between APC and MPC can be established only if the consumption function passes through the origin (see Fig. 5.1).

Second, Kuznets' data suggested that for any year when the APC (= c/y) was below the long run average c/y, it was a boom period. Similarly, any year when the APC (=c/y) was above the long run average c/y, it was a slump period. The explanation behind the above is as follows: in boom year income of the economy is more than the long run average income. According to the Keynesian consumption function APC (c/y) declines as the economy grows and have higher output level. Looking from the other side, for a particular year, suppose c/y ratio is lower than the average c/y ratio. It means it must be a year with higher income than the long run average y and hence that year is the boom period. Similar logic explains the slump period's c/y as well.

Kuznets' empirical finding that the remarkably stable ratio of consumption to income decades after decades refuted Keynes' conjecture that APC would fall as income increases. Kuznets showed that except for the Great Depression years, APC in the US economy was fairly stable over the period 1836-1938; it fluctuated in a narrow range between 0.84 and 0.89. Thus, even if income increased a lot during this time period, consumption remained as a stable fraction of income. This empirical finding by Kuznets made the central principles of the consumption theory by Keynes inconsistent. Milton Friedman (1957) named this seemingly contradictory fact as **"Kuznets' Puzzle"** or **"Consumption Puzzle".**

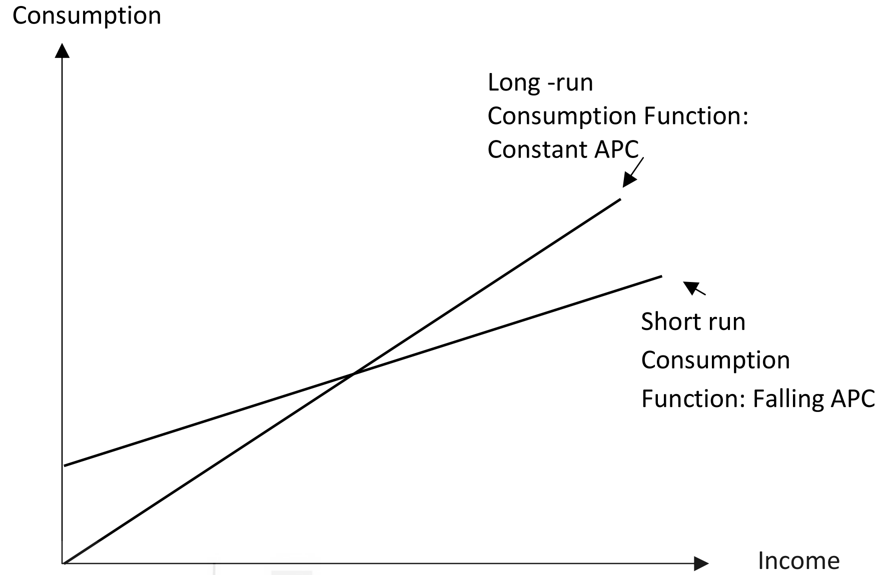

Fig. 5.1: Kuznets' Puzzle
The long run consumption function and short run consumption function exhibited seemingly puzzling or inconsistent relationship of APC with income, y.

In Fig. 5.1 we present two consumption functions as suggested by empirical evidence. The one which is passing through the origin is the long run consumption function based on the studies of long run time series data of aggregate consumption expenditure and income. The long run consumption function indicates having constant APC. On the other hand, the short run consumption function of households based on cross section data and short time series, is flatter than the long run consumption function and having positive intercept. The short run consumption function indicates falling APC.

Keynesian consumption function worked well in the short run as the short run consumption function showed falling APC just as Keynes postulated in his consumption theory. But for the long run time series, the long run consumption function appeared to give a constant APC. So, if we add the time dimension, the APCs relationship with the income turned out to be inconsistent with each other. This is often termed as the **Kuznets' Puzzle.**

The Kuznets' puzzle threw a challenge to economists who tried to explain how these two consumption functions of different time dimensions could be consistent with each other. By the late 1940s it was clear that a theory of consumption should account for three observed phenomena.

1. Cross sectional budget studies (household consumption-income data) show that c/y falls as y rises, so that in cross section of the population, MPC < APC {Consistent with the Keynesian consumption function}.
2. Business cycle or short run data show that c/y ratio is smaller than average during boom and greater than average during slump period. Thus,

in the short run, as income fluctuates, MPC < APC {Consistent with the Keynesian consumption function}

3. Long run data show that as income grows along the trend, MPC = APC. {Inconsistent with the Keynesian consumption function}

Kuznets' findings that consumption is a proportion rather than a mere function of income, economists trying to model consumption theory post-1946 period, needed to explain the apparent effect of wealth/ asset in determining consumption too.

5.3 FISHER'S THEORY OF CONSUMPTION IN TWO-PERIOD MODEL

Keynesian consumption function emphasised the relationship between the current consumption and current income. In Section 5.2 we observed that Keynesian consumption function could not explain the long run consumption behaviour. Intuitively this is not very hard to understand. A consumer knows that her/his current consumption choice depends not only on the current income but also on her/his preference towards future consumption choice, future income and borrowing constraints. More consumption today implies that (s)he will be able to consume lesser tomorrow. This is a trade-off. We all consciously or unconsciously face this trade-off while we choose our action. For example, if a typical student in the current period choose to spend her/his time on binge watching web series in Netflix (leisure), then to pass the semester, tomorrow (s)he will have to study more hours and will have very little time to enjoy leisurely moments. In the case of income-saving trade-off, if you consume less today, you will be able to save more. If you save more, you will receive more interest on your saving, and your future income will increase. Thus, less consumption today implies more consumption tomorrow.

Irving Fisher developed a multi-period model of consumer behaviour in which he showed how a rational, forward looking consumer understands this trade-off, and optimally distributes her/his consumption over time.

5.3.1 Intertemporal Budget Constraint

In order to explain Fisher's intertemporal budget constraint, we assume that there are only two time periods, viz., present and future. We further assume that our representative consumer is rational and lives for only two time periods. We also assume that the consumer has no wealth/ asset at the beginning of the present time period. The consumer receives wage or labour income if (s)he works. Since it is a two-period model, our representative consumer dies at the end of the second time period, i.e., future time period. Hence there is no question of leaving any *bequest* for the future generation; there will be no future generation at the end of the future time period. We use the following notations for building up the model:

Y_1 = Consumer's present time period's labour income.

Y_2 = Consumer's future time period's labour income which is known to the consumer.

C_1= Consumption in the present time period.

C_2 = Consumption in the future time period.

So, the trade-off before the consumer is present consumption (C_1) versus future consumption (C_2). Let us list the array of choice the consumer is facing in Table 5.1.

Table 5.1: Consumer's Choice Alternatives

Consumer's Choice	Implication
Case 1: If the consumer chooses to spend her/his entire income on consumption in each period	$C_1 = Y_1$ & $C_2 = Y_2$
Case 2: If the consumer deposits all her/his income in the bank which pays the real interest rate 'r' in the first period	$C_1 = 0$ & $C_2 = Y_1(1+r) + Y_2$
Case 3: If the consumer chooses to save some of her/his income in the first time period (present time)	$C_1 = (Y_1 – S_1)$ & $C_2 = Y_2 + (1+r) S_1$ (Note that $C_1 < Y_1$)
Case 4: If the consumer spends more than her/his income in the first (present) time period by borrowing at the interest rate 'r'	$– S_1= C_1 – Y_1$ & $C_2 = Y_2 – S_1(1+r)$ (Note that $C_1 > Y_1$)
Case 5: If the consumer plans to spend less than her/his income in the future time	$C_1 = Y_1 + (Y_2 – C_2)/(1+r)$ & $C_2 = (Y_2 – S_2)$ (Note that $C_2 < Y_2$)
Case 6: If the consumer plans not to spend anything in the second (future) time period	$C_1 = Y_1 + Y_2/(1+r)$ & $C_2 = 0$

In Table 5.1 we describe how consumer's income constrains consumption in both the time periods. Note that we use the variable S as saving and borrowings (dis-saving). The consumer needs to borrow when her/his consumption expenditure exceeds her/his income and hence negative saving (–S) is equivalent to borrowing.

Recall that r is the real interest rate. For simplicity we assume that both lending (saved amount of money when lent out) rate and borrowing rate are the same (i.e., 'r').

To derive the budget constraint, let us begin with **Case 3 (**see Table 5.1**)** where the consumer saves S_1 amount ($S_1 = (Y_1 – C_1)$, C_1 is less than Y_1) in the first period, which is being lent out at the interest rate 'r'. So, in the second period, the consumer has second period's income Y_2 and the first period's accumulated saving including interest earned on that saving, i.e., $S_1(1+r)$ at his /her disposal. This total income during the second period has to be consumed in the second period, i.e., there is no bequest (Recall our assumption that the consumer does not leave behind any income at the end of the second period).

Therefore,

$C_2 = (1+r)\, S_1 + Y_2$

or, $C_2 = (1+r)\,(Y_1 - C_1) + Y_2$

Re-arranging the terms, we can write the equation as

$(1+r)\, C_1 + C_2 = (1+r)\, Y_1 + Y_2$

Dividing both sides of the above equation by (1+r) gives us

$$\boldsymbol{C_1 + \frac{C_2}{(1+r)} = Y_1 + \frac{Y_2}{(1+r)}} \qquad \textbf{...(5.2)}$$

Equation (5.2) shows the relationship between the consumption and income during the two time periods. This is the typical way of representing the intertemporal budget constraint of a consumer. Slope of the budget constraint is **(1+r).** Fig. 5.2 shows the graphical representation of the consumer's intertemporal budget constraint.

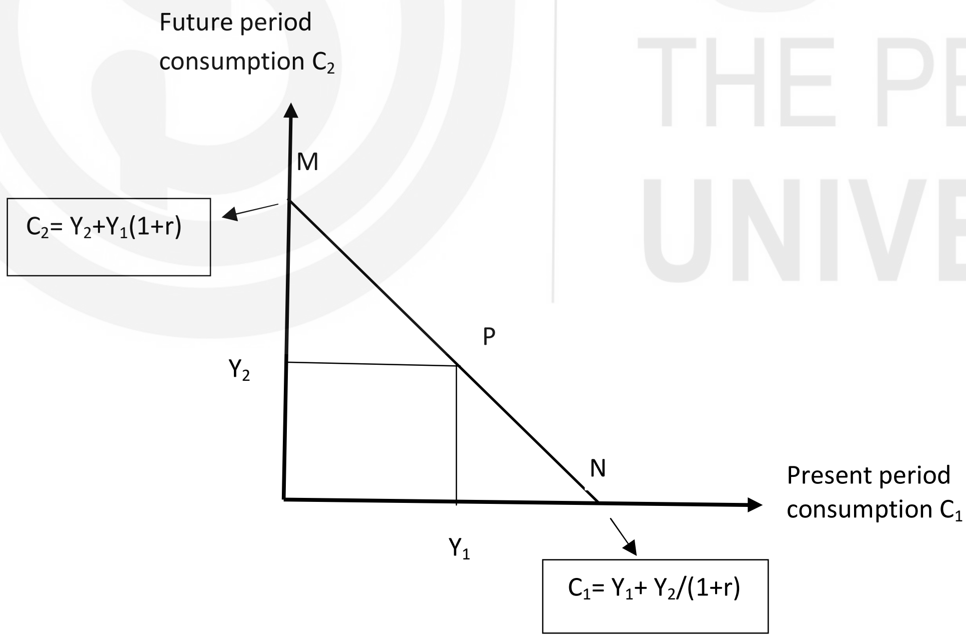

Fig. 5.2: Intertemporal Budget Constraint

More of present period consumption implies less of future period consumption. Thus the budget constraint is downward- sloping.

In Fig. 5.2 the consumer's two-period income is represented by the **point P**. If the consumer saves 1 unit of consumption in the present period, (s)he is depriving himself/ herself of 1 unit of present period's consumption. That saved amount becomes (1+r) units of future consumption. So, the value of the 1 unit of future consumption in terms of the present consumption is just 1/(1+r) of present consumption. That means, the present value of the 1 unit of future consumption is 1/(1+r) of present consumption. Thus, future consumption and future income are discounted by the factor (1+r).

If the consumer's two-period consumption choice coincides with **point P,** which is also the two-period income point, the consumer is neither borrowing nor saving in any of the periods. Therefore, $C_1 = Y_1$ and $C_2 = Y_2$ **[Case 1, Table 5.1].**

Point M on the budget constraint represents Case **2** (see Table 5.1). Here the consumer decides to put all her/his present income in the bank, consumes nothing in the present time period (implies, $C_1 = 0$, $S_1 = Y_1$). In the future time period, (s)he uses her/his future period income Y_2 and the accumulated saving and interest earned on the saving, i.e., $Y_1(1+r)$. Therefore, $C_2 = Y_1(1+r) + Y_2$.

If the consumer chooses any point (on the budget constraint) exhibiting her/his choice of C_1 and C_2, **between point M and point P**, then the consumer is consuming less in the first period and (s)he is saving in the first period **[Case 3, Table 5.1].**

On the other hand, if her/his choice of combination of C_1 and C_2 turns out to be **between point P** and **point N** on the budget constraint, then the consumer is consuming more than (s)he can earn in the first period, hence (s)he is borrowing in the first period **[Case 4, Table 5.1].**

If the consumer chooses any point (on the budget constraint) exhibiting her/his choice of C_1 and C_2, **between point P and point N**, then the consumer is consuming more than Y_1 (i.e., borrowing) in the first period and (s)he is consuming less than Y_2 in the second period **[Case 5, Table 5.1].**

Point N on the budget constraint represents Case **6** of Table 5.1. Here the consumer consumes everything in the present period and nothing in the future time period (implies $C_2 = 0$). So, the present value of her/his future period income, Y_2, becomes $Y_2/(1+r)$. Therefore, present period consumption is $C_1 = Y_1 + Y_2/(1+r)$.

5.3.2 Consumers' Preference

Consumer's utility depends on her/his consumption level of the present time period and future time period. From the individual's utility function, we can have a set of intertemporal indifference curves. Each indifference curve indicates a utility level and the consumer is indifferent between different combinations of present period consumption and future period consumption. The slope of an intertemporal indifference curve measures the rate of time preference for present consumption which is nothing but the MRS (Marginal Rate of Substitution) between future consumption and current consumption.

We have already seen that if the consumer decides to consume more today, he will be able to save less. Consequently, interest on his saving will be less. and interest earned on that saving (or, more will be the debt which needs to be repaid in future time), lesser will be the availability for future consumption. Hence, the slope of the intertemporal indifference curve will be negative.

We assume that the MRS between future and current consumption is decreasing. It implies that each equal successive extra amount of present consumption needs to be compensated by giving up of smaller amount of future consumption, so that the consumer remains on the same indifference curve. To put things in simple microeconomics jargon, the intertemporal indifference curves are convex to the origin.

Individual Consumer's Utility Function: $U = U(C_1, C_2)$

where, $MRS_{C1,C2} = MU_{C1} / MU_{C2} < 0$ and decreasing

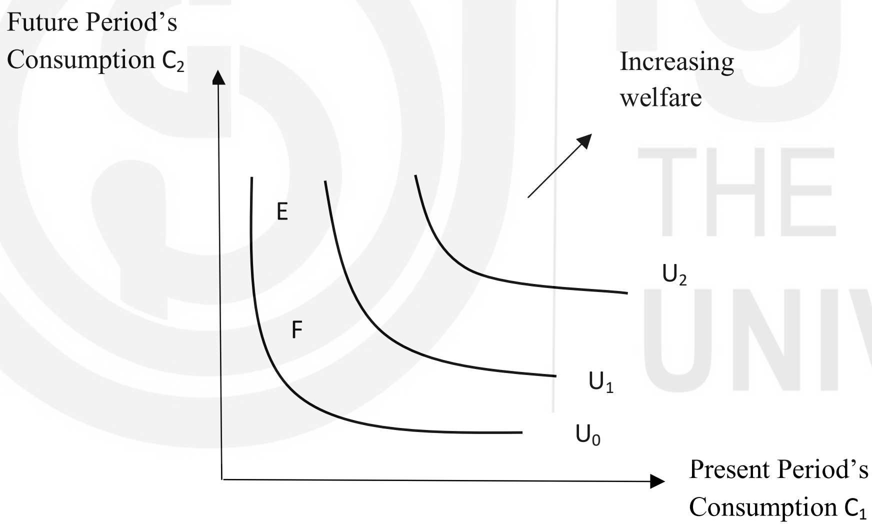

Fig. 5.3: Intertemporal Indifference Map

The set of intertemporal indifference curves represent the consumer's preferences over first (present) period and second (future) period consumption. Higher the indifference curve higher is the satisfaction or welfare level.

If the consumer has lot of one period's consumption and very little of the other period's consumption, then (s)he places a higher value on the scarce commodity (that period's consumption which he has very little). Hence the consumer is ready to give up the abundant commodity (that period's commodity which he was having lot of it) in order to get a little more of the scarce commodity. This explains why the indifference curve is so steep between points E and F.

Check Your Progress 1

1) Distinguish between cross sectional and time series data.

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2) What is meant by secular stagnation hypothesis?

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3) What type of inconsistency is observed in cross-sectional and time series data on consumption? Why is it called Kuznets' puzzle?

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4) Assume that a consumer survives for two time periods. His income in both the time periods are Y_1 and Y_2 while his consumption are C_1 and C_2. Draw the intertemporal budget constraint. Prepare a table to show the alternative consumption levels available to him.

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5.4 CONSUMER'S OPTIMIZATION PROBLEM

Keynesian consumption function, which appeared to work well in cross section studies and short time series, was based on the behavioural nuances of the consumers. But when Keynesian consumption function could not explain Kuznets' puzzle, economists such as Franco Modigliani, Milton Friedman and Robert Hall tried to explain the apparent smoothness of the long run consumption function. They discarded the behavioural approach of Keynes and used the standard tools of optimization.

They relied heavily on the theory of consumer behaviour proposed by Irving Fisher. In such optimization problems, consumers are forward looking rational economic agents, unlike Keynes' consumers who had a very myopic view about relating current consumption to only current income.

Now that we have already discussed intertemporal budget constraint and intertemporal indifference curves, the next question is, how much will the consumer consume so that her/his utility gets maximized subject to her/his budget constraint? If we put together the intertemporal budget constraint and the indifference curves, we have a complete analysis of the consumer's optimum consumption decision. Assuming that the consumer is rational and would like to maximize her/his welfare, (s)he would like to choose the combination of first period consumption and second period consumption that puts her/him on the highest indifference curve possible. This is shown in Fig. 5.4 where the consumer chooses the affordable intertemporal consumption bundle that gives her/him the maximum welfare.

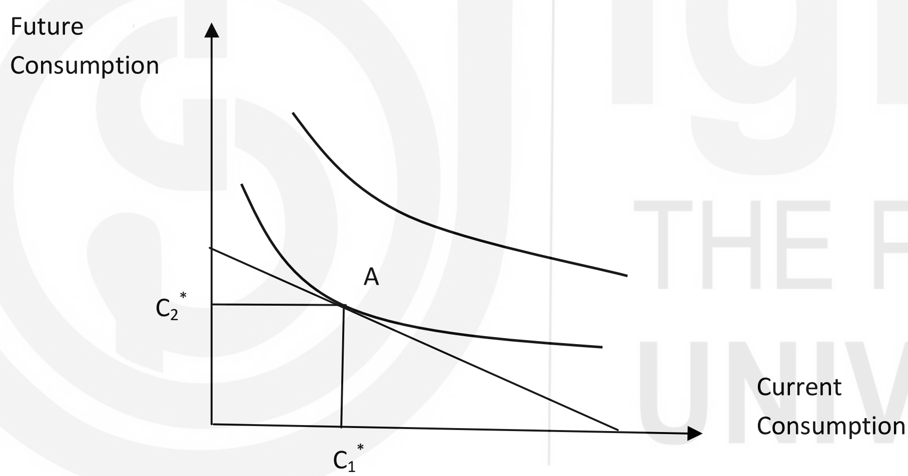

Fig. 5.4: Consumer's Optimal Choice

The optimal consumption level is at point A where an indifference curve is tangent to the intertemporal budget line.

Consumers dislike volatility in consumption – they prefer approximately equal amounts of consumption each year (consumption smoothing). For this reason, consumer equilibrium is not located at either ends of the indifference curve. Of course, if the consumer strongly favours the current period consumption then the consumer's equilibrium would have occurred on the lower segment of the budget line and vice versa. A distinct feature of Irving Fisher's model is that economic agents are not only responsive and tied up to the current income (unlike Keynesian consumption theory), they also have a perfect foresight of the future income. Consumers take into account future income while deciding the current period consumption.

5.4.1 Effect of Change in Income on Optimum Consumption

Now let us discuss how a consumer responds to a temporary one-time increase in income. Let us recall the equation of the budget constraint:

$\mathbf{C_1 + C_2/ (1+r) = Y_1 + Y_2 / (1+r)}$ Budget Constraint Equation

An increase (decrease) in either Y_1 or Y_2 would shift the budget constraint outward (inward). A higher budget constraint allows the consumer to reach a higher indifference curve. Fig. 5.5 explains the case where we see an outward shift of the intertemporal budget constraint due to an increase in income (of either period). The consumer revises her/his consumption and (s)he chooses more of both present consumption and future consumption.

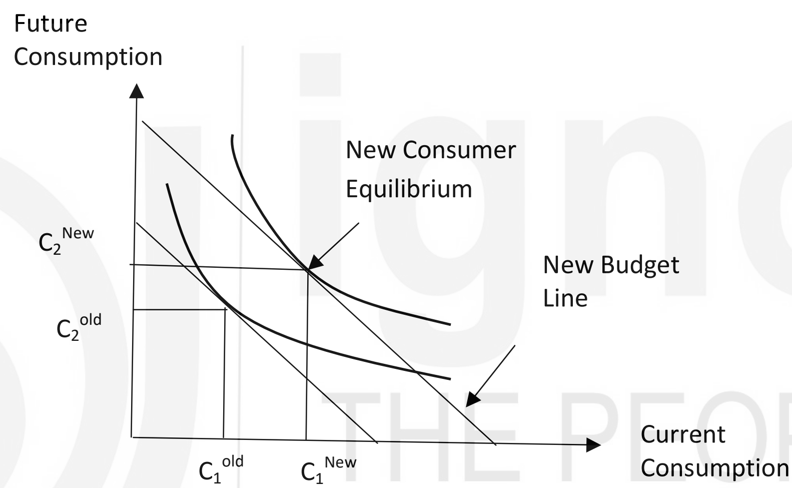

Fig. 5.5: Effect of Increase in Income on Optimum Consumption

The budget line has shifted outward due to an increase in either the current period's or the future period's income. The consumer now consumes more in both time periods.

In Fig. 5.5 the indifference curves are drawn under the assumption that consumption in both periods are normal goods. The assertion is pretty simple, as it is obvious from the diagram that whenever the income of any period increases, consumption of all periods increase. Such spreading the incremental income over consumption in both periods, regardless of which period's income increases is called *consumption smoothing*. This is happening because unlike the Keynesian consumption theory, the consumer is forward looking and either period's increase in income has incremental impact on the present value of income. This in turn has positive impact on the consumption in both periods.

Present value of income = $Y_1 + Y_2 / (1+r)$

Similarly, present value of consumption = $C_1 + C_2/ (1+r)$

So, Fisher's intertemporal model suggests that present value of consumption depends on present value of income stream. That gives us the general formulation of the theory as follows:

$$C_t = f(PV_t);\ f' > 0 \qquad \text{...(5.3)}$$

Equation (5.3) is nothing but rewriting the intertemporal budget constraint for two or more time periods. Here t indicates the time period. So, consumption of any time period, C_t, does not solely depend on the income of time period t; rather it depends on the present value of the consumer's future income stream (life time income), PV_t.

You should note that every consumer mentally discounts future satisfaction arising out of future consumption. The rate at which (s)he discounts the future satisfaction is subjective, and depends on the nature of the consumer. Some consumers are impatient; they do not want to wait for the future time period. Such consumers have a greater time preference and they apply a *higher* discount rate on future income. When income of either time period increases, consumption of both time periods being normal goods, the consumer spreads her/his incremental income on both period's consumption. But if we assume that the consumer is impatient, he will allocate *higher* fraction of her/his incremental income on present consumption and lower fraction on tomorrow's consumption. On the other hand, if the rate at which the consumer discounts the future is zero, and income increases in either period, then the consumer allocates his incremental income *equally* on both period's consumption.

5.4.2 Effect of Change in Interest Rate on Optimum Consumption

In intertemporal optimisation, interest rate plays an important role on the level of consumption. The effect of interest rate on consumption, however, is a bit complex. Fisher's model shows that, depending on consumer's preferences, changes in the real interest rate could either raise or lower consumption.

There are two types of consumers in the present time period: (i) the consumer spends more in the current time period than his/her current period income (i.e., there some borrowing in the current period), and (ii) The consumer spends less in the current period than his/ her income (i.e., there is some saving in the current period). Accordingly, in the first case (s)he is a *net borrower* and in the second case (s)he is a *net lender*. Let us discuss the case where the consumer is a net lender. The other case (net borrower) is an assignment you should attempt yourself.

Let us look into the intertemporal budget constraint again,

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) \qquad \text{... (5.2)}$$

Let us take the case where there is an increase in the real rate of interest. The slope of the budget line is (1+r); so, there is an increase in the slope (with the same amount of saving in the first period, the consumer now earns higher interest earnings; his/her consumption in the second period increases). Remember that there is no change in the income of any period; only the interest rate has increased. Consider an individual with income stream (Y_1, Y_2). If (s)he consumes (Y_1, Y_2) she will be at point P in Fig. 5.6. However, (s)he is net lender, as we have assumed. So, the new budget line (dotted line) will be passing through the point P in Fig. 5.6 and a rise in the interest rate will make the new budget line steeper. The intertemporal budget constraint rotates through point P in a clockwise direction.

In Fig. 5.6 the consumer is a net lender in the current time period. This simply means that his/her current period consumption (C_1) is less than his/her current period income (Y_1). How would the increase in the rate of interest effect his/her consumption in both the time periods? The total effect can be decomposed into two parts: Income Effect and Substitution Effect.

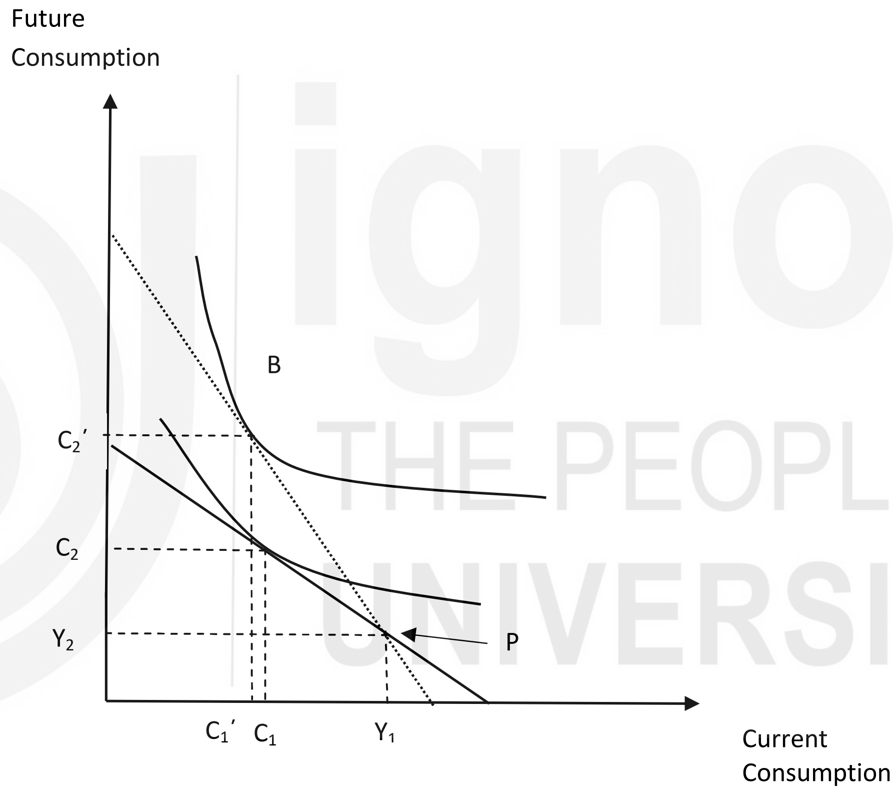

Fig. 5.6: Effect of Increase in Interest Rate

When the consumer is a net lender in the current time period, an increase in the rate of interest reduces his current period consumption and increases his future period consumption.

Substitution Effect: The substitution effect is the change in consumption that results from the change in the relative price of consumption in both the time periods. When the rate of interest increases, every unit (s)he saves, enable her/him to consume more in the future period than before. Therefore, the opportunity cost of current consumption or the relative price of current consumption, which is (1+r) has gone up. Following the same logic, the relative price of future consumption, 1/(1+r) has gone down.

Substitution effect will influence the consumer to reduce current period consumption and increase future period consumption.

Income Effect: The income effect is the change in consumption in both the time periods due to the change in income of the consumer.

Here although neither Y_1 nor Y_2 has increased, but keep it in mind that the consumer is a net lender or saver. So, when the rate of interest increases, interest income on his/ her saving has increased. So, his/her stream of life time income has increased. As we assume that consumption is a normal good, the income effect would increase consumption in both the periods.

The consumer's choice depends on both the income effect and the substitution effect. Both the effects have incremental impact on the future period consumption. So, unambiguously future period consumption will increase. But same cannot be said about the current period consumption. In Fig.5.6 we have shown the case where the substitution effect dominates the income effect, thus the higher interest rate reduces the current period consumption of the consumer.

Applying the same analogy, we can analyse the case of the consumer being a net borrower. We can also analyse the impact of a decrease in the rate of interest on consumption. These are left as exercises which you should do yourself.

5.4.3 Constraints on Borrowing

We assumed that could be net lender (saver) or net borrower in the present time period. When he is a net borrower, he consumes some of his future consumption in the present time period. But in reality, there is limit to which the consumer can borrow; that is called 'borrowing constraint'. So, in addition to the intertemporal budget constraint, the consumer faces the following borrowing constraint:

$$C_1 \leq Y_1 \quad \text{…(5.4)}$$

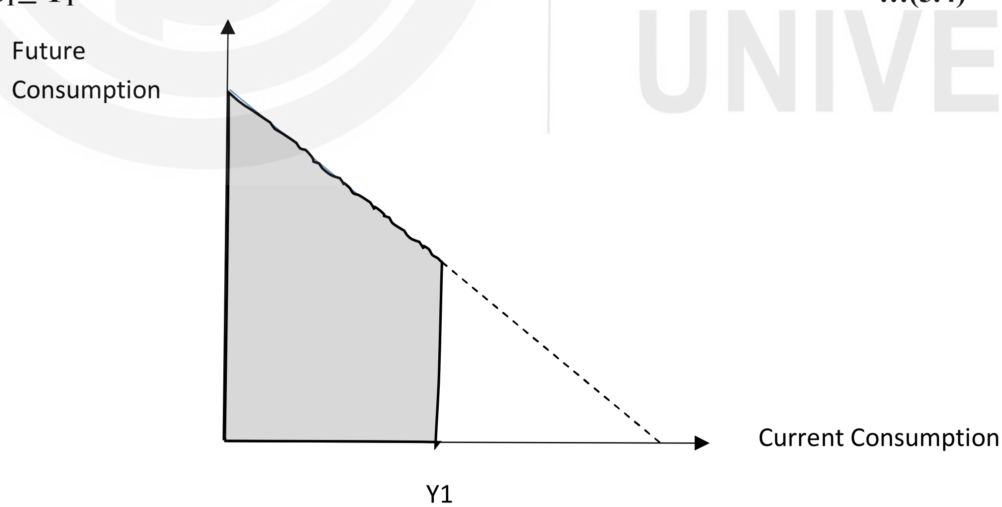

Fig. 5.7: Consumption Choice Set under Borrowing Constraint

The consumer facing the borrowing constraint will have the shaded region as his choice set of consumption of both the periods.

These two constraints, equations (5.2) and (5.4), shrink the choice set of the consumer. The shaded region of Fig. 5.7 shows the limited choice set of the consumer.

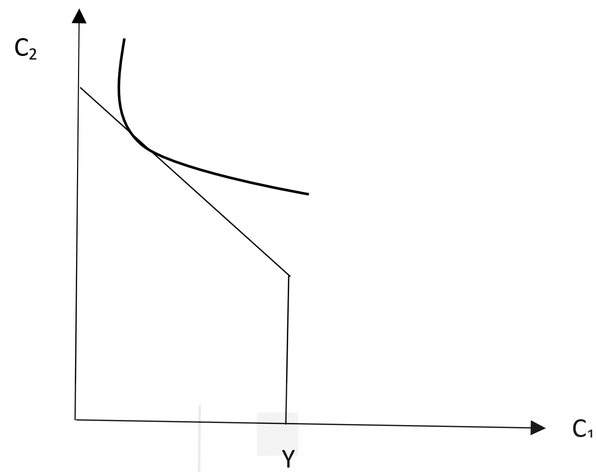

Fig. 5.8: Borrowing Constraint is not Binding

The consumer chooses the first period's consumption to be less than the income. So, the borrowing constraint is not binding on him and equilibrium consumption is unaffected.

As mentioned earlier, there are two types of consumers: net saver and net borrower. Net saver consumes less than his income in the current time period. Net borrower, on the other hand, consumes more than his income in the present time period. Borrowing constraint is equally applicable on both types of consumers. The only difference is when the consumer is net saver, (s)he will not face the brunt of the borrowing constraint and there will be no change in his/her equilibrium point. Thus, the borrowing constraint is not binding on the net saver (see Fig. 5.8). On the other hand, if the consumer is a net borrower, (s)he would like to consume more than her/his income in the first period, but (s)he cannot do so due to the borrowing constraint. So, (s)he will be restricted to limit her/his first period consumption by the first period income. Hence the borrowing constraint is binding on the net borrower (see Fig. 5.9).

Notice a very interesting fact. When the consumer is a net saver, the borrowing constraint is there; but it is not binding. Hence the consumer is facing only the intertemporal budget constraint like before. Therefore, her/his consumption of both periods depends on the present value of her/his lifetime income, i.e., $Y_1+Y_2/(1+r)$. On the other hand, when the consumer is a net borrower in the first period, the borrowing constraint is binding on her/him. In this case due the presence of the borrowing constraint, the consumer is compelled to restrict her/his present-day consumption to his present-day income. Therefore, her/his consumption function is: $C_1 = Y_1$ and $C_2 = Y_2$. This just looks like the Keynesian consumption function, where current consumption depends on the current income exclusively.

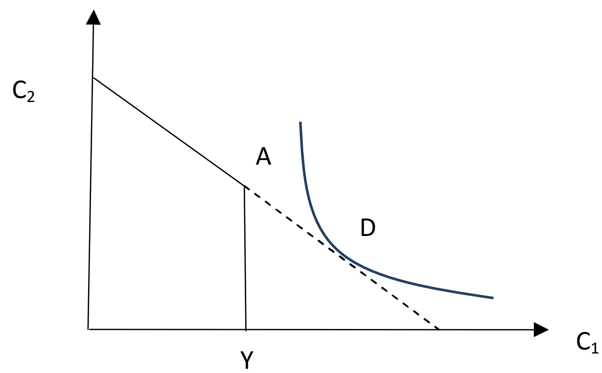

Fig. 5.9: Borrowing Constraint is Binding

The consumer would like to consume more than his income and choose the equilibrium point D. But because of the borrowing constraint he is compelled to choose the best available consumption of the first period at A, i.e., the first period income. The borrowing constraint is binding on him.

Check Your Progress 2

1) In the Fisher's two-period model assume that consumption is a normal good and the consumer is a net borrower. If there is an increase in the rate of interest, analyse its impact on consumption of both the time periods.

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2) Assume that in the Fisher's two-period model, the consumer is a net borrower in the first period. If the rate of interest rate decreases then discuss the income and substitution effects on consumption in both time periods.

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5.5 LET US SUM UP

In this unit we have seen the departure from the traditional Keynesian concept of consumption theory. In the basic Keynesian model consumption is dependent on current income and MPC is less than APC. The Keynesian model is primarily a short run model. During the WW II, Kuznets' work on the US economy over a long period of time invalidated the Keynesian proposition on consumption theory. It came as a puzzle or paradox to economists and policy makers.

In trying to find answers to Kuznets' puzzle, economists such as Franco Modigliani, Albert Ando, Richard Brumberg, Milton Friedman and Robert Hall used the Fisher model of optimization of consumer behaviour to study the features of the consumption function. Fisher offered a new idea where consumers optimize their life time utility function subject to the intertemporal budget constraint. According to Fisher, consumption depends on a person's lifetime income.

5.6 ANSWERS/ HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Time-series data is a set of observations collected at usually discrete and equally spaced time intervals. It is a dataset over a period of time. Cross-sectional data are observations that come from different individuals or groups at a single point in time.
2) According to Keynesian consumption function, there is a decline in average propensity to consumer (APC) as income increases. Consequently, average propensity to save (APS) will increase. This tendency is accompanied by declining opportunities for investment, which will cause stagnation in output. Go through Sub-Section 5.2.1 and answer.
3) The cross-sectional data shows that MPC < APC. The long-run data shows that MPC = APC. It is called Kuznets' puzzle, as it was first pointed out by Simon Kuznets. Go through Section 5.2 for details.
4) Refer to Fig. 5.2 and Table 5.1; and elaborate.

Check Your Progress 2

1) Here, the consumer is a net borrower and there is an increase in the rate of interest. The increase in rate of interest would decrease the consumer's stream of life time income (since the present value of future income less; it is discounted). Since we assume that consumption is a normal good, there will be a relative decline the consumption in both the time periods due to income effect. As a result of substitution effect, current period consumption will fall and future period's consumption will increase.

If the substitution effect is stronger than the income effect, the current period's consumption would fall unambiguously and the future period's consumption would increase. You should draw the diagram as per Fig. 5.6.

2) If the consumer is net borrower in the current time period then his current consumption expenditure exceeds the current period income. As the rate of interest decreases, opportunity cost of current consumption falls and the relative price of future consumption increases. Due to the substitution effect the consumer would consume more than before in the current period and less than before in the future time period. Since the consumer is a net borrower, a decrease in the rate of interest makes him richer. Thus, due to the income effect both future consumption and present consumption could rise. If the substitution effect is stronger than the income effect, then current consumption will increase and future consumption will fall. On the other hand, if the income effect is stronger than the substitution effect, then both present consumption and future consumption will rise. It would be a good idea if you try to draw the diagram for the same and see the effect yourself.

UNIT 6 INTERTEMPORAL CHOICE - II*

Structure

6.0 OBJECTIVES

After going through this Unit, you will be in a position to

- explain the reasons for differences in saving rate across countries;
- identify the determinants of consumption;
- explain the dynamic relationship between consumption and income;
- bring out the salient features of life cycle hypothesis
- bring out the important features of permanent income hypothesis.

6.1 INTRODUCTION

It was pointed out in the previous Unit that consumption function based on cross-section data has a different shape than consumption function based on time series data. Household surveys at a point of time shows that MPC < APC. Long run time series data, however, shows that MPC = APC. Thus, analyses on the basis of long run data are not consistent with Keynes' fundamental psychological law of consumption. This inconsistency is known as Kuznets' Puzzle, as it was brought out by Simon Kuznets.

There have been several attempts to reconcile the inconsistency between the shape of the short-run and long-run consumption functions. We will discuss two

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hypotheses in the present Unit: (i) life cycle hypothesis, and (ii) permanent income hypotheses.

6.2 LIFE CYCLE HYPOTHESIS

In line with Irving Fisher's two-period intertemporal model (1930), Franco Modigliani, Richard Brumberg and Albert Ando in the 1950s through their series of papers developed a model called 'Life Cycle Hypothesis' (LCH). According to this hypothesis, individuals maximise their lifetime utility. In this model we consider a representative consumer who is rational and forward looking. He optimally allocates his resources on consumption at any period of time on the basis of his life time resources (present value of labour income and bequest, if any) and not at all on his current level of income. The life cycle hypothesis points out that 'one *of the important motives for saving is the need to provide for retirement'*. You should note that income varies systematically over people's lifetime. People save during high income phase, so that they maintain a smooth consumption path throughout their life.

6.2.1 Description of the Model

The basic (stricter version) model which describes the life cycle path of saving and wealth has various stylized assumptions about consumer's opportunities and preferences. These are

(i) Income of the representative consumer is constant until his retirement and zero thereafter.
(ii) The consumer is rational and forward looking. He has a finite lifetime.
(iii) The consumer prefers to have constant consumption throughout his life.
(iv) The consumer does not leave anything for the bequest purpose.

One of the major sources of income variation for an individual is retirement. Most people expect to have a fall in the income (in our basic model it falls to zero) when they retire. Yet they would like to maintain more or less the same life style (in our basic model it is exactly the same) in terms of consumption. The only way to maintain the same life style after retirement is to save during their working years. This kind of saving is called 'hump saving', saving which is done in order to be able to spend it at some later stage of life.

Let us assume that the representative consumer started to work at the age of 20 years and at the age 65 years he retires. Also, assume that he is expected to live till 85 years and expects to earn Y per year (Labour Income) till he retires. When he started work at the age of 20 years, he had wealth W.

The span of his working life = (65 – 20) = 45 = WL

The Life time resources = Working Life Span × Average Labour Income = WL × Y

Counting from the age 20, number of years he lives = NL = (85-20) = 65

The individual is supposed to spread his life time resources (WL × Y) over his lifetime (NL) to allow himself annual consumption C = (WL × Y)/NL

Under these conditions, the consumer must on the average save in the earlier part of his life in order to accumulate a stock of wealth (retirement insurance) which will eventually be used to support consumption through dis-saving in the later part of his life. In **Fig. 6.1** we illustrate the consumer's income, consumption, and wealth over his lifetime. In the figure, the bright orange line indicates the flow of income which stops at retirement. The consumer will save during the working years so that he maintains constant level of consumption throughout his life.

The assumption of non-growing population signifies that the size of the younger population is roughly the same as the older population. An implication of the above is that aggregate rate of saving would be zero as positive saving of younger households would be offset by the dis-saving of the retired households. Wealth will remain constant in aggregate though it is continuously being transferred from the dis-savers to the savers.

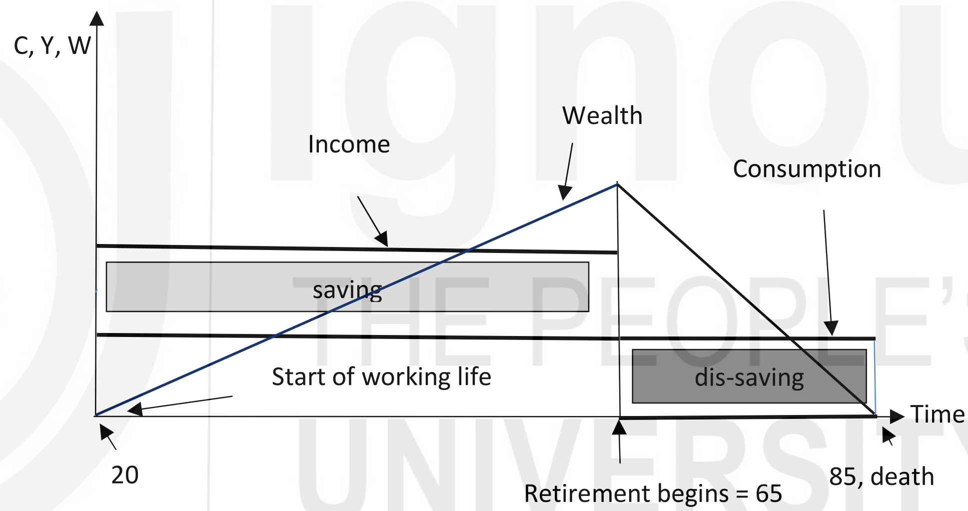

Fig. 6.1: Consumer's Wealth Accumulation over Life Cycle

The consumer likes to have smooth (constant) consumption throughout his life. He saves and accumulates wealth during his working years. He depletes wealth with dis-saving during his retirement years leaving no bequest.

Now let us assume that life of the consumer is divided into three phases, viz., youth, middle age and old age (in mathematical formulation of the model, in the next sub-section, we will extend it further to *t* time periods). The consumer works during the first two phases and leads a retired life during the third phase (see Fig. 6.2). In the youth phase, when the consumer just started work, his income is low. As he knows that he will be earning more during his middle age, he will tend to dis-save during the youth phase. In the middle years, income rises to peak and the individual saves to repay his earlier debts and provide for the retirement years. When individuals reach their retirement phase of life, their income (pension which he receives due to his past work) significantly falls and they make it up by the savings they made during working years. Hence, there are two periods of dis-saving, viz., early working years (youth phase) and retirement phase. It implies that there is only one phase of saving, i.e., middle age. Therefore, one's saving is determined by one's stage in the life cycle.

Let us assume that the present value of the future utility what the representative consumer is supposed to be derived from the future consumption is discounted at the rate δ. When a consumer forgoes a unit of present consumption, it becomes saving. The return from the saving is 'r' and it allows the consumer to enjoy r units of future consumption. If $\delta < r$ then the intertemporal consumption relation reveals that it pays to save so that one can consume later. Thus, the consumption path of the individual consumer would be rising over time.

In Fig. 6.2, we measure consumption, income and wealth on y-axis, while x-axis indicates time. We depict an upward sloping consumption line. The income line is given by inverted-U shaped red line. You should notice that consumption line is above the income line in the first and third phases; thus there is dis-saving. In the second phase, income is more than consumption; thus there is saving.

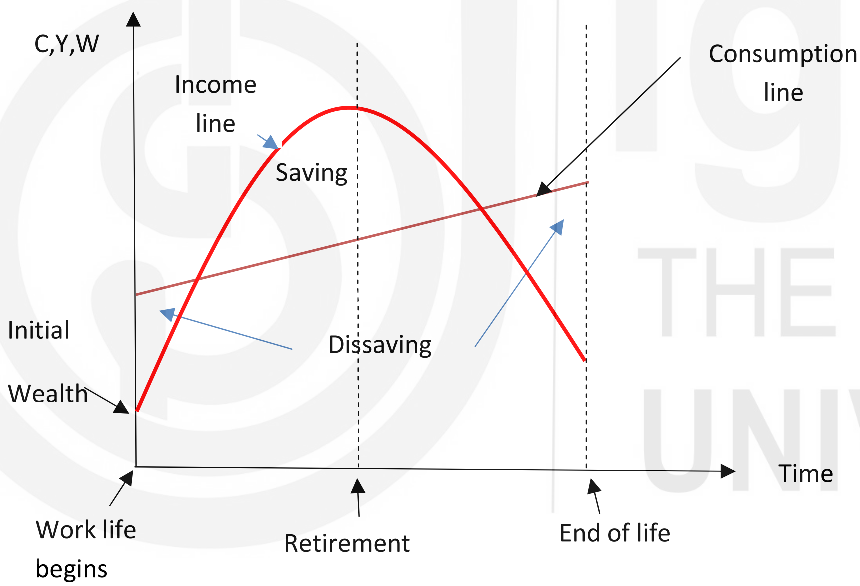

Fig. 6.2: Consumption, Saving, and Income in a Person's Life Cycle

The consumption and saving decision of a person, at each point of time, reflects the conscious attempt of the person to achieve his/ her preferred distribution of consumption over life cycle subject to the constraints.

In a static economy, the basic assumption of zero net aggregate saving implies that aggregate stock of wealth will remain constant over time. Suppose we allow the economy's population to grow but retain the basic assumptions of constant income and consumption throughout life with no bequest. In that case, the ratio of the younger population in the accumulation phase will be higher than the older population in their dis-saving phase. This will give rise to positive net aggregate flow of saving; there will be growth in the stock of wealth.

Now let us assume that there is no population growth, but there is growth in income over time due to the growth in productivity. As a result, successive cohorts (age groups) will be earning higher income than the preceding one. Hence, each successive cohort will enjoy a higher level of consumption (though the consumption level remains constant throughout life of that cohort) than the earlier cohort. As a result, any active cohort will aim to have a larger consumption path for themselves than the consumption level enjoyed by the existing retired cohort. To support this larger level of consumption, the active households will have to save on a scale exceeding the dis-saving of the existing retired group of households. It means that even if we have stationary population, there will be net positive aggregate saving and growing stock of wealth in the economy. In fact, if income tends to grow at a constant rate, then both saving and wealth will tend to grow at the same rate implying a constant saving-income and wealth-income ratio.

6.2.2 Mathematical Treatment of the Model

We have seen in Section 5.3 of Unit 5 that in Fisher's two-period model that if consumption is not an inferior good, then whenever any period's income rises, consumption in all periods rises. Let us extend the analysis to a multi-period framework. The implication of the model is that consumption of current period does not depend on the current period's income, rather it depends on the present value of the consumer's entire income stream. The relationship between the present value of the income stream and current consumption gives us the first general formulation of the consumption function, [recall equation (5.3) from previous Unit]

$$\mathbf{C_t = f\,(PV_t)\ ;\ f' > 0} \qquad \ldots(5.3)$$

where the PV_t is the present value of current and future income at time t. It can be given by

$$PV_t = \sum \frac{y_t}{(1+r)^t}$$

The present value of income for the t[th] period, y_t, is given by $\frac{y_t}{(1+r)^t}$. We add the stream of income for all time periods. t = 0 to T periods.

We can write the utility function of the consumer as

$$\mathbf{U = U\,(C_0, C_1, C_2, \ldots, C_T)} \qquad \ldots(6.1)$$

where the consumer lives for T more periods starting from his working life years (assumed to be '0' here)

In a multi-period model let us assume that the underlying utility function is logarithmic, additively separable over time, and future utilities are discounted at the discount rate δ. We have to find out the first order condition of the utility maximization subject to the budget constraint $\sum \frac{C_t}{(1+r)^t} = \sum \frac{y_t}{(1+r)^t}$ for the representative consumer.

For consumer i, if PV_t^i rises, all his C_t^i will rise more or less proportionately.

Therefore, for an individual consumer i we can write his consumption function as

$$C_t^i = k^i(PV_t^i); 0 < k^i < 1 \qquad \ldots (6.2)$$

Here k^i is the proportion of the present value of the representative consumer i's income which he spends on current period consumption.

If the population distribution by age and income is relatively constant, and tastes between present and future consumption (shape of the indifference curves) are stable through time, we can add up all the individual consumption functions in equation (6.2) to a stable aggregate consumption function,

$$C_t = k(PV_t) \qquad \ldots (6.3)$$

Ando and Modigliani, divided the PV of income term in equation (6.3) into labour income (y_t^L) and property income (y_t^P). We discount both types of income by interest rate r. Let us take '0' as our current period,

$$PV_0 = \sum_{t=0}^{T} \frac{y_t^L}{(1+r)^t} + \sum_{t=0}^{T} \frac{y_t^P}{(1+r)^t} \qquad \ldots (6.4)$$

So, the present value of the income stream is the present value of labour income plus the present value of property income.

If we assume that the property market is reasonably efficient and stable, then the present value of the property income is the value of the property itself, that is, $\sum_{t=0}^{T} \frac{y_t^P}{(1+r)^t} = a_0$. Therefore, equation (6.4) can be written as,

$$PV_0 = y_0^L + \sum_{t=1}^{T} \frac{y_t^L}{(1+r)^t} + a_0 \qquad \ldots (6.5)$$

Now notice that in equation (6.5), the present (current) of labour income (y_0^L) is observable and the property income a_0 are observable and known to the consumer. But the future incomes $y_1^L \cdot \cdots y_T^L$ are not observable and at the most can be guessed. Now it would be very difficult for the consumer to guess each future year's income. Let us assume that there is an average expected labour income y_0^e (expectations formed in time '0' about future income). So, leaving the current period '0', the present value of the future (T-1 periods) income (the second term of the equation (6.5) will be equal to $(T-1)y_0^e$. Therefore, equation (6.5) can be written as

$$PV_0 = y_0^L + (T-1)y_0^e + a_0 \qquad \ldots (6.6)$$

Now let us see how we can determine the value of the average expected labour income y_0^e. Ando and Modigliani suggest that the average expected labour income is just a multiple of the present-day labour income, that is,

$$y_0^e = \beta y_0^L \qquad \ldots (6.7)$$

where β is the multiplier and greater than zero.

The above assumption implies that if current income rises, people adjust their expectations for future income upwardly. Consequently, there is an upward shift in the present value of the income stream.

Since current consumption depends on the present value of the income stream (equation 6.5), the current consumption moves up too. Through this chain of reasoning, we can say that a shift in the current period income may shift the present value of peoples' income stream substantially (since β could be large). It can have a much larger effect on current consumption.

Substituting $y_0^e = \beta y_0^L$ in equation (6.6) we get,

$$PV_0 = [1+\beta(T-1)]\, y_0^L + a_0 \quad \dots (6.8)$$

Substituting the above in equation (6.3) we get

$$C_0 = k\,[1+\beta(T-1)]\, y_0^L + k a_0 \quad \dots (6.9)$$

Equation (6.9) is the Ando-Modigliani consumption function followed from the LCH. Notice that for any time period t, this consumption function has an intercept, ka_t and a positive slope, $k\,[1+\beta(T-1)]$. The marginal propensity to consume (i.e., the slope of the consumption function) is the coefficient of y_t^L, that is, $k\,[1+\beta(T-1)]$.

A representative statistical estimate of the equation (6.9) based on the work of Ando- Modigliani on annual US data, is

$$c_t = 0.7 y_t^L + 0.06 a_t \quad \dots (6.10)$$

Thus, according this estimate the MPC out of the labour income is 0.7 and MPC out of the wealth is 0.06. Remember that we will come back to this conclusion later when in Section 6.3 we discuss Friedman's Permanent Income Hypothesis.

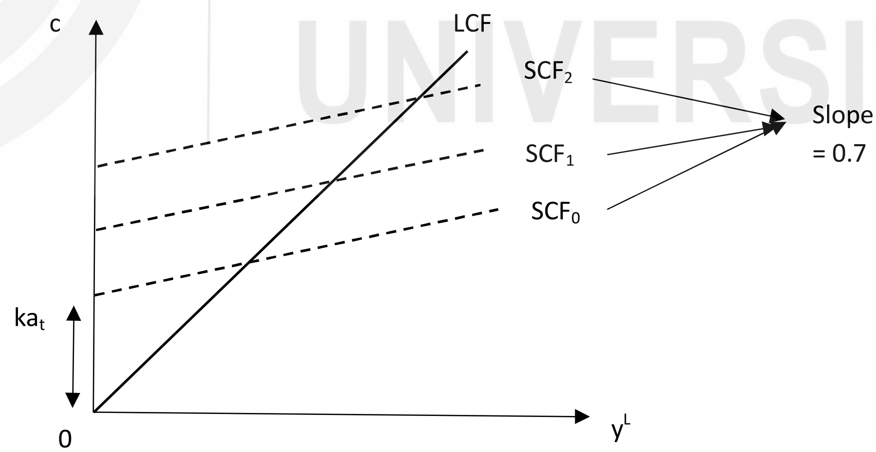

Fig. 6.3: Ando and Modigliani's Consumption Function

With increase in income, there is increase in saving and assets. This shifts the Short Run Consumption Function (SCF) upward. Tracing these SCFs we get the Long Run Consumption Function (LCF). In the short run, Ando-Modigliani's consumption function looks like Keynesian Consumption Function where APC falls as income increases. In the long run APC remain constant unlike Keynes'.

According to the LCH, the relationship between the consumption and current income is non-proportional as seems to be the case in the short run time series estimate (equation 6.10). The intercept of the consumption function in equation (6.10) is set by the level of asset, a_t. In the short run the cyclical fluctuations with assets is fairly stable. So, the short run consumption function is a positively sloped line with positive intercept, ka_t. Remember that the intercept is not constant over time. In the long run as saving rises, there is a rise in assets (a_t) too. Thus, the consumption function shifts upward as illustrated in Fig. 6.3. The shifting short run consumption functions trace out a long run consumption function as depicted in Fig. 6.3. In the figure, we depict short run consumption function (SCF) with slope 0.7 and long run consumption function (LCF) passing through the origin.

If we divide both sides of equation (6.10) by total real income y_t then, we get

$$\frac{c_t}{y_t} = 0 \cdot 7\frac{y_t^L}{y_t} + 0.06\frac{a_t}{y_t} \qquad \ldots(6.11)$$

In equation (6.11), the average c/y is the sum of two ratio: (i) share of the labour income in total income $(\frac{y_t^L}{y_t})$, and (ii) share of capital output ratio $(\frac{a_t}{y_t})$. If these two ratio are constant, then c/y will be constant. Ando-Modigliani's empirical work on the US data confirmed that c/y is constant in the long run.

Ando-Modigliani's consumption function (see Fig. 6.3) confirms three observed phenomena: (i) It explains the $MPC < APC$ result of cross sectional budget studies; (ii) It explains the long run constancy of APC; and (iii) it includes assets as an explanatory variable in consumption decision.

6.2.3 Limitations of the Model

The life cycle hypothesis is somewhat attractive in the sense that it remains close to Fisher's original intertemporal optimization. It brings out many important factors such as population growth, productivity growth, income growth, social security measures, saving plans, etc. into the analysis. It discusses the impact of these factors on net aggregate saving flow for the economy and of the wealth stock of the economy. The life cycle hypothesis, however, has been criticised on certain grounds.

The relationship between age structure of the population and aggregate saving n the economy is a debatable issue. In the two-period model, if there is population growth then the number of savers will be higher than the number dis-savers. This may lead to a situation where there is positive net saving in the economy. Further, it is unrealistic to assume that the income of retired people is zero. There are various social security measures such as old age pension for retired people.

If we take equation (6.10) literally then all increase in the current labour income would increase the current consumption by 70 per cent, which is somewhat on the higher side.

This conclusion was made possible because of Ando-Modigliani's approximation of the relationship between the current labour income and average expected labour income (Recall $y_0^e = y_0^L$).

Simple life cycle hypothesis cannot fully explain the dis-saving behaviour of the elderly people. Studies suggested that elderly people do not dis-save as quickly as suggested by the model. The elderly does not run down their wealth as quickly as expected in the model, due to their concern for unpredictability of expenses and desire for leaving bequest.

Check Your Progress 1

1) Suppose a person starts his life at age 20, plans to work until age 65, and will die at 80. The annual labour income is Rs. 30,000. He spreads his lifetime earning over the number of years of life. What would be his annual consumption expenditure? Find out marginal propensity to consume (MPC).

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2) Suppose a person lives for 4 periods and earns ₹ 30, ₹60, ₹90 in the first three periods, and ₹ 0 in the 4th period when he is retired. Assume that the interest rate is zero. He wants to maintain a constant consumption stream throughout his life cycle. Determine in which period he saves the most? The person received a wealth ₹15 at the end of the first period unexpectedly. How much will be the change in the consumption expenditure of the person, second period onward, if he recalculates?

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6.3 PERMANENT INCOME HYPOTHESIS

Milton Friedman developed the permanent income hypothesis (PIH) in his 1957 book '*A Theory of Consumption Function*'. The basic argument of the PIH is that people plan their current consumption on the basis of their average expected income over their lifetime and, not on the basis of their current period income. The permanent income hypothesis describes how a household's consumption and saving decision are affected by changes in its permanent income. The permanent income hypothesis provided an explanation for Kuznets' consumption puzzle. Further, the permanent income hypothesis questioned some of the Keynesian ideas of demand management. According to Friedman, there are two components of income: permanent and transitory.

According to PIH, a household does not alter its consumption pattern if the household perceives that the income change is temporary or transitory.

6.3.1 Description of the Model

The concepts 'permanent income' and 'permanent consumption' play critical role in the theoretical analysis of PIH. Both these terms are not readily observable by the individual consumer unit, households.

Let y be the measured income of a consumer during a time period, say a year. Friedman treated measured income as a sum of two components: a permanent income (y_P) and transitory income (y_t).

$$y = y_p + y_t \quad \text{...(6.12)}$$

Permanent income is that component of income which depends on factors such as accumulated saving of the consumer, his skill, his ability, occupation, location of the economic activity, etc. On the other hand, transitory component of income can be interpreted as accidental, unforeseen and unpredictable. Some of the factors giving rise to transitory income component are individual consumer specific (for example, illness, bad guess, etc.). There could be group specific factors as well behind transitory income (for example, impact of draught in a locality, pandemic effect of a virus on migrant workers, etc.). If we consider the individual specific factors, then for a group of random consumers, the resulting transitory component would average out and the mean measured income of the group would be equal to the mean permanent component of income. It implies that mean transitory income would be zero.

Similarly, c represents, consumer's measured consumption and is made up of two parts: permanent component (c_p) and transitory component (c_t).

$$c = c_p + c_t \quad \text{... (6.13)}$$

Like before, some of the factors giving rise to the transitory component consumptions are individual consumer specific (such as sudden illness), and some are group specific (such as extended harsh winter or bountiful harvest). In the former case, the transitory component will average out (it implies mean transitory consumption of the group would be zero) and in the latter case, either the mean transitory consumption would be positive or negative depending upon the situation. Note that individual consumer is not expected to attach precise meaning to the term 'permanent'. The distinction between permanent and transitory is intended in the theory to be interpreted by the actual consumption and income data corresponding to the consumer's behaviour.

Friedman along with Ando-Modigliani, assumes that the consumer wants to smooth his consumption during his lifetime. This gives rise to the equation which describes the relationship between the permanent income and permanent consumption, where a consumer's permanent consumption is proportional to his permanent income.

$$c_p^i = k^i y_p^i \quad \text{... (6.14)}$$

In equation (6.14) the superscript i represents individual consumer. The k^i in equation (6.14) depends on (i) the rate of interest at which the individual consumer lends or borrows, (ii) relative importance the individual consumer attaches to property and non-property income, and (iii) the individual's tastes and preferences towards consumption vis-à-vis saving. If we assume that these factors do not depend on the income level of the consumer, then we can take the average of k^i of all income classes as $\bar{k}$. Therefore, the same relationship between average permanent consumption of an income class ($\overline{c_p^i}$) and average permanent income of an income class($\overline{y_p^i}$) can be written for an income class as:

$$\overline{c_p^i} = \bar{k}\overline{y_p^i} \qquad \dots (6.15)$$

In equation (6.15) the superscript *i* represents individual consumer.

Friedman made his hypothesis specifying the characteristics of the transitory component. He hypothesised that the transitory components of income and consumption are unrelated with each other, and with the corresponding permanent components. The proposition can be translated as:

$$\rho_{y_t y_p} = \rho_{c_t c_p} = \rho_{y_t c_t} = 0 \qquad \dots (6.16)$$

In equation (6.16), we use symbol ρ for correlation coefficient between the variables shown in the subscripts. The first two correlations are self-explanatory by the definition of these variables itself. They are simply translating and completing the definition of transitory and permanent components. The last one, which shows the correlation between transitory income and transitory consumption to be zero is a bit difficult to comprehend. According to Friedman, consumption is determined by long term considerations. An increase in transitory income (say, a windfall gain) leads primarily to increase in savings (creation of assets or to the use of previously accumulated balances), not increase in consumption.

After all, why would not you spend your windfall gain on consumption which is over and above its smooth consumption trend line? Why are you likely to add the whole of the windfall gain to your wealth? Why not some of it is used in consumption?

Friedman provides **three** arguments in favour of his assumption where transitory components of income and transitory components of consumption are unrelated: (i) Contrary to the usual practice, Friedman does not include spending on consumer durable goods as a part of consumption expenditure. The definition of consumption according to Friedman is in terms of the value of the services. This definition of consumption made the assumption more applicable to empirical data. (ii) Windfall with the transitory income is not precise. If the windfall gain is expected then it is already being incorporated in the calculation of permanent income, except that the consumer was unable to borrow against this expected windfall gain. In that case, there would not be any change in transitory consumption.

On the other hand, if the windfall gain is unexpected and it is happening in the final year of the consumer's life, then this will increase the consumption expenditure of the final year itself, not the current year. (iii) If transitory increase in income could increase transitory consumption, there are instances where it could decrease transitory consumption (for example, long working hours, getting transferred to small town or village, etc). Such negative and positive correlation tends to offset each other. Friedman admitted that the zero correlation between transitory income and transitory consumption assumption need not necessarily be a stronger and stricter one as proposed. It implies a fairly close approximation to consumer behaviour.

Going by the third argument above, c_t is just a random variation around c_p and y_t. It means that, for any random sample of population classified according to income levels, for each income class 'i', average transitory consumption would be zero. It implies that average permanent consumption of a group (or, class) will be equal to the average measured consumption of that group (or, class).

$$\bar{c}_{ti} = 0 \quad \dots (6.17)$$

$$\bar{c}_i = \bar{c}_{pi} \quad \dots (6.18)$$

We can write equation (6.15) and (6.18) together as:

$$\bar{c}_i = \bar{c}_{pi} = \bar{k}\bar{y}_{pi} \quad \dots (6.19)$$

Equation (6.19) is true for all income class, whether above average income class ($\bar{y}_{ti} > 0$ and $\bar{y}_i > \bar{y}_{pi}$) or below average income class ($\bar{y}_{ti} < 0$ and $\bar{y}_i < \bar{y}_{pi}$).

For an above average income class, (i) the average measured consumption $\bar{c}_i$ is equal to $\bar{k}\bar{y}_{pi}$; (ii) the average income of that class is $\bar{y}_i$; and (iii) $\bar{y}_i > \bar{y}_{pi}$. Therefore, its measured APC, $\frac{\bar{c}_i}{\bar{y}_i}$ will be less than $\bar{k}$ as $\frac{\bar{y}_{p_i}}{\bar{y}_i} < 1$. Similarly, for a below average income class, the measured APC, $\frac{\bar{c}_i}{\bar{y}_i}$ will be more than $\bar{k}$.

We depict these results in Fig. 6.4.

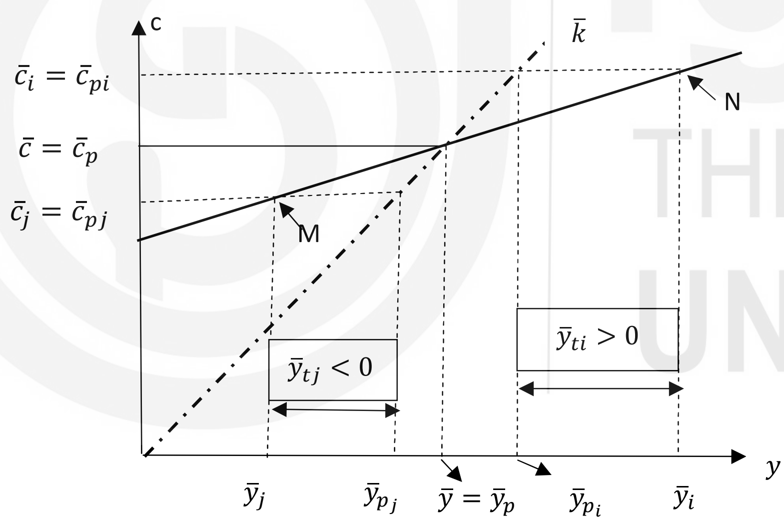

Fig. 6.4 Friedman's Cross-sectional Consumption Function
This cross-sectional consumption function is constructed by connecting the points like M and N. This function has a smaller slope than the underlying permanent function (the dotted line). In cross sectional budget studies we expect to see MPC $< APC$ if Friedman's PIH is correct.

In Fig. 6.4 two income classes have been taken. The j[th] class, whose average income is lower than the average income of the total population, and the i[th] class whose average income is above the population average income. So, the average transitory income of the below-average income group is negative while that for the above-average income group is positive. Further, we observe from equation (6.19), that $\bar{c}_i = \bar{c}_{pi} = \bar{k}\bar{y}_{pi}$ for the i[th] group and $\bar{c}_j = \bar{c}_{pj} = \bar{k}\bar{y}_{pj}$ for the j[th] group. This relationship gives us point M which connects $\bar{c}_j$ and $\bar{y}_j$, and point N which connects $\bar{c}_i$ and $\bar{y}_i$. Connecting points M and N we get cross-sectional budget studies consumption function. This function has smaller slope than the underlying permanent function ($\bar{k}$). Thus, for the cross-sectional budget studies we expect MPC<APC if Friedman's permanent income hypothesis is correct.

To explain the relationship between the long run time series consumption function we need to understand the functioning of the business cycle. A nations output grows along the business cycle over the time but not at a steady rate. It reaches its peak during the boom time period and lowest point in the slump time period. In between you have the recession and recovery phases. This fluctuation of income can be explained with the permanent income hypothesis. Permanent income over a time period can be interpreted as the long-term trend income. In any period, if the GDP or income is less than the long-term permanent income then we can say in that period the transitory income is negative and, in the year, when the income is more than the long-term trend permanent income, the transitory income of that period is positive. So, in the boom year transitory income is positive and in the slump year transitory income is negative.

Since according to the PIH, transitory components of income are unrelated to both the transitory consumption and transitory consumption, it is just a random component around the permanent consumption, the MPC of transitory income is zero or very negligible. That is why households do not alter their long-term permanent consumption plan even if they are going through the boom time or trough time of the economy.

This cyclical movement is explained through the Friedman's time series consumption function diagram in the Fig. 6.5.

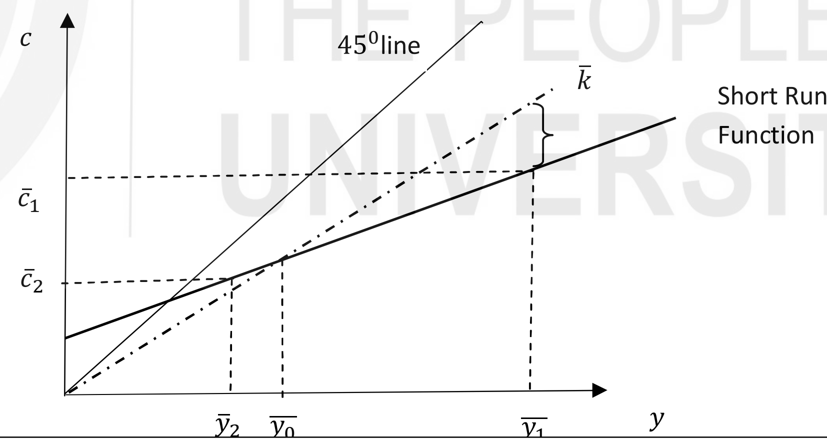

Fig. 6.5: Friedman's Time Series Consumption Function

The long run time series consumption function ($\bar{k}$) has lower slope than the 45^0 line. Hence the c/y ratio, which is fairly stable along the long run consumption function, is less than 1. This explains the consumption smoothening behaviour of the consumers and also shows that fluctuation in consumption is less than that in income.

Over time, as the economy and the national average permanent income grow along the trend, the cross sectional consumption function (see the red line in Fig. 6.4**)** shifts up. In Fig. 6.5, year 1 is the boom period. In that year the income of the country, $\bar{y}_1$ is more than the long run trend income. Therefore, the average transitory income of the population in year 1 is positive. On the other hand, year 2 is the time period when the income of the country $\bar{y}_2$ is less than the trend income. Therefore, the average transitory income of the population in year 2 is negative. The measured average consumption of the country in both these years is influenced by neither the positive transitory income of the year 1 nor the negative transitory income of the year 2. In fact, it is the $\bar{k}\, proportion$ of the permanent incomes of the country that determines the actual measured consumptions of both the years as average transitory consumption of both years is zero, so that $\bar{c} = \bar{c}_p = \bar{k} \cdot \bar{y}_p$. Thus, the APC, which is nothing but the measured consumption divided by the measured income can be interpreted as:

For year 1: APC $= \frac{\bar{c}_1}{\bar{y}_1} = \frac{\bar{c}_{p1}}{\bar{y}_1} = \frac{\bar{k}\bar{y}_{p1}}{\bar{y}_1}$; and $\bar{y}_{p_1} < \bar{y}_1$.

Thus, APC for year 1, when y is above the trend, will be less than $\bar{k}$.

For year 2: APC $= \frac{\bar{c}_2}{\bar{y}_2} = \frac{\bar{c}_{p2}}{\bar{y}_2} = \frac{\bar{k}\bar{y}_{p2}}{\bar{y}_2}$; and $\bar{y}_{p_2} > \bar{y}_2$

Thus, APC for year 2, when y is below the trend, will be more than $\bar{k}$.

Thus, the short run consumption function is having lower slope than the long run consumption function. Further, over the short run cyclical fluctuation we find that MPC$< APC$; and for the long run observation, notice that APC= MPC.

6.3.2 Implications of the Model

Permanent income hypothesis has important implications for fiscal stabilization policies of the government. It directly challenges the ability of the government to revive the economy from recession downturn through temporary fiscal stimulus measures (such as tax cuts and transfer income). In the process the model explains the failure of the transitory Keynesian demand management technique.

In a simple Keynesian framework, MPC is constant. Therefore, any tax cut policy can have large stimulatory effect on the consumption demand through its multiplier effect. The permanent income hypothesis, however, points out that an unanticipated transitory cut in taxes would only increase the transitory component of disposable income of the consumers. As transitory increase in income does not have any significant positive impact on the consumption demand, it would increase savings of the consumers. Thus, a fiscal policy of this nature is likely to fail.

A strong interpretation of the PIH predicts that social security measures (such as unemployment allowance) and tax cut policy deliver equivalent outcomes. These measures lead to transitory income and therefore, do not impact consumption spending of households. It was noticed, however, that stoppage of the spending bill due to 16 days Federal Government shutdown in the USA in October 2013, resulted in a loss of 6.6 million working days and also considerable drop in the aggregate consumption expenditure among the government employees in the US. Although this shutdown should not have impacted the expected lifetime income of those government employees (as they knew that they will be paid later for the loss of work), their consumption expenditure declined. Majority of the workers responded to the short-term income shock by cutting down their spending as opposed to the PIH.

One of the inferences which can be made readily and mistakenly from the PIH is the secularly growing inequality in most economies. The theory explains that in cross-sectional budget studies, the lower income groups have an average negative transitory income compared to the higher income groups. In order to maintain smooth consumption, permanent consumption depends on the permanent income. Therefore, the lower income groups have negative saving and higher income groups have positive savings. This accentuates the income inequality over time. In this context, Friedman clarified that if the definition of income is according to the measured income then perhaps this implication could be true. According to Friedman, however, if the definition of income is taken strictly as the permanent income, then PIH does not give any evidence on the secular behaviour of inequality of income. Further, measured income is a poor index of wealth.

6.3.3 Implications and Limitations of the Model

Friedman's permanent income hypothesis is criticised mostly on the following grounds:

- The PIH model decomposes income and consumption variables into permanent and transitory components. Although theoretically sound, these components are not observable for empirical work.
- The concept of property income is taken into account in the implicit estimation of permanent income. The importance of property income or the impact of fluctuations in the property market on consumption behaviour is not clearly spelt out in the model.
- To support the third, and probably the most controversial, assumption of the PIH, i.e., no correlation between transitory income and transitory consumption, Friedman did not take into account the spending on consumer durables as a part of consumption expenditure.
- Many economists object to Friedman's idea of zero marginal propensity to consume from transitory income. Empirically, certain evidences suggest that marginal propensity to consume from transitory income is more than zero. For a low income poor person, marginal propensity to consume from an unexpected windfall gain will definitely be positive. Same is the case with the binding borrowing constraint.
- Some economists oppose Friedman's idea of constant APC irrespective of the income class. According to them, poor people feel more pressure to spend a higher fraction of their permanent income than richer people. The APC from permanent income should be falling with rising income.

Check Your Progress 2

1) Assume that a Software Engineer has been working from home for last three months during the COVID-19 lockdown period and the company has rewarded him with ₹10,000. According to the permanent income hypothesis, will he spend most of this bonus if (a) he knows that he would be receiving this amount of bonus every 3 months, and (b) he knows that it is a onetime bonus?

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2) Give reasons for no correlation between transitory income and transitory consumption.

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3) Suppose up to the end of the year 0 the government was running a balanced budget such that T = G = 0. In year 1 the government decided to cut taxes by 1. This deficit the government is financing through debt, which the government has decided to repay in year 2. Suppose the government is to keep its spending path unchanged. Analyse how does this tax cut policy affects consumer's consumption and savings if the real interest rate is 0.05?

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4) In the above problem, assume that the consumer is supposed to die at the end of year 1 and he does not care for his future generation. How would his consumption be affected because of the tax cut?

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6.4 LET US SUM UP

Ando and Modigliani in their Life Cycle Hypothesis, highlighted that although income of persons vary substantially over their life time, they maintain a smooth consumption path over life time. Consumers use borrowing and saving to smoothen their consumption path. The model had strong implication for policy makers to analyse the inter country difference in the saving rate and its effect on growth of wealth.

Friedman explained the variation in one's lifetime income by introducing the concept of permanent income and transitory income. Permanent income hypothesis suggested that there is no correlation between transitory components of income and consumption. Consumption depends primarily on permanent income. This model questioned the effectiveness of the Keynesian policy prescription of short term fiscal stimulus measures.

6.5 ANSWER/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Consumer's lifetime income = working years × annual labour income = $(65-20)\times 30{,}000 = 1{,}350{,}000$.

Annual average consumption expenditure = Life Time income / life time

= 1,350,000 / (80−20) = 22500

You will obtain the same result by the following method also.

$\frac{65-2}{80-20} \times 30000$ = 22500

MPC = $\frac{65-20}{80-20} = 0.75$

2) His annual consumption expenditure = (30+60+90+0)/4 = 45

Hence, in the first period saving = (30 – 45) = – 15

Second period saving = (60 – 45– 15) = 0 (he paid off first period's dis-saving)

Third period saving = (90– 45) =45

Fourth period saving = (0− 45) = −45 (he used his third period's saving)

In the first period the person dis-saves (borrows) ₹15.

At the end of the first period he received ₹15 wealth, he will repay his debt with that.

He will re calculate his even consumption stream again = (60+90+0)/ 3 = ₹ 50

Earlier his consumption expenditure = ₹ 45

Change in the consumption expenditure second period onwards = (50−45) = 5

Check Your Progress 2

1) In the first case the person knew that he is going to get the bonus every 3 months, so it is a permanent increase in his lifetime income. According permanent income hypothesis, consumption depends on permanent income. Therefore, as permanent income increases, the consumer will spend more of this bonus income.

In the second case, the consumer knew that the bonus was only one time, so it is transitory. According to permanent income hypothesis, correlation between transitory consumption and transitory income is negligible or zero. So, in this case the consumer will not spend his bonus amount.

2) Friedman gives three reasons for no correlation between transitory income and transitory consumption. Go through sub-section 6.4.1 and answer.

3) In the year 1, as the government expenditure path remains the same, $G_1 = 0$ and there is a tax cut in the year 1, thus $T_1 = -1$. Therefore, size of the government deficit in year one = $(G_1 - T_1) = 1$. So, in year 1 size of debt, $B_1 = 1$ (as there was no accumulated debt from the previous year 0).

In year 2, the size of the government debt = $B_2 = B_1 \times (1+r) = 1 \times (1+0.05) = 1.05$

If the government has to repay this debt in year 2, then the government has to make primary surplus of the size of debt B_2. If the government also needs to maintain the same government expenditure path (that means $G_2 = 0$), then the only way to make this primary surplus is to increase taxes by 1.05 in year 2.

Knowing this with perfect foresight, consumers know that a tax cut by 1 in year 1 is equivalent to a rise in taxes by 1.05 in year 2. So, in year 1, although the disposable income of the consumers increase due to the tax cut, consumption demand will remain same and entire increase in disposable income will go for saving. In year 2, saved amount of money in year 1 and the rate of interest earned on it will be used to pay for the increased tax in year 2. So, in year 2, consumption demand and saving will remain the same.

4) The consumer is supposed to die at the end of year 1, and he does not care about the future generation. Due to the tax cut the consumer's disposable income increases in period 1. He will use this increased disposable income on extra consumption spending rather than saving because the higher taxes in future will be paid by the future generations.

UNIT 7 INVESTMENT FUNCTION*

Structure

7.0 OBJECTIVES

After going through this Unit, you will be in a position to

- identify the factors that drive investment;
- describe the speed of adjustment of actual capital stock to the optimum capital stock;
- identify the link between the fluctuations in investment and fluctuations in stock market;
- explain how home loan and tax policies affect home buyers' decision to investment on residential projects; and
- identify the motives behind keeping aside a part of output as inventories.

7.1 INTRODUCTION

In the previous two units we analysed a household's consumption choices. In this unit we will analyse the theoretical aspects of investment decision. As you know, private investment is an important component of aggregate demand both in terms of long-term growth and short-term business fluctuations. From the point of view of growth, the allocation of society's resources into consumption and various types of investment (in the form of physical capital, financial capital, human

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capital, and research & development) are very important for determining the size of GDP and steady state growth of an economy. There are three types of investment we will be discussing in this unit: (i) business fixed investment, (ii) residential investment, and (iii) inventory investment. Investment spending is the most volatile component of aggregate demand and thus a major source of fluctuations of economic activities, often leading to business cycle.

Importance of investment can also be highlighted through the financial market that affects the economy. We will examine the two-way relationship between the investment and financial market.

7.2 BUSINESS FIXED INVESTMENT

Business fixed investment represents spending by firms to increase production capacity. It is traditionally decomposed into (i) equipment (computers, machines etc), (ii) structures (land, plants, warehouses etc), and (iii) intellectual property (software, R&D, etc). There are three important theories of investment: (i) neoclassical theory, (ii) accelerator theory, and (iii) q-theory. The neoclassical theory, developed mostly by Dale W. Jorgenson, helps in determination of output and prices through optimal capital stock in an economy. The accelerator theory analyses the process of adjustment in the level of capital stock. The q-theory of James Tobin extends the neoclassical theory to include adjustment cost. According this theory firms choose that invest level where expected present value of a firm is maximum. We discuss these theories below.

7.2.1 Neoclassical Theory of Investment and Optimum Capital Stock

The neoclassical model of investment assumes a well-functioning and efficiently coordinating market system. Dale W. Jorgenson contributed significantly to the development of the neoclassical investment theory. The neoclassical investment theory is based on the idea that firms maximise profits and use cost-benefit analysis to reach the optimum level of capital stock.

In our model a typical profit maximizing firm employs labour (**L**) and capital **(K)** to produce its output **Y**. The production function specifies this relationship:

$$\mathbf{Y = F(L, K)} \qquad \dots (7.1)$$

It is a typical neoclassical production function where it exhibits diminishing marginal productivity of factor of production.

We assume that there is perfect competition in both goods market and input market so that a firm can sell its product at a given price **P.** The firm employs labour at the ongoing wage rate **w.** Let us assume that P_K is the supply price at which one unit of capital good may be purchased by the firm.

Now to decide how much capital the firm would use, recall the basic optimisation principle from microeconomics. The firm will work according to the profit maximizing principle

$Max\ \Pi = (Total\ Revenue - Total\ Cost)$

$= [\boldsymbol{P} \cdot \mathbf{F}\ (\mathbf{L}, \mathbf{K}) - (\ Total\ Labour\ cost + Total\ Capital\ cost)]$ … (7.2)

Total labour cost = w.L

Total Capital Cost = User cost of one unit of capital × K

We need to define this ***user cost of per unit of capital***. It has three components:

(i) The firm can purchase capital goods by borrowing from the market at interest rate ($\boldsymbol{i}$) or from its own resources. If capital is bought by borrowing, then the borrowing cost of one unit of capital would be $\boldsymbol{P_K.i}$**.** If the firm bought the capital by using its own resources, that money the firm could have lent instead and earned $\boldsymbol{P_K.i}$**.** In the latter case it is the opportunity cost of capital. In both the methods of financing, $\boldsymbol{P_K.i}$ is the interest cost of capital.

(ii) You know that capital goods are durable, but they are subjected to depreciation (i.e., wear and tear, and also obsolescence). Suppose $\boldsymbol{\delta}$ is the rate of depreciation. Therefore, money cost of depreciation is $\boldsymbol{P_K.\delta}$**.**

(iii) If the price of capital goods, $\boldsymbol{P_K}$, decreases, then the value of the capital goes down. The cost of this loss is $-\boldsymbol{\Delta P_K}$ (the $\boldsymbol{\Delta}$ symbol indicates change and the minus sign signifies our measurement of cost, not benefit).

Thus, the user cost of one unit of capital (in nominal terms) the firm bought is:

$$= \boldsymbol{P_K.i + \delta.P_K - \Delta P_K}$$

$$= \boldsymbol{P_K}(\boldsymbol{i + \delta} - \left(\frac{\boldsymbol{\Delta P_K}}{\boldsymbol{P_K}}\right)) \quad \text{… (7.3)}$$

To make things simple, let us assume that increase in the price of capital goods is the same as the rise in prices of other goods. Then, $\frac{\boldsymbol{\Delta P_K}}{\boldsymbol{P_K}} = \text{inflation rate} = \pi$. Substituting this value in equation (7.3) we obtain the user cost of one unit of capital

$= \boldsymbol{P_K(i + \delta - \pi)}$

Since *nominal interest rate (i)* − *inflation rate* (*π*) = *real interest rate (r),* we obtain

User cost of capital $= \boldsymbol{P_K(r + \delta)}$ … (7.4)

And, total capital cost $= \boldsymbol{P_K(r + \delta) \times K}$ … (7.5)

Substituting the value of capital cost (equation **7.**5) in the firm's optimization problem (equation **7.**2) we obtain

Max $\boldsymbol{\Pi} = [\boldsymbol{P} \cdot \mathbf{F}\ (\mathbf{L}, \mathbf{K}) - \boldsymbol{w.L} - \boldsymbol{P_K(r + \delta) \times K}]$ … (7.6)

The firm will maximize its objective function (equation **7.**6) with respect to labour (L) and capital (K) respectively. The first order condition with respect to the capital is

$$\frac{\partial \boldsymbol{\Pi}}{\partial \boldsymbol{K}} = \boldsymbol{PF_k} - \boldsymbol{P_K}(\boldsymbol{r} + \boldsymbol{\delta}) = \boldsymbol{0}$$

$\Rightarrow \boldsymbol{P.MP_k} = \boldsymbol{P_K}(\boldsymbol{r} + \boldsymbol{\delta})$ [Note: $F_k = MP_k = Marginal\ Product\ of\ capital$]

$\Rightarrow$ Value of Marginal Product of capital = $\boldsymbol{P_K}(\boldsymbol{r} + \boldsymbol{\delta})$ … (7.7)

Equation (**7.**7) is the profit maximization condition of the firm with respect to capital. It means that an additional unit of capital will cost $\boldsymbol{P_K}(\boldsymbol{r} + \boldsymbol{\delta})$**,** and the additional unit of capital will increase output by $\boldsymbol{MP_k}$ units, which generates revenue $\boldsymbol{P.MP_k}$. So, quantity of capital input will be increased as long as the additional revenue (benefit) exceeds the additional cost incurred to add to the capital stock and vice versa. The optimum capital stock will be determined at the point where the additional revenue is equal to the additional cost.

Equation (**7.**7) can be rewritten as

$$\boldsymbol{MP_k} = \frac{\boldsymbol{P_K}}{\boldsymbol{P}}.(\boldsymbol{r} + \boldsymbol{\delta}) = rc \quad \ldots (7.8)$$

Here, the term $\frac{\boldsymbol{P_K}}{\boldsymbol{P}}.(\boldsymbol{r} + \boldsymbol{\delta})$ = *real rental cost of capital* = $\boldsymbol{rc}$

If the marginal product of capital exceeds the real rental cost of capital then the firm finds it profitable to add to its capital stock such that $\Delta K > 0$.

Solving equation (**7.**8) for K we will obtain the optimum or desired stock of capital K^*. The general relationship among the desired capital stock K^*, the rental cost of capital $\boldsymbol{rc}$**,** and the level of output is given by

$$\mathbf{K}^* = \boldsymbol{f}(\boldsymbol{rc}, \boldsymbol{Y}) \quad \ldots (7.9)$$

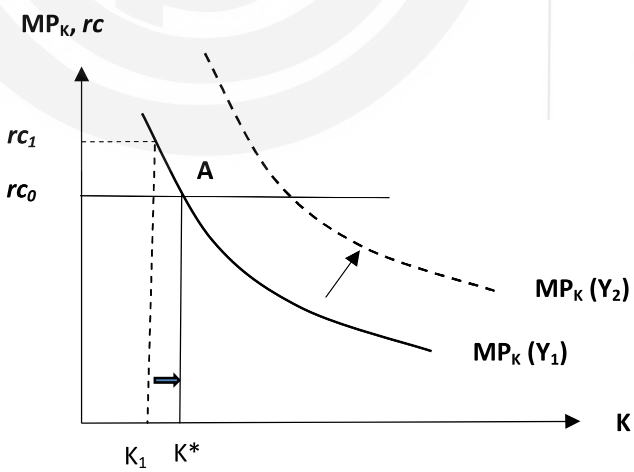

Fig.: 7.1: Optimum Stock of Capital

The optimum capital stock K* is that level of the capital at which MP_K is equated with the rc_0. The MP_K schedule is drawn for a given level of output Y_1. An increase in output shifts the MP_K schedule upward to the right.

In equation (7.9), an increase in the rental cost decreases the optimal or desired level of capital stock. Further, an increase in GDP increases the optimal level of capital stock. We depict this relationship in Fig. 7.1. When rental cost is rc_0, desired capital stock is K_0. An increase in rental cost to rc_1, decreases the level of desired capital stock to K_1. An increase in output from Y_1 to Y_2 will shift the MPK curve upward to the right. Consequently, equilibrium capital stock will increase.

Thus, business fixed investment depends on the marginal product of capital, the real rate of interest, and the depreciation rate. A decrease in the real interest rate lowers the cost of capital. It raises the profit from owning capital and increases the incentive to accumulate more (means increase investment) and vice versa. Therefore, the equation (7.8) shows the inverse relationship between the rate of interest and investment.

7.2.2. Adjustment Speed of Capital Stock

If the actual capital stock at any point of time differs from the optimum capital stock, then at what speed the firm would go about adjusting its capital stock towards the optimum level. The ***flexible accelerator model*** (also called, gradual accelerator model) helps us in finding out the adjustment speed.

Let us assume that K_{t-1} is the actual capital stock at the end of period (t-1) and the optimum capital stock is K^*. The firm plans to close a fraction, λ, of the gap between the optimum and actual capital stocks in each period. Therefore, t^{th} period's capital stock K_t would become:

$$K_t = K_{t-1} + \lambda(K^* - K_{t-1}) \quad \dots (7.10)$$

We can therefore write the t^{th} period's net investment as

$$I_t = K_t - K_{t-1} = \lambda(K^* - K_{t-1}) \quad \dots (7.11)$$

Similarly for the $(t+1)^{th}$ period, the net investment is

$$I_{t+1} = K_{t+1} - K_t = \lambda(1-\lambda)(K^* - K_{t-1}) \quad \dots (7.12)$$

So, in t^{th} period, λ fraction of the initial gap between K_{t-1} and K^* is being invested. In the $(t+1)^{th}$ period, $\lambda(1-\lambda)$ fraction of the original gap in the amount of investment is being made. You should note that as λ is a fraction, $\lambda(1-\lambda)$ is less than λ. So, in each subsequent period, amount of investment is getting smaller and smaller in order to close the gap between the actual capital stock and the optimum capital stock. Therefore, $< \cdots < I_{t+1} = K_{t+1} - K_t < I_t = K_t - K_{t-1} < \cdots <$

In Fig. 7.2 we depict this speed of adjustment. Notice that the investment that is made, to bridge the gap between actual level and desired level, decreases over time.

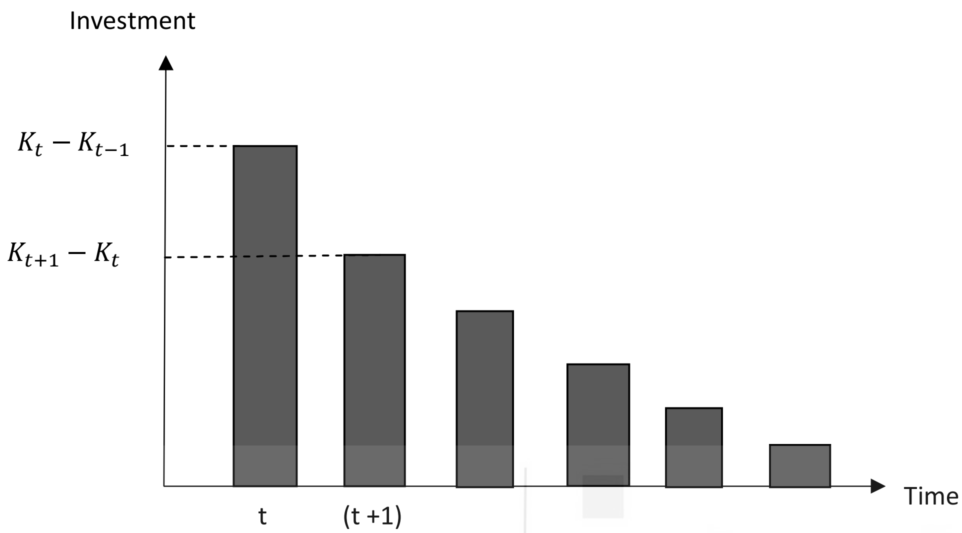

Fig. 7.2: Speed of Investment in Flexible Accelerator Model

Investment continues until the actual capital stock reaches the optimum level of capital. Larger the value of λ, faster is the speed of adjustment.

7.2.3. Stock Market and Tobin's q-Theory

So far we have assumed the sources of funds for a firm are either borrowed funds or own resources. A third source of funding for a firm, however, could be the shares or equities of a firm. A firm can issue fresh equities in a stock market and mobilise funds. Equities are financial instruments that can be traded in a stock market.

This is how the link between the fluctuations in investment and in the stock market is established. James Tobin first put forth formally the connection between investment and the stock market in his famous 'q-theory'. It is widely believed that stock market movements are poor indicator of the state of the firms or the economy, as the stock market is influenced by exogenous factors. In today's world, however, we cannot ignore the connection between the stock market and the growth of corporate firms.

Stock market plays a key role in helping firms to raise capital. Buyers of these equities, i.e., shareholders earn dividend and capital gain (that arise due to change in equity price) from holding these equities. According to the q-theory, level of investment depends on the ratio between the market value a firm's assets and the replacement cost of those assets. Tobin noted that *if the value of a company on a stock market is substantially more than the replacement cost of the asset (some form of business fixed capital) that the firm employs, then in principle that company has a major incentive to increase investment.* The q-ratio can be written as

$$q = \frac{\text{Market value of installed capital}}{\text{Replacement cost of capital}} \quad \text{... (7.13)}$$

Or,

$$q = \frac{\text{Value the stock Market places on a fi 's assets}}{\text{Actual current worth of the firm's assets}}$$

So, if $q > 1$ then for each unit of money worth of new capital the firm plans to buy, the firm can sell the shares for q units of money and get the profit $(q - 1)$. Thus there is an incentive for the firm to expand its capital stock through floating new shares. It implies increase in investment for the firm. Applying the similar logic, if $q < 1$, the market places a lower value on the firm compared to its actual value. Thus, there is no incentive for the firm to add to its capital stock.

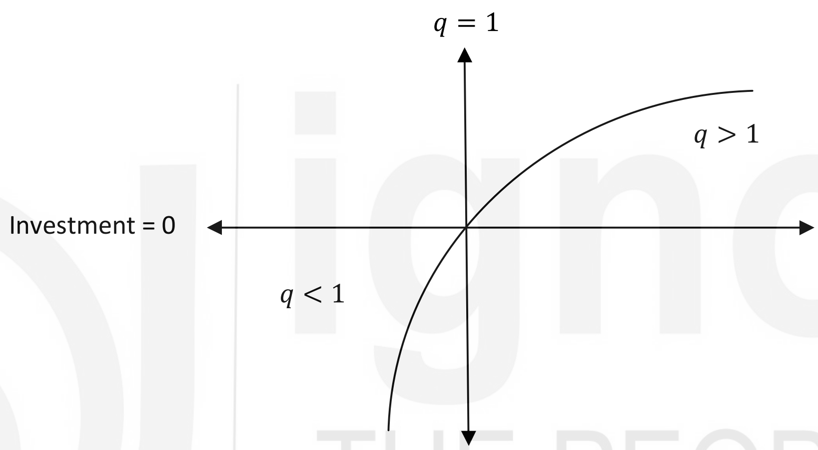

Fig. 7.3: The q-theory of Investment

If q is >1 then there is an incentive to undertake net investment. When $q < 1$ firms should start selling their capital because they would get more for it on the second hand market than the value shareholders placed on it.

The q theory is closely linked to the neoclassical investment theory that firms should invest if the rate of return on new capital exceeds the cost of capital. As a theory of investment, the q-theory implies that when the stock market is bullish, there is usually an over-valuation of stocks. This encourages firms to increase investment by issuing fresh shares. Going by the same logic, when the stock market is bearish, investment could be low. Further, firms would consolidate their position through mergers and acquisitions during the bearish phase. Despite Tobin's proposition, in reality the positive link between the investment and stock prices are not very strong. The main reasons behind this weak link are high volatility of stock prices, adjustment cost of investment, failure of the stock market to convey accurate information to the shareholders, impact of exogenous factors on stock market, and investors' sentiments.

Check Your Progress 1

1) Assume that MPK = 20 – 0.02K, is the expected future marginal product, where K is the future capital stock. The depreciation rate is (–) 20% and the real rate of interest is 10% per period. The firm pays taxes equal to 50% of output. The price of a unit of capital is 1 unit of output. What is the value of the tax-adjusted desired capital stock?

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2) For a Cobb-Douglas production function, ϒ (Gamma, the coefficient of capital) = 0.3, Y (output) = 10 and rc (rental cost) = 0.12. If the output is expected to rise to 20, how much will be the change in the desired capital stock? Suppose that the capital stock was at desired level before the change in the income was expected. Suppose further that $\lambda = 0.2$ in the flexible adjustment model of investment. What will be the rate of investment in the first year after the expected income changes?

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3) Consider a short-lived investment project, one that costs Rs. 1000 to set up today (in the first period). The project generates Rs. 500 profit in the second year and further Rs. 700 in the third year. By the end of the third year the factory has disintegrated. Should the project be undertaken if the interest rate is 10%?

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4) A country loses much of its capital stock to a war. What effect will the loss of capital stock have on the desired investment?

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5) In the context of the q-theory of investment, suppose q is less than unity. Is it a correct move for a firm to increase its capital stock? Justify your answer.

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7.3 RESIDENTIAL INVESTMENT

The global financial meltdown of 2007-2009 which originated in the US was triggered by a large decline in home prices after the collapse of the housing bubble. Declines in residential investment preceded the recession and were followed by reductions in household spending and then business investment. Here in this section we will analyse the determinants of investments in housing with reference to the market for rental apartments.

7.3.1 Theoretical Structure

The housing market comprise two segments, viz., (i) the stock of existing houses (just like stock of capital), which determines the price of houses, and (ii) the flow of new construction (like flow of investment), which determines the level of new investment. Shocks to either of the segments can affect house prices. To model this, we need to have certain set of assumptions and also need to clarify the meaning of few notations.

- At any given point of time, a fixed sock of 'housing capital' exists $H = \overline{H}$ in the economy because a negligible percentage of the stock are added annually to the stock. The short run variation in construction activity will have very little impact on the stock of housing capital. The housing stock at the beginning of each period is determined by past investment.
- Home buyers view themselves as investors and their self-occupying house as one among the many assets that wealth holders can own in their investment portfolios.

- Homeowners can claim tax deductions for some of their expenses, notably property taxes and mortgage interest, but they are not taxed on their imputed rental income.
- For simplicity in analysis, we assume that all housing units are homogeneous.

  R_H = Marginal (1 unit of house) value of the rental services per period on owner occupied house.

  P_H = The price of one unit of existing housing stock = asset price of housing

  θ = Investor's marginal tax concession rate

  When a home buyer buys a house for self-possession by taking loans, then (s)he has to pay the mortgage interest (i = interest rate on each unit of money loan has been taken), and property tax (τ_P as a share of house value). According to the tax law, home buyers can deduct θ proportion of these expenditures (mortgage interest and property tax) from their taxable income.

  δ = The depreciation rate on housing capital

  m = maintenance cost of housing capital per unit value

  Π^e = Investors' expected rate of nominal house price appreciation

  The market for an existing housing unit is completed by the equilibrium relation:

  $$H^d = \overline{H} \qquad \ldots (7.16)$$

In equation (7.16) we need to define H^d which is the demand decision made by the homebuyers while buying house based on cost-benefit analysis. The benefit of one unit of house is the imputed rental value (the rent he is saving by residing in his own house) of the house, i.e., R_H. On the other hand, the cost of possessing and occupying a unit of house has three components:

(i) Price of the house after standard deduction: This is given by $[P_H - P_H(i + \tau_P)] = P_H(1 - \theta)(i + \tau_P)$

(ii) Depreciation plus maintenance cost: This is given by $P_H(m + \delta)$

(iii) Expected capital gain or loss: If the expected price of the house in one year is $P_{H,t+1}$, then $\Pi^e = \frac{P^e_{H,t+1} - P_{H,t}}{P_{H,t}}$. Expected capital gain on the house in one year = $P_H \cdot \Pi^e$. If capital gains is positive then homebuyers are gaining (cost is negative). On the other hand, if it is negative, homebuyers are losing (positive cost). Note, here P_H and $P_{H,t}$ are equivalently used.

Homebuyers in equilibrium, ***benefit = cost.*** This implies:

$$R_H = P_H[(1 - \theta)(i + \tau_P) + (m + \delta) - \Pi^e]$$

We can re-arrange terms in the above equation to get

$$\frac{R_H}{P_H} = [(1-\theta)(i+\tau_P) + \delta + m - \Pi^e] \qquad \dots (7.17)$$

Ratio of imputed rental value to house price ($\frac{R_H}{P_H}$)

User cost of owner occupying housing ($[(1-\theta)(i+\tau_P) + \delta + m - \Pi^e]$)

Equation (7.17) describes the equilibrium condition for stock of existing houses. Note that, in the short run, the supply of houses is fixed (inelastic supply). Demand for houses varies inversely with the current level of housing prices, P_H.

The link between the current level of housing prices and the future flow of net new construction takes the following form as the rate of residential investment:

$$H_t - H_{t+1} = \phi\left(\frac{P_H}{C_t}\right) - \delta H_t \qquad \dots (7.18)$$

Net Flow of New Construction ($H_t - H_{t+1}$)

C_t is the construction cost. Construction of new housing stock begins in t time period

This many of old houses have gone bad (δH_t)

7.3.2 Graphical Analysis

Panel (a) of Fig. 7.4 shows that the price of existing houses P_H is determined by the interaction of the supply curve (SS), and the demand curve (DD). The supply curve is inelastic (vertical) for the existing housing stock *at a moment of time*, as supply cannot be increased in the short-run. The demand curve for housing is downward sloping because higher housing prices make people to do any of the following: (i) curb the demand to buy houses, (ii) force people to live in smaller houses, (iii) share residences, or (iv) even go homeless. Adjustment in housing prices takes place so that there is equilibrium between demand and supply. Decline in the following factors would shift the demand curve upward (so that there is increase in demand; prices remaining constant): (i) mortgage interest rate, (ii) property tax rate, (iii) depreciation rate, (iv) maintenance cost, and (v) return on other assets. Increase in the following factors will shift the demand curve for houses upward: (i) population size, (ii) wealth, (iii) income, and (iv) expected capital gains from houses.

Panel (b) of Fig. 7.4 we depict the supply curve of new houses (FS) *in a given time period*. It is given as a positive function of housing prices. An increase in housing prices provides incentives to produce more houses. If in the panel (a), price of existing housing goes up (due to the factors mentioned in the predecessor paragraph) then builders / developers respond to this by building new houses. Thus, any factor that affects the prices of existing housing will affect the construction of new houses, thereby resulting in a movement along the FS curve. Any factor (for example, construction cost) that shifts the FS curve will affect the rate of residential investment.

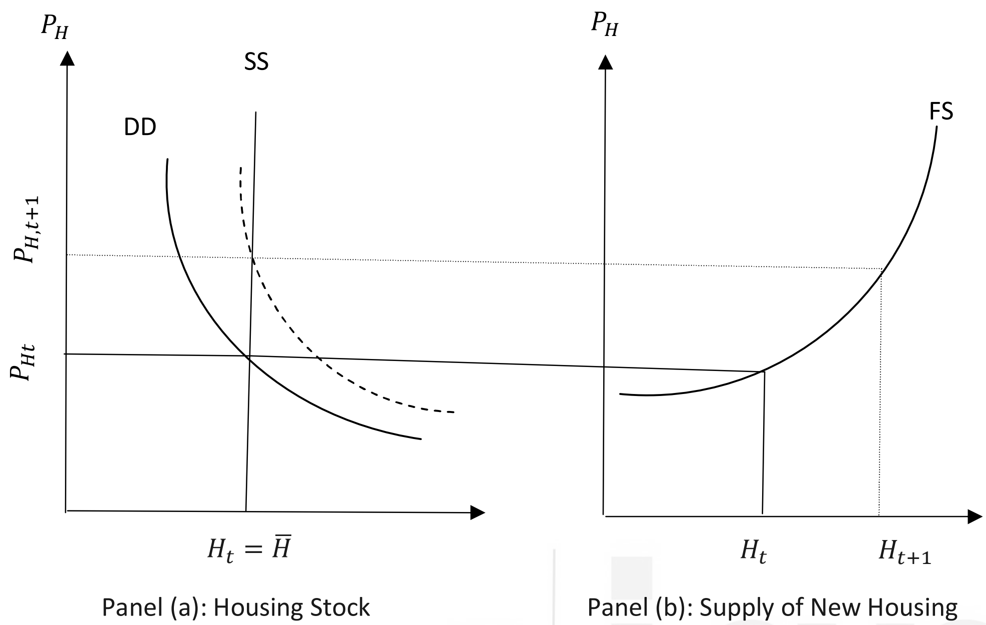

Fig. 7.4: Housing Market
An increase in housing demand leads to a rise in housing prices and residential investment.

You should note that the existing stock of housing is much larger compared to construction of new houses. Thus we often ignore the effect of the supply of new housing on the price of existing houses in the short run. However, over time, as the new construction increases the stock of existing houses. This shifts the SS curve to the right.

7.3.3 Implications of the Model

The framework we presented for residential investment has opened up several implications. Let us discuss some of them.

- The benefits of income tax rebates given on home loans do not reach poor households, as it is applicable to higher income groups who pay income tax. Similarly, when nominal interest rate rises with expected inflation, the after-tax marginal cost of borrowing, $(1-\theta)i - \Pi^e$ declines as expected inflation rises. This effect is more pronounced for high-income households and should therefore increase their demand for housing relative to that of low-income households.
- Individuals usually have higher demand for housing in the age group of 20 to 40 (due to marriage, children, etc.). The percentage of population in this age group is therefore an important determinant of the change in housing demand. Thus, any demographic change (say, for example, baby boom during the lock-down period) will have its impact on housing prices with a lag of 20 to 30 years.

- For expected inflation, Π^e, it is appealing to use the rational expectations framework. But empirical observation tells us that homebuyers extrapolate on past information (backward looking process for setting price expectations). If we incorporate this process in our model, it would result in systematic overbuilding in the housing market.
- If population, income and wealth are growing at a steady rate, then long run equilibrium would indicate that the rate of construction of houses is just sufficient to cover depreciation and the steady growth in demand. But in an economy where changes in demand are abrupt, the long run equilibrium is not necessarily ever achieved. In a static economy, long run equilibrium will be achieved when net residential investment would be zero.
- Builders take loans to finance their construction work. Hence mortgage interest rate also affects the flow supply (FS) curve.

7.4 INVENTORY INVESTMENT

Inventory is vital for the firms as well as for the economy as a whole. It is a tiny component of GDP but due to its remarkable volatility, it makes up about 70 per cent of the business cycle fluctuation. Therefore, understanding the behaviour of inventory accumulation is meaningful to predict macroeconomic fluctuations and counter it. There are two broad categories of inventories, viz., (i) Manufacturer's Inventories, and (ii) Retail Inventories. Under the Manufacturer's Inventories, we have further sub divisions like (a) Finished Goods, (b) Work–in-Progress, (c) Raw Materials and Supplies, and (d) Wholesale Inventories. The predominant types of inventories accounting for fluctuations are retail inventories, followed by raw materials and supplies. In India, changes in inventories are often a leading indicator for the overall performance of the economy. To get a broader perspective we need to examine the motives of holding inventories. Why do businesses put aside goods in storage?

7.4.1 Motives of Holding Inventory

Inventory investment is defined as the net addition to the stock of inventories. Firms hold inventories for various reasons:

(i) **Production Smoothing:** A representative firm often experiences short run shocks to the demand for its product. Firms may use inventories to absorb the unanticipated shocks to demand for their products. Instead of adjusting their production to match the fluctuations they prefer to continue their production at a steady rate. Thus, during a boom period, a firm will deplete its inventory and during the slump season it will add to its inventory.

(ii) **Production Scheduling:** Inventories give multi-product firms the flexibility in scheduling production runs.

(iii) **Reducing Delivery Lags:** Inventory may stimulate a single firm's demand by reducing delivery lags.

(iv) **Inventories as a factor of production:** Manufacturing firms stock up raw materials and other factors of production primarily for hedging against future price rise. Further, raw materials inventories are held because it is less costly for a firm to place bulk order of specific factors of production.

(v) **Stock-out avoidance:** Firms generally need to take production decision beforehand on the basis of expected sale of their product. An underestimation might lead the firm to lose sales and profit due to out-of-stock situation. In order to avoid such 'out-of-stock' situations, firms often hold inventories.

(vi) **Work-in-progress:** Certain inventories are held as an unavoidable part of the production process, especially when the production process involves several steps and takes time to produce. For example, when assembling of a car is partly completed, its components/parts are counted as a part of the automobile firm's inventory.

Categorisation of inventory investment in macroeconomic models depends on whether we consider inventories as output or input. It is widely observed that higher inventory stock lowers current output. When firms find that they are not able to sell the quantity they produce, they reduce the level of production.

The central aspect of inventory investment hinges upon the distinction between planned (intended) and unplanned (unintended) inventory investment. Planned changed in the inventory stock is the result of firms partially adjusting their inventory stock towards their targeted level. On the other hand, unplanned or passive change in the inventory stock could arise due to errors in forecast of sales.

Depending upon the specification of the nature of inventories and the motive of holding inventories, various micro models are there in the investment literature. In the Keynesian model we have seen that if the aggregate output is more than planned aggregate expenditure, then inventory begins pilling up. Such disequilibrium position of inventories gives signal to the firms to cut down their production till equilibrium is reached. This tacitly defines equilibrium as a state where inventory is constant.

7.4.2 Inventory, Real Interest Rate and Business Cycle

One of the most powerful factors causing business cycle is business investment in inventories. Although the annual amount of inventory is a very small fraction of total fixed investment, due its high degree of variability, it is considered a major factor behind the short run business cycle fluctuations. In addition, the erratic short-term behaviour of inventory accumulation creates severe forecasting problem. The role of inventories in the business cycle is a result of unanticipated and anticipated inventory change.

There are three channels through which inventory investment can destabilise the growth process in an economy: (i) demand impact, (ii) cost impact, and (iii) finance impact.

The cost of holding inventories is the rental price which comprises two components: (i) depreciation of the stock of inventory, and (ii) the interest cost that must be paid on the loan that finances the inventory (or, the interest amount the firm could have earned by selling the good today itself instead of keeping it in inventory form for tomorrow's sale). Thus, theoretically it can be said that, the real interest rate measures the opportunity cost of holding inventories. Therefore, if enterprises heavily rely on bank credits, rise in the real interest rate forces the business firms to reduce their inventory stocks. Probably that is why in the 1980s in USA, due to the prevalence of high interest rate, many firms adopted the '*just-in-time'* business strategy. It simply means producing goods just before sales.

Although the idea of interest sensitivity of inventory investment is theoretically appealing, it is neither conclusive nor definite as it depends on certain factors such as (i) the effectiveness of central bank policy in controlling interest rate, and (ii) dependence of firms on bank credit for stocking of inventories. If large enterprises do not rely on bank credits, they may escape the brunt of credit tightness. In that case high interest rate will not be able to have much of an impact on inventory accumulation.

Check Your Progress 2

1) Assume that the mortgage (home loan) interest rate has increased. Also assume that due to construction delay, the supply of new housing is a function of the price which is expected to prevail after the construction gets completed. What will happen to the rate of production of new housing, if expected prices of housing remain the same?

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2) A hypothetical automobile dealer sells 50 cars per month and holds, on an average, one-month's sales in the inventory. Assume that there is a 50 per cent drop in sales, and it takes the automobile dealer two-months to respond to the change (it means, he keeps ordering at the existing rate for two months). Corresponding to the fall in sale, the dealer would like to maintain his inventory at a new level of monthly sales of cars. How many months will he not order any new car?

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7.5 LET US SUM UP

The purpose of this Unit was to examine the determinants of investment in an economy. The main reason of examining the determinants is because of the inherent nature of instability ingrained in investment. In this Unit we covered three major types of investments, Business Fixed Investment, Residential Investment and Inventory Investment. According to the neoclassical model of business fixed investment, firms invest if the rental price of capital is more than the cost of capital. The firms disinvest otherwise. The cost of capital comprises real interest rate, depreciation rate, and the relative price of capital. The cost of capital is also affected by various tax codes and tax laws.

Firms try to bridge the gap between actual capital stock and desired capital stock only partially in each successive time period in the flexible accelerator model. In the Tobin's q-theory of investment, investment of a firm depends upon the market valuation of its assets vis-à-vis its replacement cost. If market value is higher than its replacement cost, the firm would expand its capital base by floating more equities.

The inelastic short-run aggregate supply of housing stock makes the housing prices completely dependent on the demand for housing. The demand for housing, in turn depends on mortgage interest rate, credit availability, income tax concession policy, GDP growth rate, and population size. From the suppliers' side, factors such as construction cost, and construction delay, etc. influence residential investment.

Inventories are held by the firms for various motives. This tiny component of private investment has great degree of variability and potency to influence the short run business cycle.

In addition to the factors discussed in the Unit, there are certain exogenous variables that influence investment in an economy. Political uncertainty, social unrest, corruption, natural disaster, etc. influence private investment decision to a great extent.

7.6 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) One unit of capital contributes MP_K units of output. After paying 50% of that output as tax, the tax-adjusted net contribution of the one unit of capital is

   = (1 – 50%) $MP_{K.}$
   Value of the tax adjusted MP_K = Y

$(1-50\%)MPK$ { $as\ value\ of\ 1\ unit\ capital = 1\ unit\ output$ }.

The desired capital stock will be at

Value of the tax adjusted MPK = User cost of 1 unit of the capital = rental cost of one unit capital * price of the capital

= (20% + 10%)Y. Equate both these terms and solve for K and you will get the desired capital stock = 970 units.

2) By equating MP_K = rc, we get

Desired capital stock = $\frac{\gamma.Y}{rc}$

Putting all the values and Y = 10 in that we get the desired capital stock = 50. Similarly, for

Y = 20, desired capital stock becomes = 50

Change in the desired capital stock = (50 – 25) = 25

Initially the actual capital stock was = 25. After the income change the desired capital stock has become = 50

The rate of investment in the first period = λ (K* – K) = 1/5 * (50 – 25) = 5

3) The Present value of the future profit = $\frac{500}{(1+.1)} + \frac{700}{(1+.1)^2} = 1033$. Cost of the project was 1000. Thus, the project should be undertaken.

4) Rate of investment is = λ (Desired capital stock – Actual capital stock). Irrespective of the value of λ, rate of investment will be higher if the gap (K* – K) is higher. If the actual capital stock got reduced due to the war and the desired capital stock remain same, then the gap is higher and the rate of investment increase.

5) It will be a wrong move. In the q-theory of investment, q = value of the asset / cost of producing those assets. So, if q is low, the cost of producing those assets is more than the value of those assets. So, it is not a good idea for the firm to produce more assets.

Check Your Progress 2

1) Interest rate on home loan has increased. So, demand curve for existing houses shifts downward. The supply curve of existing houses remains the same. Thus, the current price of housing goes down.

But as the supply of new housing is not a function of the current prices of housing, rather it is a function of expected future price of housing which has not changed. Therefore, the rate of production of new housing will remain the same.

2) The dealer was selling 50 cars and keeping 50 cars in the inventory. After the 50% drop in sale, the monthly sale will become 25. For 2 months the dealer would still be ordering 50 new cars per month. Hence, he added 50 more cars to its 50 inventories in these two months. His inventory has become 100 now. If he is going to sell 25 cars per month, and would like to maintain 25 cars in his inventory, then he can take $25 \times 3 = 75$ cars from the inventory and sell for 3 months, without ordering any new cars for 3 months.

UNIT 8 DEMAND FOR MONEY: POST-KEYNESIAN VIEW*

Structure

8.0 Objectives

After going through this Unit, you will be in a position to

- identify the motives behind individuals holding money with themselves;
- find out the quantity of money that people wish to hold in cash;
- explain how and to what extent the demand for money is affected by changes in interest rate;
- identify the factors that determine the optimum composition of individuals' portfolio;
- describe how attitude towards risk influences the demand for money; and
- explain how money can be viewed as producer's and consumer's good.

8.1 INTRODUCTION

Why do we demand money? The answer appears to be simple, but there is no consensus amongst economists. There are several alternative theories of the demand for money. Keynes highlighted the concept of speculative demand for money. However, the Keynesian approach has been challenged by W. J. Baumol (1952), Tobin (1956) and Friedman (1958). In this unit we will discuss post-Keynesian theories of demand for money. In this context we will look into the

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following models: Baumol-Tobin's model of transaction demand for money, Tobin's portfolio allocation model, and Friedman's restatement of quantity theory of money.

8.2 TRANSACTION DEMAND FOR MONEY

Demand for holding money arising out of the need to facilitate transactions by economic agents is called the transaction demand for money. The transaction demand for money refers to the narrow definition of money, i.e., cash, cheque account balances, etc. Basically, it refers to the M1 definition of money. Transaction theories of demand for money take various forms depending upon how the process of obtaining money and making transactions is modelled. Some of the important models under this category are (i) Baumol-Tobin Model, (ii) Shopping-Time Model, and (iii) Cash-in-Advance Model. We discuss below the most prominent one, i.e., Baumol-Tobin Model.

8.2.1 Baumol-Tobin Model of Transaction Demand for Money

Here we would present a simpler version of the model which was independently developed by William Baumol (1952) and James Tobin (1956). It emphasises the cost and benefit of holding money using *inventory theoretic approach.* The model was originally developed to provide micro-foundations for aggregate money demand functions commonly used in Keynesian and monetarist macroeconomic models.

The following are the salient features of the model:

- Money is held for transaction purposes. Thus, it serves as a medium of exchange. Holding of cash is considered as an inventory on the part of the individual or economic agent. The individual would minimise the cost of holding the cash.
- Alternative to holding money in cash (which does not yield interest) is to hold interest-yielding bonds.
- For an individual, the time of receiving income and the time of spending money is not synchronized. Income is received once a month while purchases/expenditures are spread evenly throughout the month.
- Money is held in cash to bridge the time gap between the income receipt and flow of expenditure.
- Individual will exchange bond into cash to facilitate his evenly spread expenditure stream, use the cash, and again go for exchange.
- Each time the agent exchanges bonds to cash, there is some transaction cost/ brokerage fee which is fixed and independent of the volume of exchange. We call these exchanges as transactions.
- As each of this type of exchange (transaction) involves cost, the individual will keep in mind the trade-off between the interest earnings on bonds and the cost of transaction(exchange).
- Individual's average cash/money holding, is determined by the number of transactions (exchanges) made.

- A rational individual would minimize his cost of exchange (transactions) and decide about his optimum number of transactions.
- Aggregate demand for money will reflect this representative individual's demand for average money holding.

Let us use the following notations:

y = periodical real income [time period could be a month or a year]

T = length of the entire period (month or year) in days

n = number of exchanges (transactions) during the time period

b = brokerage fee per transactions

r = real interest rate

As n number of exchanges are being made in the entire period (which has T days), the period is split into n intervals and each interval's length in days is $\frac{T}{n}$ days. To facilitate the smooth, evenly distributed expenditure stream, the agent's real periodical income y is equally distributed in these n intervals and each of these interval's expenditure requirement is $\frac{y}{n}$.

In the beginning of the time period, when the individual has received his income y, let us assume that the entire amount (income) automatically gets invested in bonds (or any interest-bearing deposit). For the first interval's expenditure requirement the individual would want to exchange $\frac{y}{n}$ amount into cash from bonds and $(y - \frac{y}{n})$ remains in the form of bonds. Therefore, for the first interval, $\frac{1}{n}$ per cent of y is held in cash and $1 - \frac{1}{n} = \frac{n-1}{n}$ per cent of y is held in the form of bonds.

The money holding pattern of the individual for the period of T days is shown in Fig. 8.1.

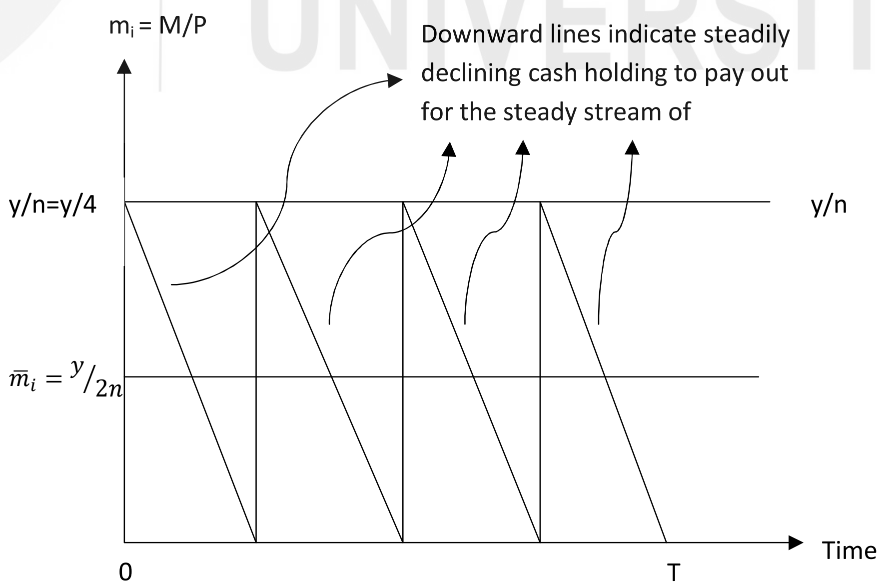

Fig. 8.1: Cash Management in the Baumol-Tobin Model

In Fig. 8.1 we split the time period into *n* (here, n = 4) sub-periods (intervals). The length of each sub-period is T/n days. Therefore, 4 transactions take place. In the beginning of each sub-period the individual converts y/n amount from bond into cash. The cash balance with the individual at the beginning of the sub-period is y/n (= y/4 in the diagram). At the end of each sub-period, as the individual exhausted the amount y/n = y/4 to pay out for that period's expenditure, his real balance becomes zero (notice the declining line, which indicates declining cash balances over the sub-period). The average real balance holding of the individual is ($\bar{m}_i$), which is the average of money holding in the beginning of the interval and money holding at the end of the interval). For Fig. 8.1, we find that

$$\bar{m}_i = \frac{(\frac{y}{n}+0)}{2} = \frac{y}{2n}.$$

8.2.2 Optimum Number of Transactions

In Fig. 8.1 we assumed that there are 4 transactions. A question arises: Is there an optimum number of transactions for an individual? For an individual, in fact, it could be a problem to determine the optimal number of transactions. We know that a rational individual would minimize the cost of converting the bonds into cash. The cost of conversion has two components: brokerage cost, and interest earnings forgone. Let us find out the details of the above two.

(i) Brokerage Cost

In each transaction, the individual will convert $\frac{y}{n}$ amount into cash. If 'b' is the brokerage fee per transaction and *n* is the total number of transactions, the total transaction cost of the entire time period will be (n.b).

(ii) Interest Earnings Forgone

If money is held in the form of bonds, it will fetch interest at the rate of *r*. On the other hand, if money is held in the form of cash, there is a loss of interest earning. Expenditure requirement of each interval is $\frac{y}{n}$ and each interval's length in days is $\frac{T}{n}$. Let us find out the interest earning foregone for each sub-period.

<u>First Interval's Interest Cost</u>: We know that $\frac{y}{n}$ amount of cash got converted from bonds. This could have remained in the bond form for the entire period, that is, for T days. So, the interest foregone on that amount is $\frac{r.T.y}{n}$.

<u>Second Interval's Interest cost</u>: Recall that again $\frac{y}{n}$ amount of cash is being converted from bond into money in the second interval. This could have remained in the bond form for the period (T– length of the first interval), that is, (T - $\frac{T}{n}$) = T ($\frac{n-1}{n}$) days. Therefore, interest amount forgone on that amount is $r.\frac{T\,(n-1)}{n}.\frac{y}{n}$

Third Interval's Interest cost: For the third interval, the interest forgone is $r.\frac{T(n-2)}{n}.\frac{y}{n}$

n[th] Interval's Interest Cost: Here $\frac{y}{n}$ amount of money could have remained in the bond form for $[\,T - \frac{(n-1).T}{n}] = \frac{T}{n}$ days. Therefore, the interest forgone = $\frac{r.T.y}{n.n}$

If we add up all the above, we obtain the total interest earnings forgone, which is given as

$$[\frac{r.T.y}{n} + \frac{r.T.(n-1).y}{n.n} + \frac{r.T.(n-2).y}{n.n} + \cdots + \frac{r.T.y}{n.n}]$$

$$= \frac{r.T.y}{n^2}[n + (n-1) + (n-2) + \cdots + 1]$$

$$= \frac{r.T.y}{n^2}.\frac{n(n+1)}{2}$$

$$= \frac{r.T.y}{2}.(1 + \frac{1}{n}) \qquad \ldots (8.1)$$

The total transaction cost (TC) of the period = brokerage cost + total interest earnings forgone

$$TC = n.b + \frac{r.T.y}{2}.(1 + \frac{1}{n}) \qquad \ldots (8.2)$$

To solve for the optimum number of transactions, we should take the first derivative of TC with respect to *n* and equate it to zero as the individual would try to minimize the total cost. We get

$$\frac{\partial TC}{\partial n} = b - \frac{r.T.y}{2.n^2} = 0 \qquad \ldots (8.3)$$

Solving for *'n'* we get,

$$n = \sqrt{\frac{r.T.y}{2.b}} \qquad \ldots (8.4)$$

So, the optimum number of transactions increases with *r, T and y* and decreases with the brokerage fee *b*. This is the famous Baumol-Tobin's 'square root formula'.

8.2.3 Aggregate Money Demand

We have found that the individual agent's average money demand (see Fig. 8.1) is

$$\bar{m}_i = y\,/\,2n$$

Substituting the value of the optimum number of transactions from equation (8.4) in the above, we get

$$\bar{m}_i = \sqrt{\frac{b.y}{2.r.T}} \qquad \ldots (8.5)$$

When an individual agent periodically converts the bond into cash, on the other side of the market there must be a firm whose money got converted into bonds. Therefore, the representative agent's bond and cash holding would reflect the firm's cash and bond holding like a mirror image. It implies that the firm's average cash holding would also be given by the square root rule given in equation (8.4).

This explanation enables us to derive the aggregate money demand function just by doubling the $\bar{m}_i$ in equation (8.5). Thus,

$$\frac{M}{P} = 2.\overline{m_i} = 2.\sqrt{\frac{by}{2r}} = \sqrt{\frac{4by}{2rT}} = \sqrt{\frac{2b}{rT}} \qquad \ldots(8.6)$$

The features of the aggregate money demand function given at equation (8.6) can be summed up as follows:

$$\frac{M}{P} = m(r, y)\ ;\ \frac{\partial m}{\partial r} < 0, \frac{\partial m}{\partial y} > 0 \qquad \ldots(8,7)$$

You should note that the interest elasticity of the money demand $[= \frac{\partial \frac{M}{P}}{\partial r} . \frac{r}{\frac{M}{P}}]$ is calculated as $(-)\frac{1}{2}$. Thus, money demand is interest-sensitive even if all the demand for money is of transactions type. The presence of speculative demand for money further adds to the 'sensitivity of money demand to rate of interest'.

8.2.4 Limitations of the Model

In the Baumol-Tobin model discussed above we assumed that income is received once in a time period while expenditure takes place frequently and regularly. Therefore, the economic agent keeps the receipts or income in the form of bonds and converts it for cash periodically. Some of the limitations of the model are as follows:

(i) Expenditure payments may not be perfectly foreseen, evenly spread and continuous as assumed. It can be lumpy and unforeseen.

(ii) Baumol-Tobin's model is based on transaction demand for money. It overlooks the fact that changing bond prices may have implications on cash demand.

(iii) Cash is by no means the only assets in which transaction balances are held as assumed in the model.

(iv) If receipts of income and expenditure coincide in terms of time and amount, then it would imply zero demand for real balances.

(v) The implicit assumption that the brokerage fee would remain constant is questionable.

Check Your Progress 1

1) If most transactions are done through online payment, would you still be interested to hold some cash to meet the daily transaction needs? Give justifications in support of your answer.

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2) Find out the optimum number of transactions for an individual in the Baumol-Tobin model, if r =10 %, Price level =1, Income of the individual = Rs. 30000 per month and the brokerage cost = Rs.5000 per transaction.

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3) If there is a rapid increase in credit card fraud cases, what will be its impact on transaction demand for money?

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8.4 PORTFOLIO THEORIES

Keynes's theory of liquidity preference asserts that people's portfolio consists of either money or bonds. In general, individuals hold portfolios consisting of many assets; thus portfolios are diversified. It is observed that risky assets earn higher returns. Therefore, an individual who is concerned about both risk and return, hold a mixture of bonds and money in his portfolio.

8.4.1 Portfolio Balance Approach

Portfolio theory presented by James Tobin emphasized specifically on a particular function of money, i.e., money as a store of value. An individual investor holds his total wealth (W) in the form of bonds (B) and money (M). His collection of investments (i.e., his portfolio) is given as follows:

$$W = M + B \qquad \dots (8.8)$$

Nominal value of money remains the same as it yields no return; but it is convenient due to its security and liquidity. Let us assume that the expected return from 1 unit of money invested on bonds is '$\bar{e}$'. It comes from the market rate of interest (r, earned on each unit of bond and this is no uncertainty) and the expected percentage rate of capital gain ($\bar{g}$). There are chances that the bond price can go either up or down. The investor therefore cannot be certain about the capital gain. He can expect an average capital gain, that is, $\bar{g}$. So, his total expected return from the bond would comprise two components: (i) interest (r) which is certain, and (ii) capital gains (g) which is uncertain. Investors are uncertain about 'g' but has an implicit normal distribution of these gains around the average expected gain $\bar{g}$. Thus,

$\bar{e}$= r + $\bar{g}$ … (8.9)

As bonds are risky, we take the standard deviation σ_g as the natural measure of risk. It implies that an investor has a probability of 0.67 (check out the properties of standard normal distribution) that g will remain between $(\bar{g} - \sigma_g)$ and $(\bar{g} + \sigma_g)$.

Since the total bond holding is B, the expected return $(\bar{R}_T)$ is

$$\bar{R}_T = B \cdot \bar{e} = B \cdot (r + \bar{g}) \quad \ldots (8.10)$$

Here 'r' is a known value, fixed, at least to the individual, by the bond market. The total risk of having the bond holding of the amount 'B' is:

$$\sigma_T = B \cdot \sigma_g \quad \ldots (8.11)$$

Institutively, higher the proportion of the individual's wealth kept in bonds; more will be the return but he would expose himself to greater risk too. Mathematically we can give this intuition a concrete form. From equation (8.11) we can write

$$B = \frac{\sigma_T}{\sigma_g} \quad \ldots (8.12)$$

Using the above in equation (8.10) we get,

$$\bar{R}_T = \sigma_T \left(\frac{r+\bar{g}}{\sigma_g}\right) \quad \ldots (8.13)$$

The slope of the opportunity locus (OC) is given by

$$\frac{d\bar{R}_T}{d\sigma_T} = \frac{r+\bar{g}}{\sigma_g} \quad \ldots (8.14)$$

Each of these terms apart from r, are fixed for each individual.

Let us plot equation (8.13) in Fig. 8.2. In the upper panel of Fig. (8.2), we measure expected returns from bond holding $\bar{R}_T$ on the y-axis and total risk σ_T on the x-axis. Remember that expected returns $(\bar{R}_T)$ increases if the individual holds more bonds; risk also increases if the person holds more bonds. Thus, at the origin '0' both returns and risk are zero (implies that the individual is holding all his wealth in the form of money). As the person's bond holding increases, there is an increase in his returns as well as risk. Thus the OC line is upward sloping. Further, there is a trade off associated here – more bonds implies more returns; more money implies less returns. This trade off between the expected return $\bar{R}_T$ and total risk σ_T is shown by the *opportunity locus* OC. Since we assume that the rate of trade-off is constant, the 'opportunity locus' is a straight line. The investor decides at what point his risk is optimum (on the OC curve). If he is risk averse, he will be more towards the origin. If he is risk lover, he will be farther from the origin. You should note that the OC curve shifts as the rate of interest changes. The line OC_1 is the opportunity locus when the rate of interest is r_1. As the market rate of interest increases, slopes of the line increases and individual's opportunity locus shifts from OC_1 to OC_2 to OC_3 corresponding to different rate of interests $r_1 < r_2 < r_3$ respectively.

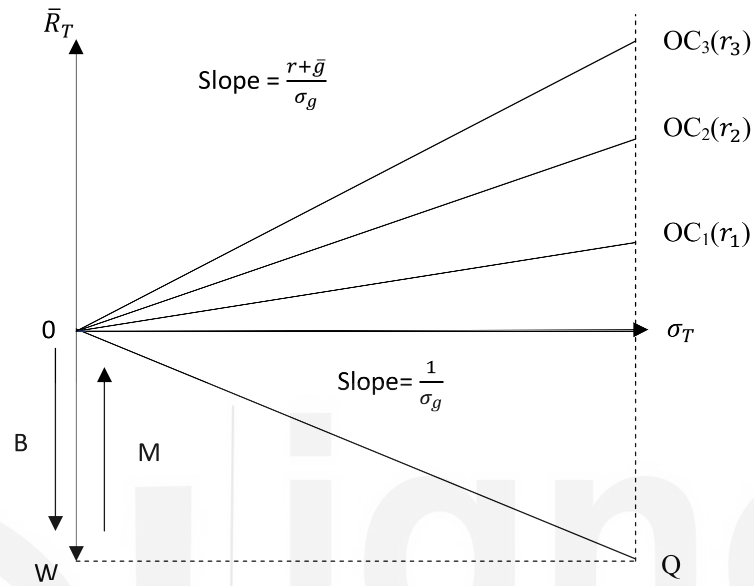

Fig. 8.2: Trade-Off between Risk and Return

In the lower panel of Fig. 8.2, we depict the relationship between risk and investment in bonds is shown by the line OQ (from equation 8.12). The length of the vertical axis in the lower panel is given by the fixed liquid wealth of the individual, W. The distance from the origin along the y-axis gives total bond holding (B), and the distance from the total wealth point (W) along the y-axis to the origin '0' gives total money holding (M). Slope of the line OQ is $\frac{1}{\sigma_g}$ from equation (8.12). The OQ line helps us in finding the composition of bonds (B) and money (M) in the portfolio of an investor for any given level of σ_T.

8.3.2 Risk Preference of the Investor and Optimum Portfolio Allocation

The investor optimises on risk and returns. Let us find out the optimum portfolio mix of B (Bond) and M (Money). To locate the optimum risk-return combination of the individual, we need to know the individual's utility function, $U = f(\bar{R}_T, \sigma_T)$. An increase in σ_T increases utility while an increase in σ_T decreases utility. We can express this utility function in the form of indifference curves (IC), such that a higher IC indicates higher level of utility (see Fig. 8.3). There are three indifference curves shown in Fig. 8.3.

Tobin distinguished broadly two kinds of investors (i) *Risk Lover* and (ii) *Risk Averter.* Risk lovers are individuals willing to accept lower expected return in order to have the chance of unusually high capital gains. They prefer high risk.

Their indifference curves will be concave to the origin. Risk averters on the other hand will not accept high risk unless they are compensated and satisfied with higher expected return. Empirically it has been observed that majority of investors are risk-averse. Their ICs will be convex to the origin. We will focus our analysis on locating the optimum portfolio allocation of the risk averters in Fig. 8.3.

Let us begin with the situation when interest rate is r_0 and indifference curve is IC_0 (see upper panel of Fig. 8.3). The investor is at the equilibrium point where OC_0 is tangent to IC_0. Thus, the investor will hold OB_0 amount of bonds and B_0W amount of money (see lower panel of Fig. 8.3). This is the optimum portfolio allocation of the investor.

Suppose there is an increase in the rate of interest to r_1. The investor is willing to take more risk, as the returns is higher now. The investor can attain a higher level of utility given by IC2. The equilibrium condition is given by the point where OC_1 is tangent to IC_1. Look into the lower panel of Fig. 8.3. The optimum portfolio allocation of the investor is given by OB_1 and B_1W of money.

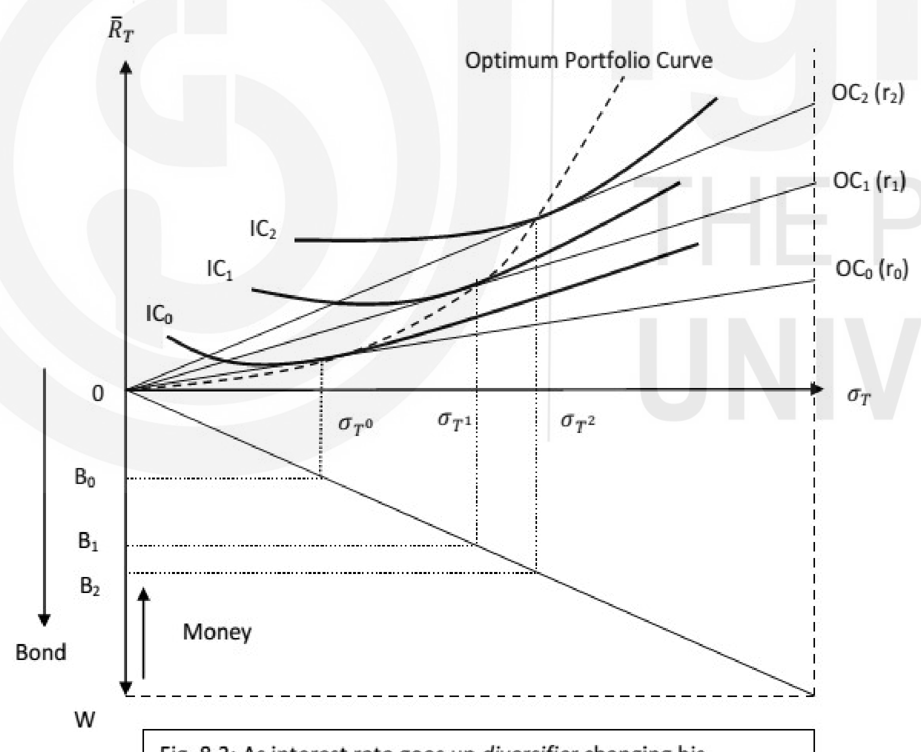

Fig. 8.3: As interest rate goes up *diversifier* changing his optimum portfolio towards more bonds and less money

8.3.3 Interest Rate Sensitivity of the Aggregate Money Demand

Aggregate Money Demand curve can be derived from the Fig. 8.3 by observing the changes in the investor's allocation of liquid wealth between bonds and money. As r increases by constant increments (r_0, r_1, r_2), the slope of the opportunity locus lines increases and rotate upwards (OC_0, OC_1, OC_2) touching successively higher indifference curves (IC_0, IC_1, IC_2). Tracing out the successive tangency points between the utility curve and the opportunity locus we get the Optimum Portfolio Curve (dotted line). You should note that for successive equal increase in r we get smaller increments in the amount of wealth (fixed) put into bonds (B_0, B_1, B_2). Since W is fixed and W= B+M, we can also say conversely that, for continual equal increase in r the investor must decrease M progressively by smaller and smaller amounts.

EXAMPLE: For a risk averse investor, suppose W = 100. His portfolio allocation is given by the following table:

Rate of Interest	Bond holding (B)	Money Holding (M)	Real money Holding (M/P)
r_0	50	50	$50/P_0$
r_1	60	40	$40/P_0$
r_2	65	35	$35/ P_0$
r_3	67	33	$33/P_0$

In the hypothetical example above, we assume that price level remains unchanged at P_0. We plot real money holding and rate of interest in Fig. 8.4. This gives us the *aggregate money demand curve*. Remember that we have assumed incometobeconstantatY_0.

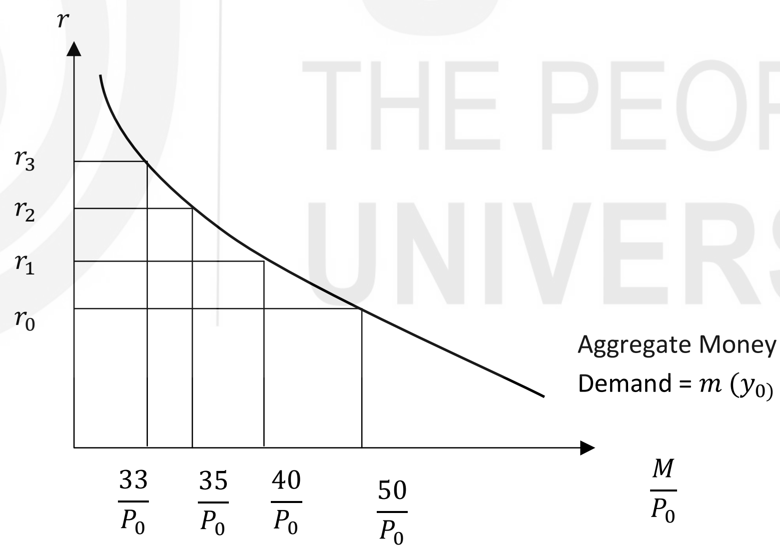

Fig. 8.4: Demand for Money Function

The demand for money function drawn in Fig. 8.4 is nothing but the speculative demand for money. It analyses the optimum allocation of fixed wealth into bond and money, depending upon the rate of interest, and expected risk and return on capital gain. In this model no reference has been made regarding the transaction demand for money.

8.3.4 Significance of the Probability Distribution of Capital Gains

Investor's estimates of σ_g of risk of bond holding are subjective. The standard deviation σ_g of the probability distribution of capital gain is influenced by the investor's perception, market experience, uncertainty, and measures of fiscal and monetary policy. The Central Bank's policy (such as open market operations) can influence investors' estimated risk. Tax rate on capital gain and interest earnings affect investor's calculation of estimated risk and return. Thus it is important to explore the impact of change in σ_g on the optimum allocation of investor's wealth.

An increase in σ_g influences the slope of both the OC line and the OQ line (see Fig. 8.2). While OC line will rotate downward, the OQ line will rotate upward. The logic is simple. When the risk of investing in bonds increases, investors like to reduce the total risk of entire bond holding (desire to reduce σ_T). The investor will cut down on B.

An increase in the capital gain $\bar{g}$ will have the same effect as the increase in interest rate. For any given rate of interest, an increase in capital gain would increase the investor's preference for bond and decrease his money demand. Thus, the money demand curve will shift downward.

Tobin's portfolio balance approach to explain speculative demand for money gives a more realistic analysis when investor's portfolio consists of both bonds and money

Check Your Progress 2

1) A bond worth Rs. 100 has a yield of Rs. 6. The price of the bond rose to Rs. 120. The bond is risky; higher the risk higher is the return. The average expected capital gain is 15% and the asset holder has a 66.7% chance that the actual capital gain will be between 11% and 19%. In this case an increase of one percentage point in the risk will buy the investor how much increase in the expected total return?

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2) Suppose there are two types of bonds in the market. Although both the types have the same average expected gain, one has a greater σ_g than the other. Which one will be preferred by the investor?

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8.4 FRIEDMAN'S APPROACH TO DEMAND FOR MONEY

Milton Friedman in his essay (1956), "The Quantity Theory of Money – A Restatement", reformulated the quantity theory of money. Friedman treated money as one type of asset. Economic agents such as households, firms and government want to hold certain portion of their wealth in the form of money. Thus, money is an asset or capital which has positive return. Hence Friedman's demand for money theory essentially a part of wealth theory. Friedman takes permanent income as a proxy for wealth.

8.4.1 Money Demand Function

Wealth can be held in five different forms: (i) Money, (ii) Bonds, (iii) Equities, (iv) Physical Goods, and (v) Human Capital. Each form of wealth has unique characteristics. Each form of wealth yields certain returns. The first four forms can be categorised as non-human wealth while the last one is human wealth. Non-human wealth can easily be converted into money. Human wealth (it refers to the income generating productive capacity of human beings such as education, skill or good health) can neither be liquidated easily nor can it be used as security to borrow money.

According to Friedman demand for money depends on the following variables:

(i) **Total wealth:** An individual's total stock of wealth is the most important determinant of his money demand. Greater the wealth of an individual, the more money he would demand for transaction and other purpose. Estimate of total wealth of an individual is seldom accurately available. Friedman used discounted value of permanent income (y_p) as an index of wealth. The permanent income is the aggregate expected yield from wealth during the agent's life time.

(ii) **The proportion of human to non-human wealth**: The proportion (w) in which the wealth (permanent income) of the agent is divided between these two forms of assets is an important factor in determining the money demand in real terms. Friedman in his *Permanent Income Hypothesis* suggested a relatively lower MPC out of human wealth. Due to this, although the ratio of human wealth to non-human wealth remains relevant, it does not play an important role in Friedman's theory.

(iii) **The expected rate of return on money and other financial assets:** Unlike other theories demand for money, Friedman takes broad definition of money. Thus, he includes time deposits along with the demand deposits and currency. So, money too has expected nominal return (R_m) like other forms of assets. As permanent income of an individual is stable, his wealth (which is surrogated by permanent income) is stable. Money and other financial assets are competing with each other to get their share out this fixed wealth. Thus, demand for money depends on the incentives for holding other assets relative to money ($\text{Bonds}: (\mathrm{R_b} - \mathrm{R_m})$, Equties: $(\mathrm{R_e} - \mathrm{R_m})$). If the return on financial assets (bonds and equities) decreases vis-à-vis money, individual agent would want to hold more money.

(iv) **Price and expected inflation**: Rising price level due to inflation has two opposing effects. Inflation erodes the purchasing power of money (in nominal terms). In such situations, an individual will want to hold higher nominal money balances to keep his real money balances constant. Further, there is an increase in the relative return on non-human assets such as real estate, gold, unique art piece, etc. This will influence people to hold less money. Thus it will depend on the relative return $(\pi^e - R_m)$ of physical goods.

(v) **Other variables**: Variables such as taste and preference, expected economic instability (global financial crisis, phases of business cycle), and institutional factors (method of wage payment system, payments of bills) too affect the demand for money. All these factors are captured in the variable (z).

Friedman's demand for money function can be written in the following form:

$$\frac{M^d}{P} = \varphi\,(y_p\,, w,\ (R_b - R_m),\ (R_e - R_m),\ (\pi^e - R_m),\ z) \qquad \dots (8.15)$$

In the above equation,

$\frac{M^d}{P}$ = Demand for real money balances

y_p = Real permanent income

w = ratio of human wealth to nonhuman wealth

R_m = Expected nominal return from money

R_b = Expected nominal return from bonds

R_e = Expected nominal return from equity

π^e = Expected rate of inflation =
proxy for expected nominal return from non financial good

z = Any other variables which seem to have power to affect the uility derived from real money

The demand for real money balances, according to Friedman, increases when permanent income increases and declines when expected returns on bond, equities, or goods increases compared to the expected nominal return on money.

Friedman views that a change in the rate of interest in the economy would change the expected return on money as well as alternative forms of assets. Consequently, there is no change in the incentive terms ($R_b - R_m$, $R_e - R_m$, $\pi^e - R_m$) in the money demand function, and hence no change in money demand. Thus, money demand is insensitive to the rate of interest. This is in sharp contrast to Keynesian view. According to Keynes interest rate is an important determinant of demand for money. This difference arises because of the difference in the definition of money considered by Keynes and friedman. Keynes takes a very narrow definition of money while Friedman takes a broad definition of money which includes time deposit (which is interest earning) along with the demand deposit. As the rate of interest increases, the demand for time deposit component of money increases and the demand for demand deposit and currency fall. So, the total effect of interest rate on money demand is negligible.

Friedman's money demand function stated in equation (8.15) can be approximated as

$$\frac{M^d}{P} = \varphi\,(Y_p) \qquad \dots (8.16)$$

You should note that terms like *w* and *z* are being dropped due to their relative insignificance in determining the demand for money. Friedman's theory suggests that real permanent income is the only determinant of real money demand. Permanent income of an individual remains fairly stable over the time as it changes only due to certain unanticipated permanent changes in the income level. Thus, the second point in which Friedman differs from Keynes is that in Keynes' theory money demand is erratic and unstable due to the change in the expected interest rate. Whereas, Friedman's real money demand is highly stable as it is dependent on the stable variable 'permanent income'. It implies that the quantity of money demand can be predicted accurately by the demand for money function stated in equation (8.16).

8.4.2 Income Velocity of Money

According to Friedman money demand function, and therefore velocity of money, are highly predictable and stable. Stability of the money demand function and consequent predictability of the velocity of money can be derived from the relationship between the real current income (= actual measured income = y) and the real permanent income (y^p). This can be observed by converting the money demand function given at equation (8.16) into the following form:

$$V = \frac{y}{\frac{M^s}{P}} = \frac{y}{\frac{M^d}{P}} = \frac{y}{\varphi(y^p)} = \text{Velocity of Money} \qquad \dots (8.17)$$

Since the relationship between the current income and the permanent income is fairly stable and predictable, velocity of money too is stable and predictable, although not constant. Friedman in his 'Permanent Income Hypothesis' defined real permanent income as follows:

$$y^p = \frac{r}{r+1} \sum_{j=0}^{\infty} \frac{y_{t+j}}{(1+r)^j} \qquad \dots (8.18)$$

Here, r = real rate of interest & t = time period. Thus, $\frac{r}{(r+1)} < 1$.

Therefore, real permanent income is less than current measured income. An implication of the above is that 'change in real permanent income is less than the change in current measured income'.

Friedman used this relationship to explain the pro-cyclical movement of the velocity of money. During the expansionary phase of a business cycle, the increase in the demand for money is less than the increase in income. This is due to the fact that the increase in permanent income is smaller relative to the increase in actual measured income (see equation (8.17)). Consequently, there is a rise in the velocity of money. During recession phase of business cycle, on the other hand, the decrease in the demand for money is less than that of income. This is due to the fact that the decline in permanent income is smaller relative to the decline in actual measured income. Consequently, there is a decline in the velocity of money during recession.

An implication of the above is that a given change in the nominal money supply will produce a predictable change in the aggregate spending. Thus, Friedman's demand for money is indeed a modern version of the quantity theory of money where money is the primary determinant of nominal aggregate spending.

8.4.3 Implications of Friedman's Theory of Money Demand

Friedman's theory of money demand has several interesting theoretical implications for the theory of money, study of business cycle, and conduct of monetary policies. It has received certain criticisms as well.

The insensitiveness of the demand for money to interest rate has received a lot of criticism. Friedman has been criticised for having a broad definition of money and including interest bearing M3 (along with M1 & M2) type of money supply which attracts rate of interest. Thus, an overall effect of a change in the rate of interest on money demand is negligible. Secondly, Friedman in his theory explained much of the cyclical fluctuations of income velocity of money by pointing out the usage of measured income and permanent income in calculating the velocity. The residual cyclical behaviour of the velocity only could be attributed to the change in the interest rates which is negligible and thus supports Friedman's idea of having demand for cash balances insensitive to the rate of interest.

Friedman considers the supply of money and the changes in the supply of money as given. He considered banks as producers of money. He ignored the possibility of any factor influencing the supply of money. However, decision on the supply of money depends on certain variables such as (i) deposits and withdrawals of currency by non-banking financial intermediaries, (ii) lending and borrowing by commercial banks form and to the Central Banks, and (iii) purchase and sale of securities by the Central Bank.

Check Your Progress 3

1) Point out the factors that determine the money demand in Friedman's modern quantity theory.

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2) What determines the velocity of money in Friedman's quantity theory of money?

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3) Suppose the real demand for money takes the functional form $\frac{M^d}{P} = 0.20 \times Y$. Use Friedman's implicit quantity theory of money equation and solve for income velocity of money.

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4) Suppose the real rate of interest is $r = 10\%$. Consider a *temporary* change in income such as $\Delta y_t = 1$ with $\Delta y_{t+j} = 0, j = 1,2,\ldots..$. How much will be the change in permanent income? If there has been a *permanent* change in income, $\Delta y_{t+j} = 1\ , j = 1,2,\ldots..$ how much do you think would be the change in permanent income?

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8.5 LET US SUM UP

The post-Keynesian theories of money demand mainly emphasized on either the transaction motive or the precautionary motive of holding cash balances. The medium of exchange function of money gave rise to the transaction models. Baumol (1952) and Tobin (1957) treated money as an inventory good which people would want to hold for transactions purpose when level of transactions is known and certain. Although alternative liquid assets are available with better rate of return than money, there is certain transaction cost due to conversion of these assets into money. Such transaction cost justifies holding of money.

Friedman (1958) analysed money as a consumer good and demand for money as a direct extension of the demand for any consumer durable goods which enters the utility function of the consumers. Friedman treated money as an asset yielding a flow of services and have a broad range of opportunity cost variables. Friedman's stable demand for money is a function of permanent income of individual consumers.

8.6 ANSWERS/ HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) If the online payments are being made through debit cards/ e-wallet, then it is as good as holding cash in hands. On the other hand, if it is made by credit cards, then payment for any month's credit card bill can be made by that month's salary as soon as that is disbursed at the beginning of the next month and rest of the salary amount can stay invested in bonds which does not need to be exchanged into money. So, depending upon financial infrastructure and attitude towards risk, the need for holding cash and exchanging bonds into money would lose its significance.

2) The optimum number of transactions for an individual is: $n = \sqrt{\frac{r.T.y}{2.b}}$.

   Price level = 1, real income Y/P = Rs.30000/Rs.1 = 30000

   T = 1 month = 30 days

   Real rate of interest 10% = 0.1

   Real brokerage cost = Nominal brokerage cost/price level = Rs. 5000/Rs.

   1 = 5000

   Putting it in the formulae we get optimum number of transactions

   $= \sqrt{\frac{0.1 \times 30 \times 30000}{2 \times 5000}} = \sqrt{9} = 3.$

5) If there is a wave of credit card fraud then the transaction demand for money will initially increase. This means that LM curve will shift to the left and the rate of interest will rise. This may, ultimately, reduce transaction demand for money.

Check Your Progress 2

1) Here the percentage yield of bond is 6%. The market rate of return $r = \frac{Rs.6}{Rs.120} \times 100 = 5\%$

   $\bar{g}$ = average expected capital gain = 15%

σ_g = the standard deviation of return on a bond = 4% [The difference between 15% and 11% ; and 15% and 19%]

As per equation (8.14), the percentage increase in the total return from the bond due to one percentage point increase in the risk:

$$\frac{d\bar{R}_T}{d\sigma_T} = \frac{r+\bar{g}}{\sigma_g} = \frac{5\% + 15\%}{4\%} = 5\%$$

2) For both types of bonds, the average expected gains from bonds is the same, i.e., $\bar{g}$. However, one has higher risk/uncertainty (σ_g) than the other. Thus, there is 66.7% chance that the actual g, that the investor would receive will remain in the range, $\bar{g} \pm \sigma_g$. So where σ_g is higher, the spectrum of uncertainty increases, and this kind of bond would be less preferred.

Check Your Progress 3

1) In Friedman's theory, increases in permanent income increase the demand for money. Increases in the returns on bonds relative to money and the returns on equities relative to money decrease money demand. Increases in the returns on goods relative to the return on money, which is the expected rate of inflation relative to the return on money, decrease money demand.
2) Velocity is determined by the ratio of actual to permanent income. As actual income increases in an expansion, permanent income increases less rapidly. Thus, money demand increases less rapidly than income, and velocity rises (and vice versa for contractions). Interest rate does not affect velocity of money in Friedman's theory. This is due to the fact that relative returns on money and other assets are relatively constant.
3) $V = \frac{Y}{\frac{M^d}{P}} = \frac{Y}{0.20\,Y} = 5$

4) $\Delta y_p = \frac{0.10}{1+0.10}\Delta y_t = 0.09$ for the temporary change in the income

   $\Delta y_p = \frac{r}{1+r}.\frac{1+r}{r} = 1$ for permanent change in the income. Refer to equation 8.18 for details.