Lesson Name: Consumption & Investment

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Learning Outcomes

After you have read this chapter, the following concepts should be clear-

1. Meaning of consumption
2. Keynesian Consumption Function
3. Fisher's theory of optimal intertemporal choices
4. Life-cycle and Permanent Income Hypothesis
5. Rational Expectations and Random Walk Hypothesis
6. Meaning of Investment and determinants of three kinds of investment – Business Fixed Investment, Residential Investment and Inventory Investment.

Keynesian Consumption Function

We all consume many things in our everyday life, from food to clothing. These all constitute our Consumption. Consumption is a function of income. As the income rises, so does our consumption. This relationship between consumption and income is known as the Consumption Function.
The Keynesian Consumption function can be written as follows:
$C = \bar{C} + c.Y_D$

Where,
C = consumption
$\bar{C}$ = autonomous consumption, that is, the level of consumption not dependent on the income level. It is the consumption if income level was zero.
c = Marginal Propensity to consume (MPC). It means by what amount the consumption will change when there is a unit change in the income. It is also shows the slope of the consumption function. The value of MPC lies between o and 1.
Y_D = Disposable income, that is, income net of transfer and taxes.

Illustration:

If consumption function is given as follows:
$C = 100 + 0.8\ Y_D$

It means that the autonomous consumption is Rs.100. That is, regardless of the level of income, the consumer's consumption will always be Rs.100.
0.8 is the Marginal Propensity to Consume. It means that if there is an increase in the income level by Rs.100, the consumption will also increase by Rs.80.
Y_D represents the disposable income and is given by:
Y_D = Income – Taxes + Transfer receipts

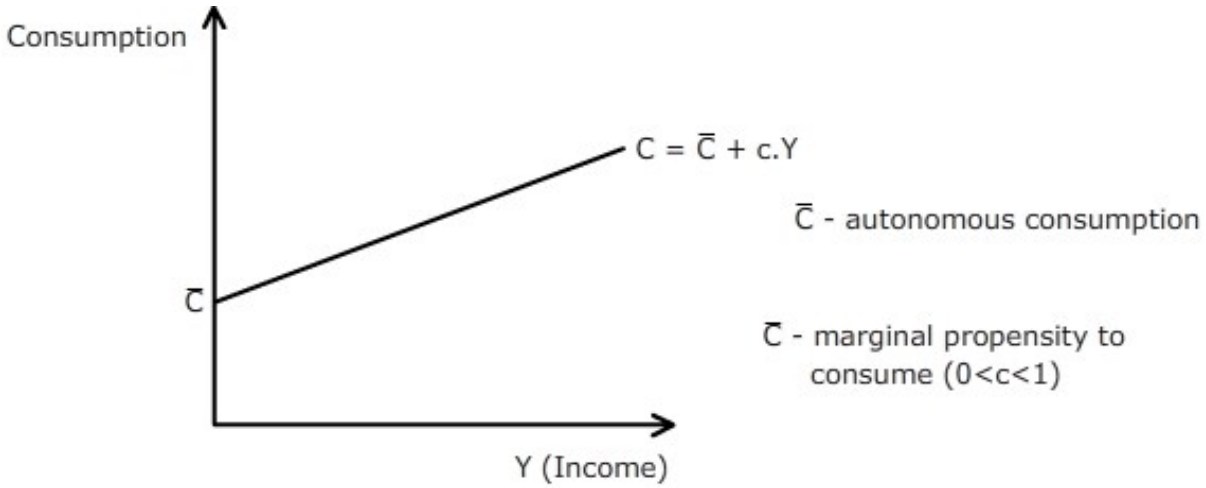

Figure 1: Keynesian Consumption Function

Keynes's Conjectures:
Average Propensity to Consume (APC) – It is defined as the consumption per unit of income. (APC = C/Y). APC decreases as the income rises.

Fisher's Theory of Optimal Inter-temporal Choices

The Keynesian consumption function depends upon the following hypotheses. First, the range of marginal propensity to consume is between 0 and 1. Second, average propensity to consume decreases when there is an increase in income.
Keynes related consumption to current income. In contrast, Fisher's model shows how rational & forward looking consumers choose consumption for the current and future period in order to maximize their lifetime satisfaction. Consumer's choices are constrained by an **inter-temporal budget constraint**, which tells us the total resources that are there for current and future consumption.

The Basic two period Model

Suppose there is one consumer and he has to make consumption choice between two periods. We use the following notations:

Period 1: present
Period 2: future
Y_1: Period1 income
Y_2: Period2 income
C_1: Period 1 consumption
C_2: Period 2 consumption
$S = Y_1 - C_1$ = Savings in period 1 (Savings earn interest rate of 'r')
S>0, if consumer is a lender in period 1
S< 0, if consumer is a borrower in period 1

Deriving the inter-temporal budget constraint

$C_2 = Y_2 + S\ (1+r)$
We are assuming that the consumer is a lender in period 1. Therefore consumption in period 2 includes – income in period 2, savings in period 1, and interest earned on savings.
Since $S = Y_1 - C_1$, we can rewrite the above equation as:
$C_2 = Y_2 + (1+r)\ (Y_1 - C_1)$
Rearranging the terms:
$(1+r)\ C_1 + C_2 = (1+r)\ Y_1 + Y_2$
Dividing both the sides by (1+r), we get,

$$C_1 + \frac{C_2}{1+r} = Y_1 + \frac{Y_2}{1+r} \Longrightarrow$$ The inter-temporal budget constraint

The left-hand side of the above equation represents the present value of the lifetime consumption and the right-hand side represents the present value of the lifetime income.

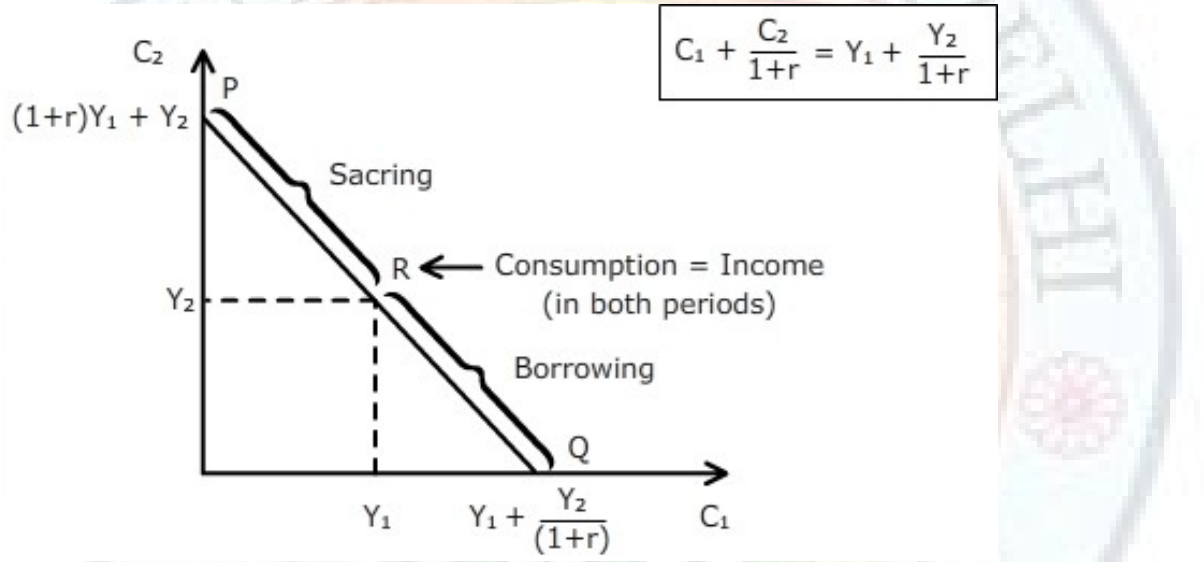

Figure 2 : The inter-temporal budget constraint

The above figure shows the inter-temporal budget constraint. C_1 is taken on the horizontal axis and C_2 is taken on the vertical axis. If the consumer consumes all in period 2 and nothing in period 1, his consumption in period 2 = income in period 2 + income in period 1 + interest earned on income in period 1, that is, $C_2 = Y_2 + Y_1\ (1+r)$. This is the vertical intercept. Similarly, if consumer consumes all in period 1 and nothing in period 2, his consumption in period 1 = income in period 1 + present (discounted) value of income in period 2, that is, $C_1 = Y_1 + Y_2 / (1+r)$. This is the horizontal intercept. Thus, PQ is the inter-temporal budget constraint. At point R, $C_1 = Y_1$ and $C_2 = Y_2$. The consumer is neither a borrower nor a lender. To the left of point R, $C_1 < Y_1$ and hence the consumer is a saver. To the right of point R, $C_1 > Y_1$ and the consumer is a borrower. The inter-temporal budget constraint PQ shows various combinations of C_1 and C_2 that exhaust all the resources of consumer. The slope of the budget line is equal to $-(1+r)$. To increase C_1 by one unit, the consumer must sacrifice (1+r) units of C_2.

Consumer's preferences

A consumer's preferences is given by an indifference curve, which shows all the combinations of C_1 and C_2 that give equal satisfaction to the consumer.

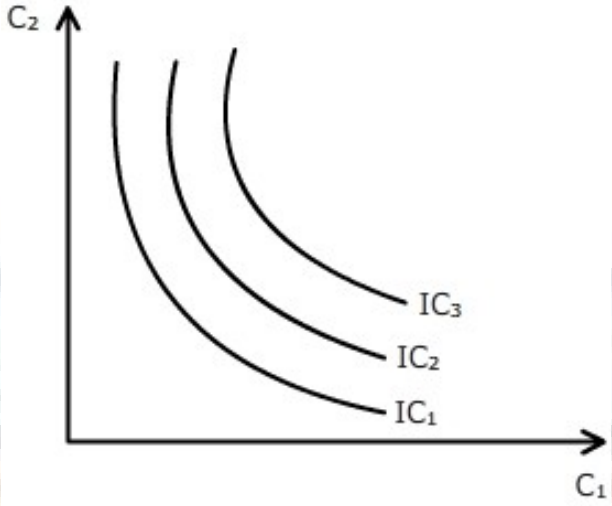

Figure 3: Indifference curves showing consumer's preferences

Higher the indifference curve, higher is the level of satisfaction.
Slope of the indifference curve at any point is given by Marginal Rate of Substitution (MRS). It is defined as the amount of C_2 the consumer would be willing to give up for a unit of C_1.

Optimization

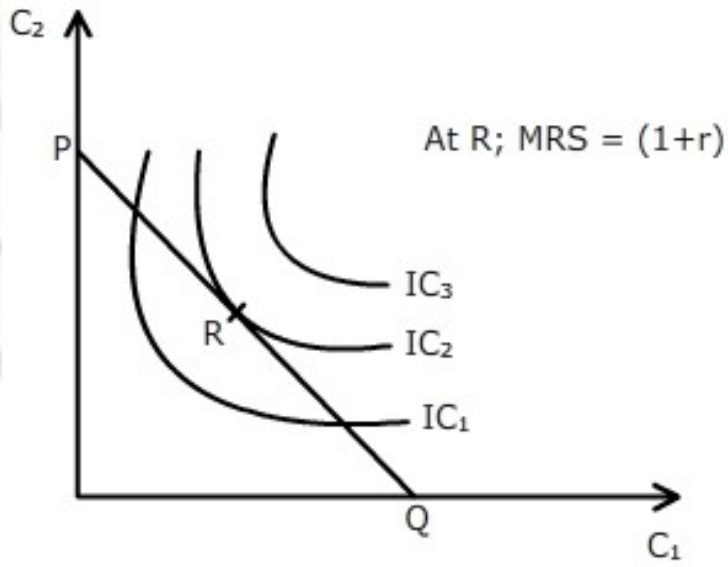

Figure 4: Optimization

The optimal (C_1, C_2) is where the budget line is tangent to the highest indifference curve. In the above figure, point R represents the optimization point where the budget line PQ is tangent to the highest indifference curve (IC_2). At point R, slope of the budget line is equal to the slope of the indifference curve, that is, MRS = (1+r).

Conclusion

Current consumption is dependent on the present value of lifetime income. The timing of consumer's income is not important as the consumer can both borrow and lend between the periods.

Life-cycle hypothesis

According to Keynes, an individual's consumption is a function of his current income. The life-cycle hypothesis states that individuals schedule their consumption and savings behaviour over their entire life. They smoothen out their consumption in the best possible manner over their life-cycles, by saving when they earn and dis-saving when they retire.

This model implies that in early lifetime, consumption of an individual exceeds his income as people make major purchases like buying home, starting a family, and beginning a career. At this stage, the individual will borrow from future in order to support such expenses. In middle of one's life, however, these expenditure patterns begin to even out as it is being supported by income increases. At this stage, the individual starts repaying his past borrowings and begins to accumulate for his retirement. On retirement, consumption begins declining whereas income decline is even greater. In this stage, the individual dis-saves and lives off past savings until his death.

The basic model

C = aWR + cYL
WR = real wealth
a = marginal propensity to consume out of wealth
YL = labour income (assumed constant)
c = marginal propensity to consume out of labour income
WL = number of years until retirement (working life)
NL = lifetime in years
(NL – WL) = retirement years

- Assumptions:
  - Ignore any uncertainty about life expectancy or length of working life
  - Interest rate on savings is zero (savings do not earn interest)
  - Consumption-smoothing is optimal
- Individual's lifetime consumption possibilities:
  With WL years of working life, lifetime income from labour is (WL* YL), per year income times total number of working years.
  We assume that the consumer prefers to have an even flow of consumption through his lifetime. Thus, consumption is not dependent on current income, rather on lifetime income.
- With lifetime consumption equal to lifetime income, consumption each year times the number of years of life (NL) equals the lifetime income. Thus,
  C*NL = YL*WL
  Rearranging the terms,
  C = (WL/NL) * YL

Illustration:

Suppose a person starts working at the age of 20, works until 65, and will die at 80. Working life (WL) is thus 45years (65-20). Number of years of life (NL) is 60years (80-20). Labour income (YL) is Rs.30,000.
Thus, lifetime income = YL * WL
= 30,000 * 45 = Rs. 13,50,000
According to the assumption that we made, the consumer spreads this lifetime income evenly over his life, thus,
C = (WL/NL) * YL
= (45/60) * 30,000 = 0.75*30,000 = Rs.22,500
Thus, 0.75 of labour income is consumed each year. 0.25 of each year's income is saved for consumption during the retired years.

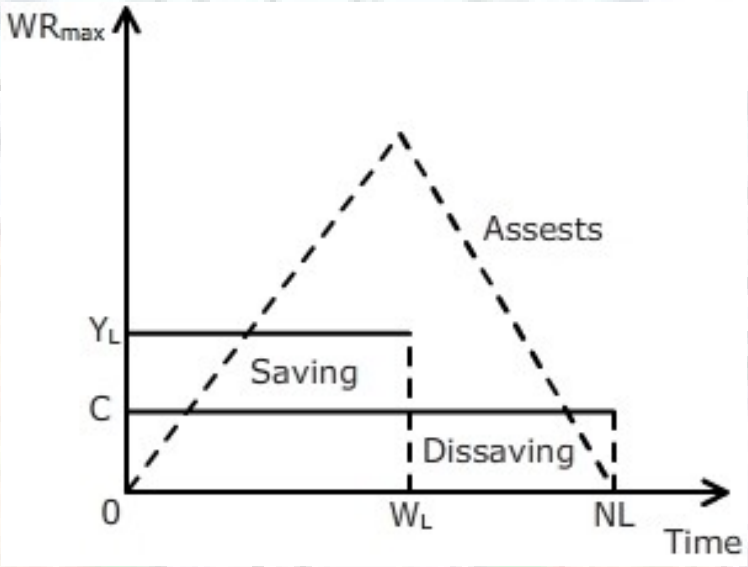

Figure5 : Lifetime Income, consumption, savings & wealth in the Life-cycle model

Saving and Dissaving
Since saving is equal to income minus consumption, we have,
S = YL - C
= YL – (WL/NL)×YL
= $\frac{NL - WL \times YL}{NL}$
The saving rate during working life is equal to the proportion of life spent in retirement. The above figure shows the lifetime pattern of consumption, saving and dissaving. There is an even flow of consumption during the whole lifetime. Consumption during retirement is financed by taking out the savings accumulated during working life. Therefore, (YL – C) × WL [saving during working years] and C × (NL – WL) [dissaving during retirement] are equal. The key idea of life-cycle theory of consumption is thus, consumption plans are made in order to achieve an even level of consumption by saving when income is high and dissaving when income is low.

Assets

Since the consumer saves during his working life, he builds up certain assets. An individual's wealth or assets increase over his working life and reach the maximum at his retirement age. After retirement, assets decrease as they are sold to finance consumption after retirement until death.

Total consumption during retirement is equal to C × (NL – WL). All this consumption is financed out of assets accumulated at the retirement, at which assets are at their peak. Thus, maximum amount of assets (WR_{max}) is given by
WR_{max} = C × (NL – WL)

In the illustration above, C = Rs.22,500 and (NL – WL) = 15years, therefore, C × (NL – WL) = 22,500×15 = Rs.3,37,500 (saving at the retirement). In other words, the individual worked for 45years, saving Rs. 7500 every year, accumulating Rs. 3,37,500 at the age of retirement (65years).

Introducing Wealth

Now we extend this model by allowing for initial assets or wealth. The consumer will try to achieve an even consumption pattern. A person is at some point T in his life, with wealth WR and labour income of YL accruing for (WL-T) years. Life expectancy is (NL-T)years. Thus, consumption possibilities,

C × (NL-T) = WR + (WL-T)× YL
This means total consumption until death is equal to wealth plus total labour income accruing till retirement. Thus, consumption each year is
C = aWR + cYL WL>T
Where, a = 1/ (NL-T)
C = (WL-T)/ (NL-T)

Coefficient 'a' is marginal propensity to consume out of wealth and 'c' is marginal propensity to consume out of labour income.

In the above illustration, the person started working at the age of 20years, retire at 65 and will die at 80 years. Thus, WL = 65-20 = 45 and NL = 80-20 = 60. It was also assumed that YL = Rs.30,000. We now suppose that the person is 40 years old. Thus, T= 20, that is, the person is in 20^{th} year of working life. We now calculate marginal propensity to consume out of wealth and labour income:
a = 1/ (NL-T) = 1/ (60-20) = 0.025
c = (WL-T)/ (NL-T) = (45-20) / (60-20) = 0.625
we now suppose that the individual's wealth is Rs.200,000. Then, consumption can be found by:
C = aWR+cYL
= (0.025×200,000) + (0.625×30,000) = Rs. 23,500

Consumption now is higher than the previous level because the individual has more wealth at the age of 40 than he would have if his wealth came from saving of labour income.
An increase in either wealth or labour income will increase the consumption. Increasing the working life too will increase the consumption as it increases lifetime income and decreases the period of dissaving.

Summary

1. Consumption is constant over consumer's lifetime.
2. Consumption is financed by initial wealth and lifetime income.
3. Current consumption spending depends on current wealth and lifetime income.

Permanent Income Hypothesis

An individual's consumption at any point is determined not only by their current income, but by their expected future income as well, i.e. their permanent income. Permanent income hypothesis implies that changes in permanent income rather than temporary income lead to change in the consumer's consumption patterns. Income includes a permanent component and transitory component. In this hypothesis, the key determinant of consumption is the lifetime income of a person and not the current income. Thus consumption is proportional to the permanent income:

$C = cYP$

Where YP is the permanent income. We now define and estimate the concept of permanent income.

Estimating Permanent Income

Given the present level of wealth, the steady rate of consumption that a person could maintain for his remaining life is known as the permanent income. We all have a certain level of income, on the basis of which we decide how much to consume. Now assume that there is an increase in the income. An individual has to decide whether the increase in income is permanent or transitory, based on which whether to increase consumption or not. An associate professor promoted to professor is an example of a permanent income change, whereas a worker's high overtime income can be regarded as a transitory increase. However, in general, a person cannot always be so sure of the income change as permanent or transitory.

We estimate the permanent income as being equal to last year's income plus a certain fraction of the change in income from last year to this year:

$YP = Y_{-1} + \theta (Y - Y_{-1}) \qquad 0<\theta<1$

$= \theta Y + (1 - \theta) Y_{-1}$

Where θ is a fraction and Y_{-1} is the last year's income. Thus permanent income can be seen a weighted average of current and past income.

Illustration:

Assume that $\theta = 0.6$, this year's income (Y) = Rs.25,000 and last year's income (Y_{-1}) = Rs.24,000. Therefore the value of permanent income can be calculated as follows:

$YP = \theta Y + (1 - \theta) Y_{-1}$

$= (0.6 \times 25000) + (0.4 \times 24000) = Rs.24,600$

Points to be noted

1. If this year's and last year's income are equal ($Y = Y_{-1}$), then the permanent income is equal to the income earned this year and last year.
2. If this year's income increases compared with the last year, then the permanent income rises by less than the current income.

Rational expectations and Random Walk Hypothesis

Random walk hypothesis is based on Fisher's model and Permanent Income Hypothesis, in which forward looking consumers' base their consumption on expected future income. The assumption of Rational Expectations is also added, according to which, all the available information is used by people to forecast the future variable such as their incomes.

If permanent income hypothesis is right and consumers also follow rational expectations, then random walk is being followed by consumption, i.e. any changes in consumption could not be predicted. An anticipated change in income or wealth has been already taken into expected permanent income, thus it will not affect consumption. Only

unanticipated changes in income or wealth that affect the expected permanent income will change consumption.

if consumers follow the permanent income hypothesis and also have rational expectations, then only unanticipated policy changes will affect consumption.

Investment – Introduction

Investment spending is one of the major topics in macroeconomics. Changes in investment lead to changes in the GDP. Also, investment spending determines the rate at which the economy adds to its stock of capital affecting the growth and productivity of the economy. In this chapter we shall look into various components of investment spending – Business Fixed investment, Residential Investment and Inventory Investment. Business Fixed Investment means business spending on machinery, equipment and structures. Residential Investment consists largely of investment in housing. Inventory Investment means addition to the stock of inventories.

Determinants of Business Fixed Investment

1. Discounted Cash Flow Analysis

Business people undertaking an investment decision use discounted cash flow analysis. Consider a business project that costs Rs.100 to set up in the first year and then generates revenue of Rs.50 in the second year and Rs.80 in the third year. The factory will be disintegrated at the end of third year.
The decision on whether the project should be undertaken depends on the present value of the entire project. The revenues accruing from the project should be discounted to present in order to calculate their present value. If the present value of the project is positive then the project should be undertaken. We assume the rate of interest to be 12%pa.

	Year1	Year2	Year3	Present Discounted Value
Cost or Revenue (A)	-100	+50	+80	
Discounting Factor (B)	1	1/1.12 = 0.893	$1/(1.12)^2$ = 0.797	
Present Value (A×B)	-100	50×0.893 = 44.65	80×0.797 = 63.76	(-100+44.65 +63.76) = 8.41

Since the present value of the project is Rs.8.41, thus the firm should undertake the project. Had the interest rate been higher, the decision would have been not to undertake the investment project. Thus, the higher the interest rate, the less likely the firm will be to undertake any given investment project.

2. The Accelerator Model and Cost of Capital Effects

According to the Accelerator model, investment spending is proportional to change in output and it is not being affected by the cost of capital. Firms invest in new capital when they need to produce more. Therefore, firms would undertake investment if output was expected to change not otherwise. Studies show that cost of capital though affects the rate of investment, but not majorly. There are findings that rental cost of capital also affects the rate of investment.

3. Uncertain Expectations

Investment decisions are made on uncertain basis. Individual's knowledge for estimating yields on long tenure investment project amounts to little or nothing. Thus, investment decisions are affected by how much optimistic or pessimistic the investor feels. Sometimes, there is no good basis for the expectations on which the investor base their decisions. And in the absence of a good basis, the decisions can change very easily, along with the volume of investment.

4. The timing of investment decision

An important reason for fluctuation in investment is that the investment decisions can be delayed. A firm considering an investment project can delay its decision if the economy is currently in a recession or it can wait till the project becomes profitable or may also wait till the time it sees increases in profitability. Thus, timing of investment decision play a major role in influencing the investment project.

Determinants of Residential Investment

Residential investment refers to the amount of money that people spend on purchasing homes (either for living or renting), home equipments or improvements. Housing can be viewed as one among the many assets that a wealth holder can hold.

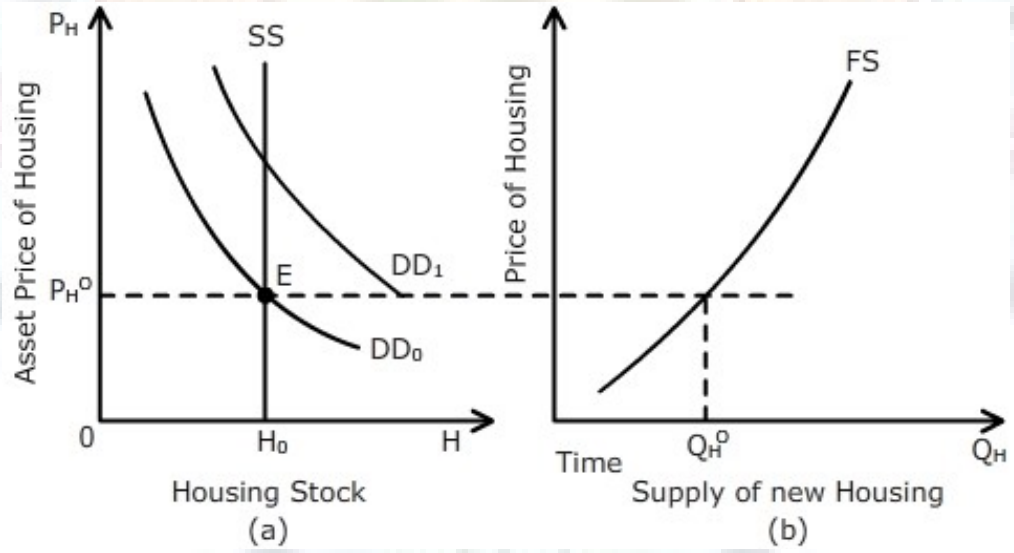

Figure 6: The Housing Market: Determination of the Asset Price of Housing & the Rate of Housing Investment

In the above figure, demand for housing is shown as downward sloping curve DD_0. Quantity demanded for housing is a negative function of the price of housing (P_H). More wealthy people desire to own more housing. Therefore, an increased wealth would shift the demand curve for housing to right from DD_0 to DD_1. The demand for housing also depends upon the return on other assets. If other assets have low return, they would not attract the investor in front of housing as an asset. Thus a reduction in return on other assets would also shift the demand curve for housing to right from DD_0 to DD_1. Mortgage rates also affect the demand for housing. A reduction in the mortgage interest rate makes housing an attractive asset and thus shifts the demand curve for housing to right

to DD_1. Supply of housing is fixed, i.e. there is a given stock of housing that cannot be changed quickly. Supply curve is thus SS. The price of housing is determined by the interaction of demand and supply. Equilibrium price of housing is P^0_H.

The Rate of Investment

We now look at the determinants of the rate of investment in housing. In the above figure, panel b, FS curve represents the supply of new housing as a function of price of housing. The curve is like any other supply curve, upward sloping. With increase in price of housing suppliers would supply more of new housing and vice versa. The position of FS curve is affected by the cost of factors of production in the construction sector and the technological factors.

Given the price of housing (from panel a) as P^0_H, suppliers would supply the new housing of the amount Q^0_H. With an increase in the price, the supply for new housing would also go up. Thus the above figure represents the basic theory of housing investment.

Factors affecting the demand for existing housing (discussed above) will affect the price of housing (P_H) and thus the rate of investment in housing. Similarly any factor affecting the FS curve will also affect the rate of investment in new housing.

The q Theory of Investment

Assume that there is a given stock of shares in an economy. Investors place a value on those shares, with the price of shares in the market equal to P_H in figure 6 above. The managers respond to the price of stock by producing more new capital, i.e. investing when price of shares is high and producing less new capital, i.e. not investing at all when price of shares is low. Q represents the estimate of the value that the stock market places on a firm's assets in relation to the cost of producing those assets. When Q is high, firms would want to produce more assets. On a similar note, P_H can be thought of as price of an existing house relative to the cost of building a new house. When that ratio is high, there will be lots of houses.

Monetary Policy and Housing Investment

Monetary Policy plays a major role in determining the rate of housing investment. We assume that most houses are purchased on mortgage. And the demand for housing is affected by interest rates, which is linked with monetary policy.

An increase in the interest rate increases the amount of monthly repayment by the borrower. Thus an important component of the cost of owning a house rises with the interest rate. Therefore demand for housing is very sensitive to the interest rate. Monetary policy determines the changes in the interest rate, which in turn is negatively related to the demand for housing. An increase in interest rate reduces the demand for housing and vice versa.

Determinants of Inventory Investment

Introduction

Inventories include raw material, goods in the process of production, and finished goods held by the firm for sale. Various reasons for which a firm hold inventories-

- To meet future demand for goods, as it takes time to manufacture goods.
- In order to smoothen out the production. It is very costly to change the level of output on a production line, therefore firms produce a steady rate even when the demand changes, adding to inventories when demand is low and taking them out when demand is high.
- In order to take advantage of price increase and quantity discount.
- Economies of scale in procurement - Buying raw materials in large amount and holding inventory is cheaper for the company than buying them frequently in small lots. In such cases, it is better to buy in bulk and hold inventories in warehouses.

Most firms have desired ratio of inventories to firm's sales. This ratio depends upon several economic variables such as-

- If cost of ordering new goods is small and the speed with which they arrive is great, then the inventory-sales ratio will be small.
- Level of sales also determines the inventory-sales ratio. An increase in the sales lead to a falling ratio as there is relatively less uncertainty about sales.
- There is an interest cost involved in holding inventories. Since when a firm is holding inventories, it has to forgo the interest it could have earned elsewhere. Thus this interest serves as the opportunity cost of holding inventories. An increase in the interest rate will lead to a fall in the desired inventory-sales ratio.

Anticipated versus Unanticipated Inventory Investment

Increase in inventories by a firm leads to inventory investment. Inventory investment could be high on account of anticipated (desired) or unanticipated (undesired) inventory investment. An example of unanticipated inventory investment is unexpectedly low sales. This would result in unsold inventories accumulating with the firm. Anticipated inventory investment is when firms themselves plan to build up inventories.
These two have different implications on Aggregate Demand. Unanticipated inventory Investment is a result of low aggregate demand. Whereas anticipated inventory investment adds up to the aggregate demand.

Inventories in the Business Cycle

Inventory investment fluctuates more in the business cycle. During a recession, aggregate demand falls and firms add involuntarily to the stock of inventories. Thus there is an increase in the inventory-sales ratio. At the end of the recession, demand begins to rise and firms start to reduce their inventories, resulting in a fall in the inventory-sales ratio. The role of inventories, in business cycle, is result of a combination of unanticipated and anticipated inventory change.

Just-in-time Inventory Management

A management system in which products are produced only as per the demand requirement is known as Just-in-time Inventory Management. This approach has become very popular as suppliers and retailers can collaborate to control the costs of inventory and at the same time meeting the demand of customers. By using just-in-time concepts, the need for raw materials and work-in-process is getting reduced, while finished goods inventories should be negligent. The following are the advantages of the use of just-in-time inventory:

- Minimal amount of inventory obsolescence.
- Minimised inventory holding costs.
- Easier to halt production of one type of product and switch to another product to meet changes in consumer demand.
- Less damage to inventory and quick correction of production mistakes.

Exercise

Ques1. Explain the Fisherman idea of consumption as an inter-temporal choice.

Ques2. Explain how does Keynes consumption function vary from Life-cycle and permanent income hypothesis?

Ques3. Describe the Random Walk Hypothesis of consumption.

Ques4. Explain the determinants of the following kinds of Investment-

1. Business Fixed Investment
2. Residential Investment
3. Inventory Investment

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