

Chapter 11

Decision Making in Finance:

Time Value of Money, Cost of Capital and Dividend Policy

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Key words: Present value of a flow, future value of a flow, annuity, doubling period, compounding, effective interest rate, nominal interest rate, return, investment, cost of debt, cost of equity, cost of preference stock, weighted cost of capital marginal cost of capital

Suggested readings:

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11.1 Introduction

The major objective of the financial decision-making is wealth maximization. In wealth maximization, the timings at which benefits are received play an important role. A financial decision spreads over time horizon, i.e., it ventures into the future. For example, a new piece of equipment installed today, will be useful for many years (useful life of the equipment) to come. However, the payment for this equipment may also be spread over many years to come. Then a financial decision is to be made on the basis of the cash outflows (i.e. the payments) and the cash inflows (i.e., the benefits) associated with the decision. In such situations, in order to facilitate effective and valid comparisons, it is necessary that the cash flows during different time periods have the same monetary value. From this requirement originates the concept of “time value of money”. Money has time value. This simply means that the value of money is different at different time periods. A rupee today is more valuable than a rupee one year from now. Worth of money changes due to the following reasons.

- (i) In general, individuals prefer present consumption to future consumption, as future is uncertain.
- (ii) Capital can be invested to generate positive returns, so if r is the annual rate of return, then one rupee invested today would yield Rs. $(1+r)$ one year hence, so Rs. $(1+r)$ after one year will have the same worth as one rupee today.

So, if we are interested in cash flows occurring at various time points, as is the case with most of the financial problems, we have to consider explicitly the time value of money.

11.2 Time value of money

In order to understand the concept of the time value of money, we define the following terms.

- (i) **Future value of a single flow** Suppose that we want to invest an amount P for n years at a rate of interest of i %. Then the future value of amount P is defined as

$$S = P(1+i)^n \quad (11.1)$$

Where S is the future value after n years.

The factor $(1+i)^n$ is called the compounding factor or the future value interest factor ($FVIF_{i,n}$).

If the interest is compounded continuously, then the future value of the flow is given by

$$S = P e^{in}$$

(ii) Present value of a single flow For a single flow

$$P = \frac{S}{(1+i)^n} \quad (11.2)$$

The factor $\frac{1}{(1+i)^n}$ is called the discounting factor or the present value interest factor ($PVIF_{i,n}$). Tables

are available to calculate $PVIF_{i,n}$ for different values of n and i .

If the interest is compounded continuously, then the present value of the flow is given by

$$P = S e^{-in}$$

Doubling period Doubling period of an investment is the time needed to double that investment. Using equation (6.1), we calculate the doubling period of investment P as follows:

$$2P = P(1+i)^n$$

$$\Rightarrow 2 = (1+i)^n$$

$$\text{or, } \log 2 = n \log (1+i)$$

$$\Rightarrow n = \frac{\log 2}{\log (1+i)}$$

$$= \frac{0.301}{\log (1+i)}$$

(iii) Future value of an annuity An annuity is a series of periodic cash flows (payments or receipts) of equal amounts. The cash flows may occur at the beginning or at the end of a period. If the cash flows are occurring at the beginning of the period, the annuity is called an annuity due and if the cash flows are occurring at the end of the period, the annuity is called a regular or deferred annuity.

We define the future value of an annuity as the amount received in future when an annuity is invested at a given rate of interest. Mathematically,

$$S_n = R(1+i)^{n-1} + R(1+i)^{n-2} + \dots + R$$

$$= R \left[\frac{(1+i)^n - 1}{i} \right]$$

where, S_n = Future value of a regular annuity which has a duration of n period;

R = Constant periodic flow;

i = Interest rate per period; and

n = Duration of the annuity.

The factor $\left[\frac{(1+i)^n - 1}{i} \right]$ is called the future value interest factor for an annuity ($FVIFA_{i,n}$). Tables are available to calculate $FPVIF_{i,n}$ for different values of n and i .

If the interest is compounded continuously, then the future value of the annuity is given by

$$S_n = R \left[\frac{e^{in} - 1}{e^i - 1} \right]$$

(iv) Sinking fund factor Reciprocal of ($FVIFA_{i,n}$), the sinking fund factor is the discounting factor of a future flow. So

$$R = S_n \left[\frac{i}{(1+i)^n - 1} \right]$$

and $\left[\frac{i}{(1+i)^n - 1} \right]$ is called the sinking fund factor.

(v) Present value of an annuity Present value of an annuity is its present worth discounted at a rate equal to the rate of interest. Mathematically,

$$P_n = R \left[\frac{1}{1+i} \right] + R \left[\frac{1}{1+i} \right]^2 + \dots + R \left[\frac{1}{1+i} \right]^{n-1}$$

$$= R \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$$

where, P_n = Present value of a regular annuity which has a duration of n period;

R = Constant periodic flow;

i = Interest (discount) rate per period; and

n = Duration of the annuity.

The factor $\left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$ is the present value interest factor for annuity ($PVIFA_{i,n}$). It can be seen that

$$PVIFA_{i,n} = FVIFA_{i,n} \times PVIF_{i,n}$$

Tables are available to calculate $PVIFA_{i,n}$ for different values of n and i .

Example 1: The payment to a 10 period annuity of Rs. 5,000 will begin seven years from now.

What is the present value of the annuity at a discount rate of 12%?

Sol: The value of this annuity one year prior to its maturity, i.e., six years from now, will be

$$\text{Rs. } 5,000 \times PVIFA_{12,10} = 5,000 \times 5.650 \text{ (from tables)}$$

$$= \text{Rs. } 28,250$$

Present value of this amount is

$$\text{Rs. } 28,250 \times PVIF_{12,6} = 28,250 \times .507 \text{ (from tables)}$$

$$= \text{Rs. } 14,323$$

(vi) Capital recovery amount Capital recovery amount, R , is that amount which can be withdrawn periodically for a certain length of time in response to a certain investment today. Mathematically

$$P_n = R \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$$

$$\Rightarrow R = P_n \left[\frac{i(1+i)^n}{(1+i)^n - 1} \right]$$

The factor $\left[\frac{i(1+i)^n}{(1+i)^n - 1} \right]$ is called the capital recovery factor.

(vii) Present value of an uneven series Till now, we have derived various expressions assuming that cash flows associated with an annuity are equal in amount. However, this situation may not always be true and various cash flows associated with an annuity are unequal in amount. For example, the dividend stream of an equity is consists of unequal payments. The present value of an uneven series is, then, calculated by considering all the cash flows occurring at various time points:

$$PV_n = R_1 \left[\frac{1}{1+i} \right] + R_2 \left[\frac{1}{1+i} \right]^2 + \dots + R_n \left[\frac{1}{1+i} \right]^n$$

$$= \sum_{t=1}^n \frac{R_t}{(1+i)^t}$$

where, PV_n = Present value of a cash flow stream which has a duration of n period;

R_t = Cash flow occurring at the end of the period t ;

i = Interest (discount) rate per period; and

n = Duration of the cash flow stream.

(viii) Shorter compounding periods Sometimes the interest is not compounded annually but for shorter periods. In this case the future value of the annuity can be calculated as follows:

$$S = P \left(1 + \frac{i}{m} \right)^{mn}$$

where, S_n = Future value after n years;

P = Present amount;

i = Nominal interest rate per year;

m = Number of times compounding is done during a year; and

n = Duration of the compounding.

The difference of the principals of the annual compounding and the shorter period compounding represents the interest on annual interest.

Effective versus nominal rate Consider the following offer of a company.

AEO Ltd. is offering 12% interest semi-annually on the investments made to the company. A person wants to invest a sum of Rs. 10,000. Calculate the amount, which he will receive after one year.

(a) If the compounding is done semi-annually:

(i) First six months:

Principal at the beginning = Rs.10,000.00

$$\text{Interest of six months} = \text{Rs. } 10,000 \times \frac{0.12}{2}$$

$$= \text{Rs. } 600.$$

Principal at the end = Rs.10,000.00 + Rs. 600.

$$= \text{Rs. } 10,600.00$$

(ii) Second six months:

Principal at the beginning = Rs.10,600.00

$$\text{Interest of six months} = \text{Rs. } 10,600 \times \frac{0.12}{2}$$

$$= \text{Rs. } 636.$$

Principal at the end = Rs.10,600.00 + Rs. 636.

$$= \text{Rs. } 11,236.00$$

(b) If the compounding is done annually:

Principal at the beginning = Rs.10,000.00

Interest of six months = Rs. 10,000 $\times$ 0.12

= Rs. 1200.

Principal at the end = Rs.10,000.00 + Rs. 1200.

= Rs.11,200.00

The difference between the two principals, i.e., Rs. 36 is the interest on interest of the first six months for the second six months. Thus in the case of semi-annual compounding the principal is growing effectively at a rate of 12.36% annually. Now, we can differentiate between effective and nominal rates of interest:

Nominal rate of interest is that rate which is offered at an annual basis, irrespective of the number and size of the compounding periods.

Effective rate of interest is that rate at which the principal is actually growing annually if the size of the compounding period is less than the size of the period for nominal rate. In fact this is the rate under annual compounding which will let the principal grow at the same rate at which shorter period compounding is being done.

There exists a mathematical relationship between effective and nominal rates of interest:

$$i = \left(1 + \frac{i^{(m)}}{m}\right)^m - 1$$

where, i = Effective interest rate per year;

$i^{(m)}$ = Nominal interest rate per year; and

m = Number of times compounding is done during a year.

If d is the discount rate associated with the present value of Re.1 then

$$d = \frac{i}{1+i}$$

$$= 1 - \left(1 - \frac{d^{(m)}}{m}\right)^m$$

$d^{(m)}$ = Nominal discounting rate per year

11.3 Applications of present value and future value techniques

There are some situations in real life where we have to compare the cash flows at two different time points. In such situations these techniques can be used effectively to make meaningful comparisons.

- (1) An annual saving of a certain sum may be required to generate a fund which would be needed sometime in future, e.g., to repay an existing liability or to replace a piece of equipment. Then the fund manager is interested in knowing the size of the annuity to generate the required fund.

Example 2: A company has sold 7.5% bonds that will mature after 8 years from today. Now the company plans to create a fund for repayment of bonds in which a fixed amount is to be deposited (at the end of) each year. If the funds are expected to earn 7% annual interest, find the amount of the annuity needed to accumulate a sum of Rs. 10, 00,000 at the end of 8 years.

Sol: In this case we have to find the size of a 5-year annuity whose future value is Rs. 10, 00,000

$$FVIFA_{7,8} = 10.26$$

$$\Rightarrow \text{Size of the annuity} = \frac{10,00,000}{10.26} = \text{Rs. } 96252.$$

- (2) When the loan, which has been borrowed today, is to be repaid in future, the fund manager is interested in knowing the size of the annuity.

Example 3: A company has installed a machine worth Rs. 15, 00,000. the amount has to be repaid in 5 equal installments at an interest rate of 12 %. Find the size of the annuity.

Sol: In this case we have to find the size of a 5-year annuity whose present value is Rs. 15,00,000.

$$PVIFA_{12,5} = 3.605$$

$$\Rightarrow \text{Size of the annuity} = \frac{15,00,000}{3.605} = \text{Rs. } 4,16,089.$$

(3) The market price of shares and securities are significantly affected by the dividends paid by the company offering them. If the growth rate of dividends is higher than the prevailing interest rate or the growth rate of other securities, the market price of shares will be high. An investor may be interested in determining the growth rate of dividends that he is receiving.

Example 4: Given below are the dividends received by Mohan from a certain infrastructure company:

Table 11.1

Year	Dividends (Rs.)
1	25.00
2	28.35
3	32.80
4	35.50
5	38.00
6	40.27

The rate of return on other similar securities is 8%. Mohan wants to know whether or not should he dispose off his stock. What should he do?

Sol: Since the dividends are received at the end of the period (year), so the above table reveals that the dividends have grown from Rs. 25 to Rs. 40.27 in five years' time. Thus

$$40.27 = 25.00(1+i)^5$$

$$\Rightarrow (1+i)^5 = \frac{40.27}{25.00} = 1.611$$

$$\Rightarrow i = 10\% \text{ (From compounding tables)}$$

Since Mohan is earning dividend, which has a growth rate higher than the growth rate of similar securities in the market, he should not sell his stock.

Example 5: Calculate the value five years from now of a deposit of Rs. 20,000 made today at the rate of interest (i) 8%, (ii) 10%, (iii) 12%, and (iv) 15%.

Sol:

$$S = P(1+i)^n = 20000(1+i)^5$$

(i) $i = 0.08$

$$\begin{aligned} S &= P(1+i)^n = 20000(1.360) \text{ if } n = 4; \\ &= 20000(1.587) \text{ if } n = 6 \end{aligned}$$

$$\begin{aligned} \Rightarrow S &\approx 20000 \left(\frac{1.360 + 1.587}{2} \right) \\ &= 20000 \times 1.473 \\ &= \text{Rs. } 29460 \end{aligned}$$

(ii) $i = 0.10$

$$\begin{aligned} S &\approx 20000 \left(\frac{1.464 + 1.772}{2} \right) \\ &= 20000 \times 1.618 \\ &= \text{Rs. } 32360 \end{aligned}$$

(iii) $i = 0.12$

$$\begin{aligned} S &\approx 20000 \left(\frac{1.574 + 1.974}{2} \right) \\ &= 20000 \times 1.774 \\ &= \text{Rs. } 35400 \end{aligned}$$

(iv) $i = 0.15$

$$\begin{aligned} S &\approx 20000 \times 2.011 \\ &= \text{Rs. } 40200 \end{aligned}$$

Example 6: A retiring person has been offered two alternatives, between which he has to make a choice: (a) An annual pension of Rs.30, 000 as long as he lives; and (b) a lump sum amount of Rs. 2, 00,000. If the expected life of that person is 15 years more after retirement and that prevailing rate of interest is 15%, which option is more lucrative?

Sol: (a)

$$\begin{aligned}\text{Future value of the annuity after 15 years} &= 30,000 \left[\frac{(1+0.15)^{15} - 1}{0.15} \right] \\ &= 30,000 \times 47.50 \\ &= \text{Rs.}14,25,000\end{aligned}$$

(b)

$$\begin{aligned}\text{Future value of the single after 15 years} &= 2,00,000(1+0.15)^{15} \\ &= 2,00,000 \times 8.137 \\ &= \text{Rs.}16,27,400\end{aligned}$$

Second option is a better one.

Example 7: What will be the size of the annuity if Rs. 1,00,000 deposited in a bank at an interest rate of 10% reduces to zero in 30 years?

Sol:

$$\begin{aligned}R &= P_n \left[\frac{i(1+i)^n}{(1+i)^n - 1} \right] \\ &= 1,00,000 \left[\frac{.10(1+.10)^{30}}{(1+.10)^{30} - 1} \right] \\ &= \frac{1,00,000}{9.427} \\ &\approx \text{Rs. } 10,608\end{aligned}$$

Example 8: A firm has installed a new machine at a down payment of Rs. 2,50,000 and will pay Rs. 2,00,000 and Rs. 1,00,000 respectively for first two years and rest will be paid in 10 equal installments of Rs. 75,000. If the interest is charged at rate of 12% per annum, what is the present worth of the machine?

Sol: Since the cash flows are uneven, we calculate the present worth of each of the outflow:

$$\begin{aligned} \text{(i)} \quad & \text{Present worth of Rs. 2,00,000 due in one year} = 2,00,000 \times 0.893 \\ & = \text{Rs. 1,78,600} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & \text{Present worth of Rs. 1,00,000 due in two years} = 1,00,000 \times 0.797 \\ & = \text{Rs. 79,700} \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & \text{Present worth of an annuity of size Rs. 75,000 at the beginning of year 3} \\ & = 75,000 \times 0.4.968 \\ & = \text{Rs. 3,72,600} \\ & \text{Present worth of a single flow at the beginning of year 3} \\ & = \text{Rs. 3,72,600} \times 0.797 \\ & = \text{Rs. 2,96,962.2} \end{aligned}$$

Hence the total cost of the machine is

$$\begin{aligned} & = \text{Rs. 2,50,000} + \text{Rs. 1,78,600} + \text{Rs. 79,700} + \text{Rs. 2,96,962.2} \\ & = \text{Rs. 8,05,262.2} \end{aligned}$$

Example 9: A lease contract requires payment of Rs. 96 per thousand per month at the end of every month over a period of 12 months. Develop a repayment schedule.

Sol: The implied effective rate of interest is

$$\begin{aligned} \text{Rs. 96} \times PVIFA_{i_m, 12} &= 1000 \\ \Rightarrow PVIFA_{i_m, 12} &= \frac{1,000}{96} = 10.4167 \end{aligned}$$

From tables

$$PVIFA_{2, 12} = 10.575$$

$$PVIFA_{3, 12} = 9.954$$

$$\begin{aligned}
\Rightarrow i_m &= 0.02 + \left(0.01 \times \frac{10.4167 - 10.575}{9.954 - 10.575} \right) \\
&= 0.02 + \left(0.01 \times \frac{0.1583}{0.621} \right) \\
&= 0.0225 \\
&= 2.25\%
\end{aligned}$$

Effective rate of annual interest

$$\begin{aligned}
&= (1.0225 - 1)^{12} - 1 = 0.306 \\
&= 30.6\%
\end{aligned}$$

Nominal rate of interest = $12 \times 0.0225 = 27\%$

Table 11.2: Loan repayment schedule (Rs.)

Months	Beginning amount	Installment	Interest (2.25%)	Capital
1	1000.0	96.0	22.5	73.5
2	926.5	96.0	20.8	75.2
3	851.3	96.0	19.2	76.8
4	774.5	96.0	17.4	78.6
5	695.9	96.0	15.7	80.3
6	615.6	96.0	13.9	82.1
7	533.4	96.0	12.0	84.0
8	449.4	96.0	10.1	85.9
9	363.6	96.0	8.2	87.8
10	275.7	96.0	6.2	89.8
11	185.9	96.0	4.2	91.8
12	94.1	96.0	2.1	93.9

The difference is due to rounding off of the values.

11.4 Cost of capital

The cost of capital of a firm is the minimum rate that the firm must earn on its investments in order to satisfy the expectations of its investors who provide the funds to the firm. The cost of capital is used for (i) evaluating the net present value of the investments; and (ii) determining the attractiveness of the internal rate of return.

If a firm's rate of return on its investments is more than its cost of capital, it results in enhancement of the wealth of the (equity) shareholders. This is due to the fact that in this case the rate of return earned on the equity capital after meeting all other costs of financing, is more than the rate of return required by the investors. Hence the wealth of the shareholders will increase.

For example, consider a firm whose cost of equity and debt are respectively 14% and 6% and the firm employs equity and debt in equal proportions. The cost of capital for the firm, which is the weighted average cost of capital, is 10%. If the firm invests Rs. 50 lakhs on a project, which is expected to earn 18% rate of return, then the rate of return on equity funds will be given by

$$\begin{aligned}\text{Rate of return on equity} &= \frac{\text{Total return on the project} - \text{Interest on debt}}{\text{Equity funds}} \\ &= \frac{50 \times 0.18 - 25 \times 0.06}{25} \\ &= 0.3 = 30\%\end{aligned}$$

This rate of return is greater than that required by the investors (14%). Therefore the market value of the equity capital will increase and hence the wealth of the equity stockholders.

A firm's cost of capital is the weighted average of the cost of various sources of finance used by it. Hence to calculate the cost of capital for the firm, we need to know

- (i) The cost of different sources of finance; and
- (ii) The proportions of different sources of finance in the capital structure of the firm.

In order to use the average cost of capital for appraising new investments, we make some assumptions:

- (i) The risk characterizing new investments proposals under consideration is same as the risk characterizing the existing investments of the firm, and the adoption of the new proposals will not change the risk structure of the firm.
- (ii) The capital structure of the firm will not be affected by the new investments, and the firm will continue to pursue the same policies; and
- (iii) Each new investment is deemed to be financed from a pool of funds in which the various sources of long-term financing are present in the proportions in which they are found in the capital structure of the firm.

11.5 Cost of different sources of finance

The total cost of a source of finance may be deemed to be consisting of two components: (a) Explicit cost; and (b) Hidden cost.

(a) Explicit cost The explicit cost is the rate of discount, which equates the present value of the expected payment to that source of finance with net funds received from that source of finance. Mathematically, it is the value of k in

$$P = \sum_{t=1}^{\infty} \frac{C_t}{(1+k)^t};$$

where

P = Net funds received from the source; and

C_t = Expected payment to the source at the end of the period t .

For calculating the cost of capital of the firm, we work with the explicit cost of different sources of finance.

(b) Hidden cost hidden cost of a source of finance is the increase in the explicit cost of other sources of finance as a result of employment of the source of finance being considered.

For example, consider a firm, which presently employs Rs. 50 lakh of equity funds at a cost of 12%. Now the firm plans to raise additional funds of Rs. 100 lakh by issuing debentures having an explicit

cost of 6%. However the cost of existing equity capital increases from 12% to 14% as a result of employing debenture capital. This increase is on account of perceiving greater risk in the company due to debenture capital. Hence equity shareholders demand greater return. This increase in the equity cost, as a result of employing debt capital, is a hidden cost of debt. However, hidden costs are not treated separately and these are reflected finally in the explicit cost.

Another cost is the **implicit cost**, which is the rate of return earned on the best alternative possible investment on which the funds of a source may be employed.

(c) **Cost of debt** The explicit cost of debt is the discount rate which equates the present value of post-tax interest payment and principal repayments with the net proceeds of debt issue. Mathematically, the cost of debt is the value of k_d in the equation

$$P = \sum_{t=1}^{\infty} \frac{C(1-T)}{(1+k_d)^t} + \frac{F}{(1+k_d)^n};$$

where

P = Net funds received from the debt;

C = Annual debt interest payment ;

T = Tax rate;

F = Redemption price, which is generally the face value of the debenture;and

n = Maturity period of the debenture.

The debt interest is a tax-deductible expense, that is why C is multiplied by $(1-T)$. In other words, C is in pre-tax terms and $C(1-T)$ is in post-tax terms.

$$\begin{aligned} P &= \sum_{t=1}^n \frac{C(1-T)}{(1+k_d)^t} + \frac{F}{(1+k_d)^n} \\ &= C(1-T) \left(\frac{(1+k_d)^{n+1} - 1}{k_d} \right) + \frac{F}{(1+k_d)^n} \end{aligned}$$

and

$$k_d = \frac{C(1-T) + \frac{F-P}{n}}{\frac{F+P}{2}}$$

If the difference between F and P is amortized evenly over the duration of debt financing then

$$k_d = \frac{C(1-T) + \frac{F-P}{n}(1-T)}{\frac{F+P}{2}}$$

Perpetual debt If the maturity period of the debt capital is infinite, the debt is called perpetual debt. For this debt, the cost of capital (debt) is the value of k_d in the equation

$$\begin{aligned} P &= \sum_{t=1}^{\infty} \frac{C(1-T)}{(1+k_d)^t} \\ &= \frac{C(1-T)}{k_d} \\ \Rightarrow k_d &= \frac{C(1-T)}{P} \end{aligned}$$

Term loans Term loans are the debts raised from the financial institutions or banks, which are repayable normally within 8 to 11 years in equal installments which are either yearly or half yearly after an initial grace period of one to four years. The post-tax cost of a term loan is

$$\text{Interest rate}(1-\text{tax-rate})$$

If I_d stands for total interest on debt and M_d is the total market value of debt, then

$$\begin{aligned} k_d &= \frac{I_d}{M_d}; \\ M_d &= \frac{I_d}{k_d} \end{aligned}$$

Example 10: A firm issues 14% debentures having face value Rs. 100. The net amount realized per debenture is Rs. 96, and the debentures are redeemable after 12 years. The tax rate is 40%. What is the cost of debentures to the firm?

Sol:

$$k_d = \frac{C(1-T) + \frac{F-P}{n}}{\frac{F+P}{2}}$$

$$= \frac{14(1-0.40) + \frac{100-96}{8}}{\frac{100+96}{2}} = \frac{8.4+0.5}{98} = 0.09$$

Thus the cost of debentures to the firm is approximately 9%.

Example 11: A firm is planning to raise capital through issue of 15% debentures at face value of Rs. 200. The cost of issue works out to be 2%. The debentures are repayable after seven years. The firm has a tax rate of 40%. If the difference between the par value and the net amount realized can be amortized evenly over the life of the debentures, what is the cost of debt to the firm?

Sol: Net amount realized per debenture = $98 \times \frac{200}{100} = \text{Rs. } 196$

$$\Rightarrow k_d = \frac{C(1-T) + \frac{F-P}{n}(1-T)}{\frac{F+P}{2}}$$

$$= \frac{14(1-0.4) + \frac{200-196}{7}(1-0.4)}{\frac{200+196}{2}}$$

$$= \frac{8.4 + \frac{2.4}{7}}{198} = 0.044 = 4.4\%$$

(d) Cost of preference capital

Preference capital is that source of finance, which carries a fixed rate of dividend. Though this dividend is payable at the discretion of the board of directors, generally it is paid regularly. The cost of preference, which is perpetual, is the value of k_p in the equation

$$P = \sum_{t=1}^{\infty} \frac{D}{(1+k_p)^t} = \frac{D}{k_d}$$

where

P = Net amount realized per preference share; and

D = Preference dividend per share payable annually.

$$\Rightarrow k_p = \frac{D}{P}$$

Redeemable preference stock The preference stock which is not perpetual, i.e., redeemable after n years, is called the redeemable preference stock. The cost of such stock is the value of k_p in the equation

$$P = \sum_{t=1}^n \frac{D}{(1+k_p)^t} + \frac{F}{(1+k_p)^n}$$

where

F = The redemption price; and

n = Maturity period.

Then,

$$k_p \approx \frac{D + \frac{F-P}{n}}{\frac{F+P}{2}}$$

If the difference between F and P is amortized evenly over the duration of capital financing and the tax rate for the firm is T , then

$$P = \sum_{t=1}^n \frac{D + \frac{(F-P)T}{n}}{(1+k_p)^t} + \frac{F}{(1+k_p)^n}$$

$$\Rightarrow k_p \approx \frac{D - \frac{F-P}{n}(1-T)}{\frac{F+P}{2}}$$

Example 12: A firm is issuing preference shares at a dividend rate of 12%. The preference capital is repayable in two equal installments at the end of the 10th and the 11th year respectively. The amount realized per preference share is Rs. 97. What is the cost of the preference capital?

Sol:

$$\begin{aligned}
 k_p &= \frac{D + \frac{F-P}{10} + \frac{F-P}{11}}{\frac{F+P}{2}} \\
 &= \frac{12 + (100-97)\left(\frac{1}{10} + \frac{1}{11}\right)}{\frac{197}{2}} \\
 &= \frac{12 + 3\left(\frac{21}{110}\right)}{\frac{197}{2}} = 0.1269 = 12.69\%
 \end{aligned}$$

(e) Cost of equity capital

The cost of equity capital is the minimum rate required on the net equity funds raised in order to leave the market price of the equity stock unaffected.

To calculate the cost of equity capital, we must know the rate of return required by the equity stockholders, which is then adjusted for the floatation costs when the firm issues the additional equity stock.

Rate of return required by the equity stockholders The dividend stream receivable by the equity stock holders is not governed by any contract or fixed rules. Hence measuring the rate of return required by the equity stockholders is difficult to know. Several approaches have been suggested to estimate this rate.

(i) Dividend forecast approach The value of an equity stock is equal to the sum of the present value of dividends associated with it, i.e.,

$$P = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t};$$

where

P = Price per share of equity stock;

D_t = Expected dividend at the end of the period t ; and

k_e = Rate of return required by the equity stock holders.

If the future dividend stream, as expected by the equity stock holders can be forecasted, then given the current market price per equity share, the rate of return can be calculated.

If the dividend is expected to be constant annually then

$$k_e = \frac{D}{P}$$

If the equity stockholders expect the dividend to grow annually at a rate of g % forever, then k_e is given by the expression

$$\begin{aligned} P &= \frac{D_1}{1+k_e} + \frac{D_1(1+g)}{(1+k_e)^2} + \frac{D_1(1+g)^2}{(1+k_e)^3} + \dots + \frac{D_1(1+g)^{t-1}}{(1+k_e)^t} + \dots + \\ &= \frac{\frac{D_1}{1+k_e}}{1 - \frac{(1+g)}{1+k_e}} \\ &= \frac{D_1}{k_e - g} \left(\frac{1+g}{1+k_e} < 1 \text{ since if } g > k_e, \text{ prices will tend to } \infty \right) \\ \Rightarrow k_e &= \frac{D_1}{P} + g \end{aligned}$$

Thus the cost of equity capital is equal to the dividend yield plus the annual growth rate of dividend.

Example 13: The market price per share of a company is Rs. 20.00 and the dividend expected one year from now is Rs. 1.25. The expected rate of dividend growth is 6%. What is the cost of equity capital to the company?

Sol:

$$\begin{aligned} k_e &= \frac{D_1}{P} + g \\ &= \frac{1.25}{20} + 0.06 \\ &= 0.1225 = 12.25\% \end{aligned}$$

If D/P ratio is 100%, then $g = 0$

$$\begin{aligned}
k_e &= \frac{D_1}{P} = \frac{E_1}{P} \\
&= \frac{E_1 N}{PN}; N \text{ is the number of outstanding equity shares and} \\
&\quad E_1 \text{ is the earnings in period 1.} \\
&= \frac{EBIT - I_d}{M_e}; M_e \text{ is the total market value of equity} \\
&= \frac{NI}{M_e}; NI \text{ is the net income available to shareholders.} \\
\Rightarrow M_e &= \frac{NI}{k_e}
\end{aligned}$$

When the expected growth rate of dividend varies over time, this variation has to be taken into account. Suppose that the expected growth rate is g_1 for n_1 years, g_2 for n_2 years and g_3 forever after that, and then the equation for k_e is

$$P = \sum_{t=1}^{n_1} \frac{D_1(1+g_1)^{t-1}}{(1+k_e)^t} + \sum_{t=1}^{n_2} \frac{D_{n_1}(1+g_2)^t}{(1+k_e)^{n_1+t}} + \sum_{t=1}^{\infty} \frac{D_{n_1+n_2}(1+g_3)^t}{(1+k_e)^{n_1+n_2+t}}$$

Example 14: The market price per share of a company is Rs. 150 at present. The dividend expected one year from now is Rs. 20 per share, which is expected to grow at a rate of 10% per share for five years. Thereafter the growth of the dividend is expected to decline to 8% where it will stay forever. What is the cost of equity to the company?

Sol: The cost of equity to the company is the value of k_e in the equation

$$\begin{aligned}
150 &= \sum_{t=1}^5 \frac{20(1+0.10)^{t-1}}{(1+k_e)^t} + \sum_{t=1}^{\infty} \frac{20(1+0.10)^4(1+0.08)^t}{(1+k_e)^{5+t}} \\
&= \sum_{t=1}^5 \frac{20(1.10)^{t-1}}{(1+k_e)^t} + \frac{20(1.10)^4(1.08)^t}{(1+k_e)^5} \left(\frac{1.08}{k_e - 0.08} \right)
\end{aligned}$$

(ii) Realized yield approach According to this approach, the yield realized by equity shareholders historically is regarded as a proxy for the rate of return required by them. The yield on an equity stock for the year is given by

$$Y_t = \frac{D_t + P_t}{P_{t-1}} - 1;$$

where

Y_t = Yield for year t ;

D_t = Dividend at the end of the period t payable at the end of the period;

P_t = price per share at the end of the period t ; and

P_{t-1} = price per share at the end of the period $t-1$, i.e. at the beginning of the period t .

$\frac{D_t + P_t}{P_{t-1}}$ is called the wealth rate.

The yield for the n -year period is $\prod_{t=1}^n \left(\frac{D_t + P_t}{P_{t-1}} \right)^{\frac{1}{n}} - 1$

The basic assumptions of this approach are

- (i) The yield earned by the investor and the expectations of the investor are similar; and
- (ii) The investors' expectations in future will be similar to those in the past.

Example 15: The dividend per share and the price per share data of an equity stock are given below

Table 11.3

Year	Dividend per share (Rs.) (D_i)	Price per share (Rs.) (P_i)
1	1.00	10.00
2	1.15	10.5
3	1.25	11.00
4	1.50	11.50
5	1.50	10.75
6	1.75	12.00

Obtain the yield for the five-year period on this stock.

Sol: We calculate the wealth ratio as follows

Table 11.4

Year	D_i (Rs.)	(P_i) (Rs.)	(P_{i+1}) (Rs.)	$W_i = \frac{D_t + P_t}{P_{t-1}}$
1	1.00	10.00	10.50	1.15
2	1.15	10.50	11.00	1.16
3	1.25	11.00	11.50	1.16
4	1.50	11.50	10.75	1.07
5	1.50	10.75	12.00	1.26
6	1.75	12.00	-	
				$\prod_{i=1}^5 w_i = 2.06$ $\left(\prod_{i=1}^5 w_i \right)^{\frac{1}{5}} = 1.156$ $Y = 1.156 - 1 = 0.156$

Thus the return on the stock is 15.6%.

However, the assumptions of this approach, particularly the second assumption is somewhat unrealistic. The investors' expectations change with the anticipated change in rate of inflation and subsequently change in the interest rate structure. Thus if historical return (yield) is to be used as a proxy for the future rate of return, appropriate caution must be taken. However, the historical figure may serve as a starting point to obtain estimates of the future.

11.6 Capital asset pricing model (CAPM)

As we have already seen, CAPM can be used for pricing of assets and portfolios. Also we have used this model for the determination of required rate of return. This method is based on the assumption that investors eliminate the unsystematic component of the risk by diversifying their portfolios efficiently

and are needed to be compensated for the systematic component of the risk, which is reflected in the beta coefficient. However due to market imperfections, unsystematic component of the risk may creep into the model for which the investor should be appropriately compensated. But this feature is missing from the model.

Another limitation of the model lies in the instability of the beta. This makes the use of historical value of beta somewhat unsuitable. In spite of this limitation this model is used widely in making financial decisions.

(i) Earning price ratio approach

According to this approach, the rate of return required by the equity investors is

$$k_e = \frac{E_t}{P}$$

where

E_t = Expected earnings per share for the next year

= Current earnings per share(1+growth rate of earnings per share)

P = Current market price per share.

The approach can be used appropriately when

- (i) The earnings per share are expected to remain constant and the dividend payout ration is 100%;

The cost of equity capital in this case is the value of k_e in the expression

$$\begin{aligned} P &= \sum_{t=1}^{\infty} \frac{D}{(1+k_e)^t} \\ &= \frac{D}{k_e} \\ \Rightarrow k_e &= \frac{D}{P} \end{aligned}$$

- (ii) When the retained earnings are expected to earn a rate of interest equal to the rate of return required by the investors.

As a simple case, let the firm be an all-equity firm. Let the retention rate of the firm is $b\%$ in each period which is constant.

Since the reinvested funds earn a return equal to $k_e\%$, the earnings, retained earnings and the dividends are given by the following expressions

Table 11.5

Year	Earning	Retained earnings	Dividends
0	E_0	$E_0 b$	$E_0 (1-b)$
1	$E_0 (1+ b k_e)$	$E_0 (1+ b k_e) b$	$E_0 (1+ b k_e) (1-b)$
2	$E_0 (1+ b k_e) + E_0 (1+ b k_e) b k_e = E_0 (1+ b k_e)^2$	$E_0 (1+ b k_e)^2 b$	$E_0 (1+ b k_e)^2 (1-b)$
3	$E_0 (1+ b k_e)^3$	$E_0 (1+ b k_e)^3 b$	$E_0 (1+ b k_e)^3 (1-b)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$
n	$E_0 (1+ b k_e)^n$	$E_0 (1+ b k_e)^n b$	$E_0 (1+ b k_e)^n (1-b)$

Now,

$$\begin{aligned}
 P &= \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t} \\
 &= \sum_{t=1}^{\infty} \frac{E_0 (1+ b k_e)^t (1-b)}{(1+k_e)^t} \\
 &= \frac{E_0 (1+ b k_e)(1-b)}{k_e (1-b)} = \frac{E_1}{k_e} \\
 \Rightarrow k_e &= \frac{E_1}{P}
 \end{aligned}$$

However both these situations are difficult to meet in practice. As such this method should be used with caution.

(ii) Bond yield plus risk premium approach

According to this approach, the rate of return required by the equity investors is given by

Yield on the long-term bonds of the firm + risk premium.

The approach rests on the assumption that the equity investors have a higher degree of risk than the bondholders and hence their required rate of return should include a risk premium in addition to the return earned on the long-term bonds.

However, there is no sound theoretical basis for defining the risk premium and it is subjective quantity based on operating risk and the risk preference of the firm.

Adjustment for the floatation cost

The firm should thus earn a rate of return equal to the rate required by the equity stock holders of the firm. However this assertion is true when there is no floatation cost, for example, cost of issuing shares, commission, brokerage etc. This will, thus be true in case when the firm obtains the equity funds from its retained earnings.

However, when a firm raises funds by issuing (additional) equity stock, generally floatation cost is incurred. In this case the net funds realized by the firm are less than what has been contributed by the equity holders. In this case, the firm should earn a rate of return higher than the required rate of return by the equity holders to take care of this additional cost. Mathematically, if the floatation cost is $f\%$, and the required rate of return is $k_e\%$, then the firm should be able to earn a rate of return equal to

$\frac{k_e}{1-f}\%$ on the net equity fund raised by it.

Weighted average cost of capital

Once the cost of different sources of finance has been determined, the firm's overall cost of capital is the weighted average cost of different sources of finance. Mathematically,

$$k_a = w_d k_d + w_p k_p + w_r k_r + w_e k_e$$

where

k_a = Overall cost of capital;

k_d = cost of debt; w_d = weight of debt;

k_p = cost of preference capital; w_p = weight of preference capital;

k_r = cost of retained earnings; w_r = weight of retained earnings;

k_e = cost of additional equity; w_e = weight of additional equity.

If the only sources of finance are equity and debt (as in case of a new company), then

$$\begin{aligned}k &= w_d k_d + w_e k_e \\&= \frac{M_d}{V} k_d + \frac{M_e}{V} k_e; \text{ V is the total value of the firm.} \\&= \frac{M_d}{M_d + M_e} k_d + \frac{M_e}{M_d + M_e} k_e \\&= \frac{M_d k_d + M_e k_e}{M_d + M_e} \\&= \frac{I_d + NI}{M_d + M_e} \\&= \frac{EBIT}{V} \\ \Rightarrow V &= \frac{EBIT}{k} = \frac{I_d}{k_d} + \frac{EBIT - I_d}{k_e} \\ \Rightarrow k_e &= \frac{k - k_d \left(\frac{M_d}{V} \right)}{\left(\frac{M_e}{V} \right)} \\&= \frac{k - k_d \left(\frac{M_d}{V} \right)}{1 - \left(\frac{M_d}{V} \right)} \\&= \frac{k M_e + (k - k_d) M_d}{M_e} \\&= k + (k - k_d) \left(\frac{M_d}{M_e} \right)\end{aligned}$$

Example 16: Consider the information available about the four firms A, B, C and D

Table 11.6

Firms	<i>EBIT</i> (Rs.)	<i>I_d</i> (Rs.)	<i>k_e</i> (%)
A	4,00,000	40,000	12
B	6,00,000	1,00,000	10
C	5,00,000	1,00,000	20
D	8,00,000	2,00,000	15

Assuming no taxes and the cost of debt at 10%, calculate the total market value and weighted average cost of capital of each firm.

Sol:

Table 11.7

Particulars	A	B	C	D
<i>EBIT</i> (Rs.)	4,00,000	6,00,000	5,00,000	8,00,000
Less: Interest (Rs.)	40,000	1,00,000	1,00,000	2,00,000
<i>NI</i> (Rs.)	3,60,000	5,00,000	4,00,000	6,00,000
<i>k_e</i>	0.12	0.10	0.20	0.15
<i>M_e</i> (Rs.)	30,00,000	50,00,000	20,00,000	40,00,000
$M_d = \frac{I_d}{0.10}$ (Rs.)	4,00,000	10,00,000	10,00,000	20,00,000
<i>V</i> (Rs.)	34,00,000	60,00,000	30,00,000	60,00,000
$k = \frac{EBIT}{V}$ (%)	11.76	10	16.67	13.33

System of weighting

Assignment of weights to different sources of finance is an important aspect in determination of the overall cost of capital to the firm as variation in weights would lead to variation in the total cost of

capital. Several methods have been proposed for determination of weights. We discuss here some of these method.

(i) Book value method

In this method, the weights are assigned according to the values found in the balance sheet of the firm. The weights are the proportion of the book value of the source of finance to the total value of (long-term) finance of the firm.

The book value methods are simple to obtain and are fairly stable since book values are not affected by the market fluctuations. At times these may be the only available weights e.g., the market values are not easily available if the firm is not listed or its shares are not actively traded in the market. However, the method suffers from a number of drawbacks. First of all, the present values of different sources of finance may not be much related to their book values. Secondly book value weights do not go with the concept of the cost of capital, which is the minimum required rate of return to maintain the market value of the firm.

(ii) Market value weights

In this method, the weights are assigned according to the market values of the sources of finance of the firm. The weights are the proportion of the market value of the source of finance to the total market value of finance of the firm. Thus these weights are consistent with the concept of the cost of capital. However theses weights may be difficult to obtain if the firm is not listed or its shares are not actively traded in the market. Further the speculative forces working in the market may distort the weights.

(iii) Financing planning weights

In this method of assigning weights, weights are assigned to different sources of finance in the proportions in which theses sources are providing funds to undertake present and the future investments. Thus these weights are in actual proportion of the sources of finance that would correspond to the market value of these sources. However the actual mix of capital needed to finance future investments may be difficult to obtain.

Example 17: Consider the following data

Table 11.8

Capital structure of the firm	Book value (Rs. in crores)	Market value (Rs. in crores)
As on March 31 st , 2006		
Debentures (8.5% due 2010 -13)	1.00	0.87
Debentures (11% due 2017 -21)	2.23	1.76
Long-term loan (10%)	2.77	2.77
Preference capital (7%, market price per share Rs. 50)	0.89	0.45
Net worth	8.87	8.75

Table 11.9

Equity details	Value (Rs.)								
	1998	1999	2000	2001	2002	2003	2004	2005	2006
Earnings per share	17.4	16.1	13.1	17.7	16.4	21.8	20.3	20.3	20.0
Dividend per share	13.0	13.0	5.0	13.0	13.0	13.0	13.0	13.0	15.0
Bonus	1:12								
Adjusted earnings per share*	17.4	16.1	13.1	19.2	17.8	23.6	22.0	22.0	31.4
Adjusted dividend per share*	13.0	13.0	5.0	14.1	14.1	14.1	14.1	14.1	16.3
Market price**	101.25								

* Adjusted for bonus declaration in 2001

** Market price is the average of high and low in the month when capital structure has been determined.

The effective tax rate for the company is 57.75%. Calculate the cost of capital for the firm.

Sol: (i) Post tax cost of 8.5% debentures due 2010-13

These debentures carry an interest rate of 8.5% and are repayable in four annual equal installments starting from 2010. The market value per Rs. 100 face value of the debenture was Rs. 87 in March 2007. The post tax cost of these debentures is that discount rate which would equate the present value

of the post-tax cash outflows (interest and the principal repayment) with the market value, i.e., the value of k_d in the expression

$$\begin{aligned}
 87 &= \frac{8.5(1-0.5775)}{(1+k_d)} + \frac{8.5(1-0.5775)}{(1+k_d)^2} + \frac{8.5(1-0.5775)}{(1+k_d)^3} + \frac{8.5(1-0.5775)}{(1+k_d)^4} \\
 &+ \frac{6.375(1-0.5775)+25}{(1+k_d)^5} + \frac{4.25(1-0.5775)+25}{(1+k_d)^6} + \frac{2.125(1-0.5775)+25}{(1+k_d)^7} \\
 \Rightarrow k_d &= 0.065 = 6.5\%
 \end{aligned}$$

(ii) Post tax cost of 11% debentures due 2017-21

These debentures are payable in five equal annual installments. The post tax cost of these debentures is the value of k_d in the expression

$$\begin{aligned}
 79 &= \sum_{t=1}^{10} \frac{11(1-0.5775)}{(1+k_d)^t} + \frac{11(1-0.5775)+20}{(1+k_d)^{11}} + \frac{8.8(1-0.5775)+20}{(1+k_d)^{12}} \\
 &+ \frac{6.6(1-0.5775)+20}{(1+k_d)^{13}} + \frac{4.4(1-0.5775)+20}{(1+k_d)^{14}} + \frac{2.2(1-0.5775)+20}{(1+k_d)^{15}} \\
 \Rightarrow k_d &= 0.07 = 7\%
 \end{aligned}$$

(iv) Post tax cost of 10% long-term loan

$$\begin{aligned}
 k_l &= \text{rate of interest}(1-\text{tax rate}) \\
 &= 10(1-0.5775) = 4.225\%
 \end{aligned}$$

(v) Post tax cost of 7% preference capital

For perpetual preference capital the cost of capital is given by

$$k_p = \frac{\text{Annual dividend}}{\text{Market price}} = \frac{7}{50} = 14\%$$

(vi) Post-tax cost of equity

$$k_e = \frac{D_1}{p_0} + g$$

where

g = Actual growth rate of dividends over the period 1998-2006

$$\Rightarrow 15 = 13(1+g)^8$$

$$\Rightarrow g = 3\%$$

Now,

$$D_1 = 15.0$$

$$p_0 = 101.25$$

$$\Rightarrow k_e = \frac{15}{101.25} + 0.03 = 17.2\%$$

Then we have

Table 11.10

Source of capital	Weight (Market value)	Cost of the source
Debentures (8.5%)	$\frac{0.87}{8.75} = 0.10$	0.065
Debentures (11%)	0.20	0.07
Long-term loan	0.32	0.04225
Preference capital	0.05	0.14
Equity	0.33	0.172
Cost of capital		0.09862 = 9.862%

11.7 Marginal cost of capital

Till now, we have been assuming that the cost of capital remains the same irrespective of the amount of being raised. However, this is a simplified assumption and usually the cost of capital increases after certain amount. This increase in cost while raising additional funds for the firm is called the marginal

cost of capital. To illustrate this point consider the following situation when a firm has the following capital structure

Table 11.11

Source of capital	Value (Rs. in lakh)
Equity (market value)	1200
Debt (market value)	800
Debt-equity ratio	2:3
Required rate of return by current equity holders (%)	15
Required rate of return by current debtors (%)	14
Current net earnings	135
Proposed equity dividend	75
Proposed retained earnings	60
Cost of raising additional equity (%)	5
Cost of debt	Nil
Tax rate applicable to the firm	40%

Then the marginal cost of capital, which the cost of capital at the margin is given by

$$\begin{aligned}
 k &= \frac{3}{5} \times 0.15 + \frac{2}{5} \times 0.14 \times (1 - 0.40) \\
 &= \frac{0.45 + 0.252}{5} \\
 &= 0.1236 = 12.36\%
 \end{aligned}$$

However, at this cost of capital the firm cannot raise unlimited fund. As the requirement for the fund rises, the cost of capital is bound to rise. The capital schedule can have jumps at several points when the cost of capital changes. Let the additional information in the above schedule be as follows

- (i) The required return on first 40 lakhs of equity is 15% and on the next 60 lakh is 16%.
- (ii) The required return on first 60 lakhs of debt is 14% and on the next 40 lakh is 16%.

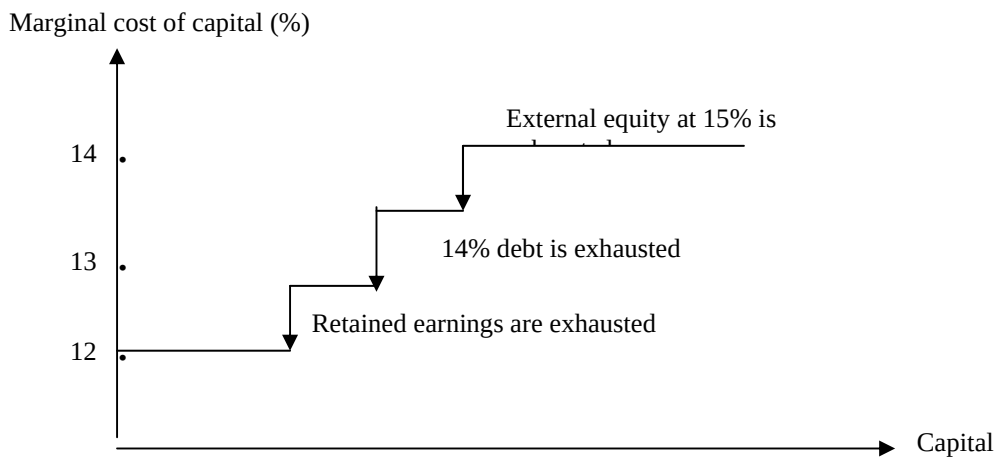
What can be the composition of the additional funds? To see this, we can calculate the cost of capital corresponding of different composition of the additional funds

Table 11.12

Chunk	Composition	Average cost of capital
First	Rs. 60 lakh of retained earnings at cost 15% + Rs. 40 lakh of debt costing 14%	$\frac{3}{5} \times 0.15 + \frac{2}{5} \times 0.14(1 - 0.4) = 12.36\%$
Second	Rs. 30 lakh of retained earnings at cost 15.75% (including 5% issue cost) + Rs. 20 lakh of debt costing 14%	$\frac{3}{5} \times 0.1575 + \frac{2}{5} \times 0.14(1 - 0.4) = 12.81\%$
Third	Rs. 10 lakh of retained earnings at cost 15.75% (including 5% issue cost) + Rs. 6.67 lakh of debt costing 16%	$\frac{3}{5} \times 0.1575 + \frac{2}{5} \times 0.16(1 - 0.4) = 13.29\%$
Fourth	Rs. 50 lakh of retained earnings at cost 16.8% (including 5% issue cost) + Rs. 33.33 lakh of debt costing 16%	$\frac{3}{5} \times 0.168 + \frac{2}{5} \times 0.16(1 - 0.4) = 13.92\%$

Several other combinations are possible for calculating the cost of capital

Graphically the situation is

**Fig 11.1**

11.8 Marginal cost of capital and capital budgeting

While evaluating capital projects, the marginal cost of capital is taken into account. A project is worthwhile if it has a positive *NPV* discounted at a rate equal to its marginal cost of capital. If the marginal cost of capital is constant, then as we have seen, the evaluation of projects is done with the existing cost of capital since that will be the marginal cost of capital also. However if the marginal cost of capital is increasing then we proceed as follows.

- (i) Determine all those projects, which have a positive *NPV* for each level of financing before a jump in the marginal cost of capital schedule.
- (ii) Choose the level of financing and the corresponding set of projects that has the highest *NPV*.

Consider the following estimated marginal cost of capital schedule for a firm

Table 11.13

Level of financing (Rs. lakh)	Marginal cost of capital (%)
50	10
100	10.5
150	11
200	12

For each level of financing, the firm first of all chooses the set of all the projects with positive *NPV*.

Let the *NPV* be given as follows

Table 11.14

Level of financing (Rs. lakh)	<i>NPV</i> (Rs.)
50	20
100	10.5
150	45
200	40

The highest *NPV* is obtained when the firm raises Rs. 150 lakh of financing.

11.9 Investment and financial decisions

The use of weighted average cost of capital is based on the assumption that every project is financed by the same debt-equity (or any other proportion of sources of finance) mix. However, the situation may not be always so and different projects may vary for the debt capacity and other features like subsidiaries and other relaxations. The impact of financing on capital budgeting is measured by the following two methods

(i) Adjusted NPV method

The adjusted NPV of a project is the NPV calculated after making adjustments for the impact of financing on the project.

$$\text{Adjusted NPV} = \text{Base case NPV} + \text{NPV of the financing decisions associated with the project}$$

where base case NPV is the NPV of an all-equity project.

Example 18: Consider a project that needs an investment of Rs. 50 lakh. It is expected to produce a net cash flow of Rs. 10 lakh per year for eight years. The return needed by the equity holders of the project is 16% and the cost of issuing the equity is 4%. The firms can raise Rs. 16 lakh of the investment needed by debt at 12% interest and will be repaid in eight equal annual installments over eight years period, first installment due in one year from now. The tax rate applicable to the firm is 40%. Calculate the adjusted NPV of the firm.

Sol:

$$\begin{aligned}\text{Base case NPV} &= -50,00,000 + \sum_{t=1}^8 \frac{10,00,000}{(1.15)^t} \\ &= -\text{Rs. } 5,13,000\end{aligned}$$

Now, we calculate the adjustment factor

(i) Adjustment for the issue cost

Net equity finance = Rs. (50 – 16) lakh = Rs. 34 lakh

Cost of issue = 4%

$$\text{Total equity stock to be issued} = \frac{34,00,000}{0.96} = \text{Rs. } 35,41,667$$

The difference of Rs. 1,41,667 is the cost related to the issue of the new equity stock.

(i) Adjustment for the tax shield associated with the debt

Table 11.15: Present value of tax shield

Year	Debt outstanding (at the beginning of the year) (Rs. lakh)	Interest (I_d) (Rs. lakh)	Tax shield (Rs. lakh)	Present value of the tax shield (Rs.) $\frac{\text{Tax shield}}{(1+r)^t}$
1	16	1.92	0.768	68,571.43
2	14	1.68	0.672	60,000
3	12	1.44	0.576	51,428.57
4	10	1.2	0.48	42,857.14
5	8	0.96	0.384	34,285.71
6	6	0.72	0.288	25,714.29
7	4	0.48	0.192	17,142.86
8	2	0.24	0.096	8,571.429
Total				3,08,571.4

Adjusted NPV = Base case NPV – NPV of the issue cost + NPV of the tax shield

$$= -5,13,000 - 1,41,667 + 3,08,571.4$$

$$= -\text{Rs. } 3,46,095.6$$

Since the adjusted NPV of the project is negative, so it should not be accepted.

(ii) **Adjusted cost of capital method**

Consider the following example

Example 19: Following are the financial details of a new project under consideration

Table 11.16

Particulars	Value (Rs.)
Investment needed (Rs. lakh)	50
Annual post-tax savings (Rs. lakh)	5
Life of the project (years)	Perpetual
Debt capacity of the project (Rs. lakh)	30
Interest on debt (%)	10
Life of debt (years)	Perpetual
Tax rate of the firm (%)	40
Required rate of return (%)	12

Find whether the project is worth accepting.

Sol:

$$\begin{aligned}\text{Base case NPV} &= -50,00,000 + \frac{5,00,000}{0.12} \\ &= -\text{Rs. } 8,33,000\end{aligned}$$

$$\begin{aligned}\text{Annual value of tax-shield} &= 30,00,000 \times 0.10 \times 0.40 \\ &= \text{Rs. } 1,20,000\end{aligned}$$

$$\text{Present value of tax-shield} = \frac{1,20,000}{0.10} = \text{Rs. } 12,00,000$$

$$\begin{aligned}\Rightarrow \text{adjusted NPV} &= -\text{Rs. } 8,33,000 + \text{Rs. } 12,00,000 \\ &= \text{Rs. } 3,67,000\end{aligned}$$

Thus the *NPV* of the project is negative when it is an all-equity project. However the project becomes acceptable when it is partly financed through debt. As long as, the adjusted *NPV* of the project is

positive, it should be accepted. The adjusted *NPV* is positive till base case *NPV* is more than –Rs. 12,00,000.

Calculation of adjusted cost of capital

If the base case *NPV* is –Rs. 12,00,000, then the annual income corresponding to it is

$$\begin{aligned} -12,00,000 &= -50,00,000 + \frac{\text{annual income}}{0.12} \\ \Rightarrow \text{annual income} &= \text{Rs. } 4,56,000 \end{aligned}$$

Since the life of the project is perpetual and the cash flows are constant so the *IRR* corresponding to this acceptable income is

$$\begin{aligned} IRR &= \frac{\text{Annual cash flow}}{\text{Initial investment}} \\ &= \frac{4,56,000}{50,00,000} = 0.0912 = 9.12\% \end{aligned}$$

11.10 Dividend policy

Dividend refers to that part of a firm's net profits, which are paid to the shareholders (equity holders) of the firm. The dividends are complementary to the retention of the earnings by the firm. Retention of earnings is a major source of financing the investment requirements of the firm. So, larger dividends may affect the financing of the new investment proposals.

Thus the two (alternative) uses of the earnings of a firm are competitive and conflicting. Then a major decision problem of the management is to strike a balance between the two with an objective of the maximization of the shareholders' wealth. Thus the profits should be distributed to the shareholders if it leads to the maximization of the shareholders' wealth. If not, earnings should be retained with the firm with an objective of financing the future investment proposals. Then the problem of the decision maker is the appropriate allocation of the net earnings into the two uses of the earnings, viz., the dividends to be paid, and the earnings to be retained to finance the future projects.

11.11 Determinants of the dividend policy

Dividend policy is an integral part of the investment policy of a firm. The choice of an appropriate dividend policy influences the value of a firm. However, if the dividends are in excess of the appropriate quantity, the retained earnings will fall short of the capital needed to finance future projects. In such situations the firms will have to raise funds externally to finance the future projects. Thus a balance is needed to be maintained in paying the dividend and the retention of the earnings. As such, there are several determinants of the dividend policy.

(f) Dividend pay-out ratio (*D/P* ratio)

D/P ratio is the proportion of the total earnings to be paid in cash to the shareholders (equity holders) of the firm. Mathematically,

$$D/P \text{ ratio} = \frac{\text{Cash dividend per share}}{\text{Earnings per share}} \times 100$$

According to the Walter's model of dividend policy, the optimal dividend policy of the firm is determined by the firm's internal rate of return (r) and the firm's cost of capital (k). The firm should distribute its earnings among the shareholders if $r < k$, i.e., if the required rate of return exceeds the internal rate of return. In this case, the shareholders will be able to reinvest their earnings to earn a higher return than what could have been earned if the firm had retained the earnings. Alternatively, if $r > k$, then the firm is able to earn more than what the shareholders could earn if the earnings are paid to them in the form of the dividend. The objective of the firm in both the situations would remain the same, i.e., the maximization of the shareholders' wealth.

To put the same argument in an alternative form, a firm that has adequate profitable investment opportunities (a growth firm) should adopt a policy of zero dividend payout ratio because the reinvestment of the retained earnings will maximize the return of the firm and consequently the market price of the shares will be maximized. If the firm does not have sufficient profitable investment opportunities, then a *D/P* ratio of magnitude 100 would provide investors an opportunity to earn a higher return and as a result, the market price of the shares will be maximized.

For $r = k$, the market price of the shares will remain the same and hence any percentage of the earnings (from 0 to 100) could be distributed as dividend and the firm does not have an optimal dividend policy.

Under some assumption, the relation between the market price of the shares and the dividend to be paid can be worked out using Walter's model

Assumptions of the Walter model

1. There are no external sources of finance e.g., external debt, or new equity shares. All the financing is done through retained earnings only.
2. The business risk of the firm does not change with the new investments. In other words for new investments, the structure of r and k will remain the same as the existing structure of r and k .
3. The key variables, i.e., the earnings per share E and the dividend per share D , will remain the same.
4. The firm has perpetual or at least very long life.

Under these assumptions, we know that the cost of the equity is given by

$$k_e = \frac{D}{P} + g \quad (11.4)$$

where

k_e = Cost of the equity capital;

D = Initial dividend;

P = Price per share; and

g = Expected growth rate of earnings.

Since all the future financing is to be done from retained earnings only so

$$g = rb \quad (11.5)$$

where

$$b = \text{retention ratio} = \frac{E - D}{E}$$

$$\therefore g = r \left(\frac{E-D}{E} \right) \quad (11.6)$$

Now,

$$g = \frac{\Delta P}{P} \quad (11.7)$$

$$\Delta P = \frac{r}{k_e} (E-D) \quad (11.8)$$

and

$$k_e = \frac{D}{P} + \frac{\Delta P}{P} \quad (11.9)$$

Then from (11.7), (11.8) and (11.9), we have

$$k_e = \frac{D + \frac{r}{k_e} (E-D)}{P} \quad (11.10)$$

Or

$$\begin{aligned} P &= \frac{D + \frac{r}{k_e} (E-D)}{k_e} \\ &= \frac{D}{k_e} + \frac{r}{k_e} (E-D) \times \frac{1}{k_e} \\ &= \frac{D}{k_e} + \frac{\Delta P}{k_e} \end{aligned} \quad (11.11)$$

The factor $\frac{D}{k_e}$ of the equation is the present value of all the dividends (the firm has perpetual life) and

the factor $\frac{\Delta P}{k_e}$ is the present value of all the capital gains (changes in the prices of the shares). Thus

the market price of the shares in all-equity firm is the sum of the present value of all the dividends and the present value of all the capital gains.

To understand the effect of the dividend policy on the market price of shares according of the Walter's model of dividend policy, consider the following example

Example 20: The cost of capital of a firm is 10% and the earning per share is Rs. 20. What will be the market price of the shares of the firm according of the Walter's model of dividend policy if the rate of return (r) on the investment is

- (i) 15%; (ii) 10%; and (iii) 8%?

The D/P ratios are given to be

- (i) 0; (ii) 20; (iii) 40; (iv) 50; (v) 60; (vi) 80; and; (vii) 100.

Sol: (i) $r = 15\%$

(a) D/P ratio = 0 $\Rightarrow$ dividend per share = 0

$$P = \frac{0 + \left(\frac{0.15}{0.10}\right)(20 - 0)}{0.10} = \text{Rs. } 300$$

(b) D/P ratio = 20 $\Rightarrow$ dividend per share = Rs. 4 (20% of 20)

$$P = \frac{4 + \left(\frac{0.15}{0.10}\right)(20 - 4)}{0.10} = \text{Rs. } 280$$

(c) D/P ratio = 40 $\Rightarrow$ dividend per share = Rs. 8

$$P = \frac{8 + \left(\frac{0.15}{0.10}\right)(20 - 8)}{0.10} = \text{Rs. } 260$$

(d) D/P ratio = 50 $\Rightarrow$ dividend per share = Rs. 10

$$P = \frac{10 + \left(\frac{0.15}{0.10}\right)(20 - 10)}{0.10} = \text{Rs. } 250$$

(e) D/P ratio = 60 $\Rightarrow$ dividend per share = Rs. 12

$$P = \frac{12 + \left(\frac{0.15}{0.10}\right)(20 - 12)}{0.10} = \text{Rs. } 240$$

(f) D/P ratio = 80 $\Rightarrow$ dividend per share = Rs. 16

$$P = \frac{16 + \left(\frac{0.15}{0.10}\right)(20 - 16)}{0.10} = \text{Rs. 220}$$

(g) D/P ratio = 100 $\Rightarrow$ dividend per share = Rs. 20

$$P = \frac{20 + \left(\frac{0.15}{0.10}\right)(20 - 20)}{0.10} = \text{Rs. 200}$$

Similarly, we can calculate the market price of shares for other two rates of return and we have the following table

Table 11.17

D/P ratio	Market price of shares (Rs.) when $r =$		
	15%	10%	8%
0	300	200	160
20	280	200	168
40	260	200	176
50	250	200	180
60	240	200	184
80	220	200	192
100	200	200	200

We can observe the following points

- (i) If $r > k$, the price of the shares is inversely related to the dividend payout ratio. In this case, the optimal dividend policy is to pay zero dividends.
- (ii) If $r < k$, the price of the shares is directly related to the dividend payout ratio. In this case, the optimal dividend policy is to pay 100 percent dividends.
- (iii) If $r = k$, the price of the shares is not related to the dividend payout ratio and is a constant. In this case, there is no optimal dividend policy.

However the capital market is imperfect and the future is uncertain. In these situations, the investors would not prefer to forego present earnings in the hope of receiving a better dividend in the future. As such 100% retention of the earnings by the firms is a theoretic concept.

So even if the firms may have good opportunities to invest retained earnings, still a low D/P ratio may cause a decline in the market price of the shares of the firm.

In such situations, the provisions of financing become secondary objectives of the dividend policy of the firms.

(ii) Stability of dividends

This is the second aspect affecting the dividend policy of a firm. Stability of dividend has two aspects-regularity of dividends and payment of a minimum certain amount. Thus stable dividends are consistent with respect to time and magnitude.

Need for stable dividends

A (stable) dividend policy has a direct bearing upon the market price of the shares of the firm. There several reasons that can be attributed to this behavior exhibited by the investors.

(a) Desire for a stable income

Some investors prefer regular current income to the higher dividends in future. The people with no other source of regular income, for example, retired persons and senior citizens, view dividend as a source of funds to meet their requirements.

If the dividends are not stable, then they might find it difficult to meet their regular expenses in case dividends decline. As a remedy, they may have to sell (a part of) their stock in order to meet their requirements. On the other hand, if the dividends they receive is more than their requirements, then they might require reinvesting their additional income. Both the situations may be inconvenient to them as it involves an element of cost (transportation cost, commission, brokerage etc.) besides

physical inconvenience. Such investors prefer stable income (dividend) for which they are ready to pay higher prices also.

(b) Information window

This aspect of stable dividends is useful from the market as well as management's point of view. Investors view dividend as indicators of the firm's performance. If dividends are stable, then a change in the dividends is an indicator of the long-term changes in the (expected) earnings of the firm. Thus stable dividends reduce investors' risk by giving indication about the firm's performance. On the other hand, an unstable dividend policy will increase investors' risk since they would not be able to peep into the firm's future performance. Thus a stable dividend policy serves as an information window for investors and instills the confidence of market in the firm.

(c) Institutional investors

Institutional investors like insurance companies or mutual funds etc., by virtue of their size and the capacity to invest, are a significant market force in the capital markets. Due to their return obligations, these institutional investors are required to invest their funds in those companies, which have a record of uninterrupted and continuous stable dividend policy. The bulk buying of stock by these investors enhances the market price of the shares and hence the worth of the firm.

(d) Capital market imperfections

By perfect capital markets, we mean a market where there are no taxes, floatation costs, transaction costs, and other charges. As a result the investors are indifferent to payment of dividends or the retention of earnings by the firms. But this is not the situation and the capital markets are imperfect. Taxes are there and are different for capital gains and income from dividends. Further taxes are incremental. As a result, the investors from the lower tax brackets deem payment of dividends a better option than the retention of earnings by the firms.

Form of stable dividends

Stable dividends can be in one of the following forms

(i) Constant dividend per share

In this form of dividend policy, a certain fixed sum is paid as dividends each year. For example, dividend may be a certain percentage of the face value of the share. Then, the same amount will be paid every year irrespective of whether or not the firm has earned profits. Even if there are fluctuations in the earnings of the firm, dividend stream will remain stable. If the dividend increases, the increase will be maintained for sometime before the next increase.

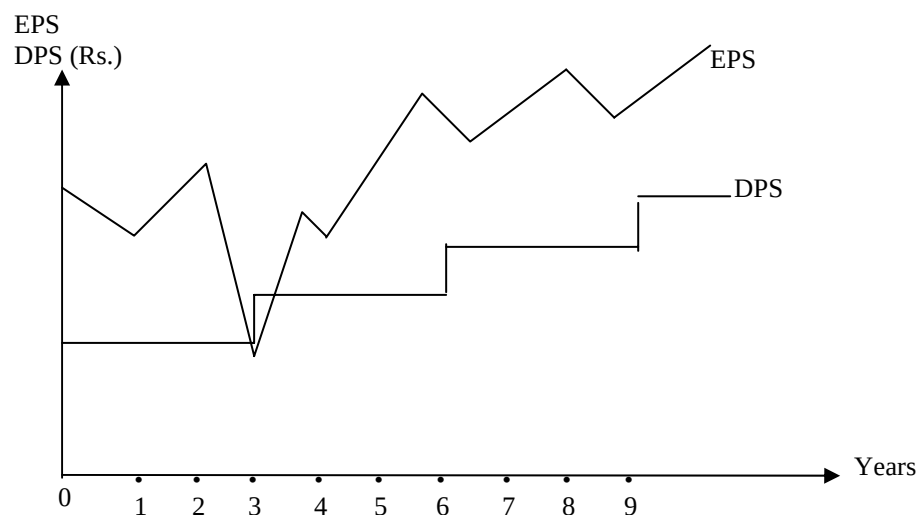


Fig. 11.2

As is evident from the figure, dividends remain stable even if the earnings of the firm fluctuate. In such situations, the firm will have to make provisions for dividend to be paid in those years when the earnings are not sufficient to pay the dividend. The balance standing in such a fund is called the **reserve for the dividend equalization**. This fund can be invested in those assets, which can easily be liquidated.

This form of dividend policy is considered to be the best by the investors since they are getting assured dividends for their investments. There is no element of irregularity and uncertainty in receiving of the income.

(ii) Stable dividend payout ratio

This is the second form of stable dividends. In this policy, the firms pay a constant or fixed percentage of the earnings as dividends. However, if the earnings are not stable, then under this policy, the dividends will also fluctuate. If at some point of time the earnings are very low or there are losses, the dividendness will practically be nil.

This situation is good from the management's point of view since they would not have to pay dividend if the earnings are low and if the earnings are good, they will have sufficient funds to retain for future investments. However this situation is not good from the investors' point of view since there is no assured dividend (return) for their investments. Thus the element of uncertainty creeps in.

(iii) Stable rupee dividend plus extra dividend

In this form of stable dividends, the firm pays a minimum certain sum to the shareholders. In addition if the earnings of the firm are above normal, along with regular dividend some additional dividend is paid. When the firm earns normal income, it will gain turn over the normal dividend.

From the investors' point of view, this situation is not considered as good since in this case investors know that the income that they are receiving is not permanent and their return will decline if the earnings of the firm become normal. Again there is an element of uncertainty.

The need for a stable dividend policy is supported by Gordon's model also.

Gordon's model for dividend policy

The model is based on the assumption that the investors are risk averse people. As a result, they would put a premium on the current income. The current income eliminates the element of risk, which is the uncertainty in terms of time and amount of returns. The firms retain earnings so that a higher dividend can be paid in future. But the future is uncertain so a risk averse investor would prefer current income to the future income. Thus the retained earnings would have a higher discount rate and consequently

the market price of the shares of a firm, which has higher retained earnings, would decline. In order to avoid uncertainty, the investors are willing to pay a higher amount thus increasing the value of the firm.

Assumption of the model

1. The firm is an all-equity firm. This means that there is no other source of finance and all the investments are financed by retained earnings only.
2. The cost of equity k_e and the rate of return on the firm's investments r are constant.
3. The life of the firm is (practically) perpetual.
4. The retention ratio b is constant. As a result, the growth rate $g (= rb)$ is also constant.
5. The cost of equity is greater than the growth rate, i.e., $k_e > g (= rb)$.

Graphically the argument can be presented as follows

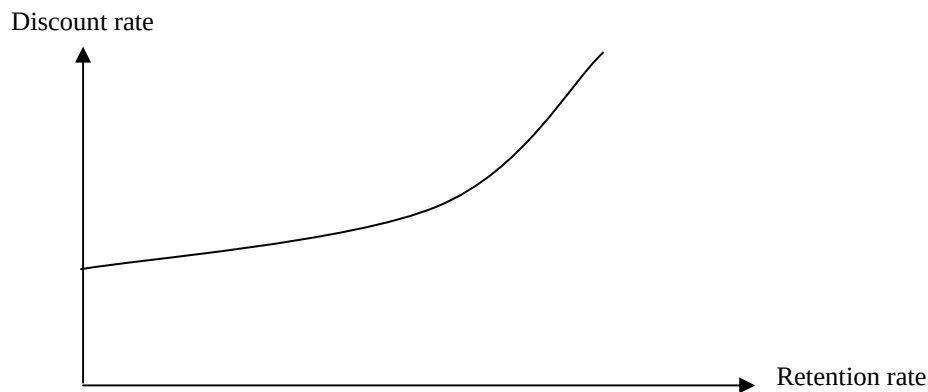


Fig. 11.3

Mathematically, under the assumptions of the model the price P of a share is given by

$$\begin{aligned}
 P &= \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_e - br)^t} \\
 &= \sum_{t=1}^{\infty} \frac{E(1-b)}{(1 + k_e - br)^t}, \text{ } E \text{ is the earnings per share} \\
 &= \frac{E(1-b)}{k_e - br}, \text{ as the life of the firm is perpetual.}
 \end{aligned}$$

To understand the implications of this formula, consider the following example

Example 21: The cost of (equity) capital of a firm is 20% and the earning per share is Rs. 20.

What will be the market price of the shares of the firm according of the Gordon's model of dividend policy if the rate of return (r) on the investment is

- (i) 15%; (ii) 10%; and (iii) 8%?

The D/P ratios are given to be

- (i) 0; (ii) 20; (iii) 40; (iv) 50; (v) 60; (vi) 80; and; (vii) 100.

Sol: Here $E = \text{Rs. 20 per share}$

$$k_e = 20\%$$

Then we have

Table 11.18

D/P ratio ($1 - b$)	Retention ratio (b)	Market price of shares (Rs.) when $r =$					
		15%		10%		8%	
		$g (= rb)$	$P = \frac{E(1-b)}{k_e - br}$	g	P	g	P
0	100	15	0.00	10	0.00	8	0.00
20	80	12	50.00	8	33.33	6.4	29.41
40	60	9	72.73	6	57.14	4.8	52.63
50	50	7.5	80.00	5	66.67	4	62.50
60	40	6	85.71	4	75.00	3.2	71.43
80	20	3	94.12	2	88.89	1.6	86.96
100	0	0	100.00	0	100.00	0	100.00

Thus the dividend policy affects the market value of the firm.

Lintner's model of dividend policy

An autoregressive model, Lintner's model of dividend policy is based on the assumption that dividends are after effects of the earnings and hence lag behind the earnings for one or more periods. Most of the

firms have two components of dividend policy – a stable rupee amount of dividends and the (long-term) target pay out ratio. The period-to-period dividends may not be same as the target pay out ratio, which the firms aim at. In order to avoid any conflict between the payout policy and the earnings when the earnings are lean, the firms raise the dividends gradually.

Dividends, according to this model, are functions of earnings of that year, existing dividend rate, the target pay out ratio, and a multiplier representing the speed of adjustment (partial adjustment model).

The change in the dividends in the consecutive time periods is given by

$$D_t - D_{t-1} = a_0 + \alpha(D_t^* - D_{t-1}) \quad (11.12)$$

where

D_T = Dividend paid in T^{th} time period; $T = t, t-1$

a_0 = Constant (≥ 0)

D_t^* = Target pay-out ratio ($= rP$)

r = Dividend pay-out ratio

P = Profit after taxes

α = Speed of adjustment.

R.H.S. of (11.12) can be rewritten as

$$\begin{aligned} \Rightarrow D_t &= D_{t-1} + a_0 + \alpha(rP_t - D_{t-1}) \\ &= a_0 + \alpha r P_t + (1-\alpha)D_{t-1} \quad a_0 + \alpha(rP_t - D_{t-1}) \\ &= a_0 + \beta_1 P_t + \beta_2 D_{t-1} \end{aligned}$$

where

$\beta_1 = \alpha r$ is the short-term propensity to pay dividends; and

$\beta_2 = (1-\alpha)$ is the long-term propensity to pay dividends.

11.12 Constraints of dividend policy

Till now, we have been discussing the minimum dividends that are to be paid. However the firms cannot pay unlimited dividend or an amount at their wish only. There are certain constraints that put a ceiling on the amount of dividend to be paid. The dividends are restricted by several factors.

(i) Legal constraints

Payment of dividends is not a legal compulsion or even requirement. However law directs the conditions under which dividends are to be paid.

(a) Capital impairment

According to legal stipulations, firms cannot pay dividends more than their current income and the accumulated past retained earnings. The implication of this restriction is that working capital of the firm cannot be used for payment of dividends and the claims of lenders and creditors are protected since they relied upon the equity base of the firm while extending credit to the firm. Thus under law, the impairment of the capital is illegal.

(b) Insolvency

A firm is said to be insolvent if its liabilities become larger than its assets or the firm is not in a position to pay its bills. An insolvent firm cannot pay dividends. The reason for this restriction is that the dividends are the results of the firm earnings and the primary liability of the firm is to retire debt first, and only then dividends can be paid.

(iii) Contractual restraints

Sometimes, external creditors also impose restrictions on the dividends to be paid. The restrictions may be on the percentage of earnings to be paid as dividends, the absolute amount to be paid as dividends or no dividend at all till a certain level of earnings is reached. This restriction arises from the fact that lower dividends mean higher retained earnings and hence low debt/equity ratio. A low debt/equity ratio leads to a larger margin of safety for the lenders.

(iv) Internal restrictions

In addition, certain internal restrictions for the firms are also there on the dividend policy that put a limit on the dividend to be paid.

First of all, the firms should have enough cash funds or liquid assets to meet the requirements of the dividends to be paid. In this situation, the growing firms or the firms that have other payment obligations may feel a crunch of the funds.

In order to undertake future investment plans, the firms need to re-plough their earnings into these plans. This puts a limit on the amount of dividend to be paid. The firms with good investment opportunities also tend to pay a lower dividend.

(v) Taxes

Taxes also play a role in formulating dividend policies of the firms. Since capital gains are taxed at a lower rate than the dividend income, so a firm with a large number of investors in a higher tax bracket would tend to pay lower dividends than a firm with a large number of investors in a lower tax bracket

(vi) Inflation

As prices rise, the value of the retained earnings declines, as the retained earnings have to provide for depreciation also. In such situations, the firms tend to retain a large part of their earnings and consequently the dividends decline.

Problems

1. A person is saving Rs. 2,000 per year for five years and Rs. 3,000 per year for 10 years thereafter. What amount will he receive after 15 years at a rate 10% of interest?
2. Find the rate of interest if at the end of six years of depositing Rs. 10,000 per annum, Rs. 1,00,000 are returned.
3. At an interest rate of 10%, how much you ought to invest today to get an income of Rs. 15,000 annually for a perpetual time period starting 10 years from now?
4. Calculate the value of Rs. 1,000 invested today to earn an interest of 12% for a period of (a) 60- days; (b) 90- days; (c) 110-days; and (d) 275 days, if the number of days in a year is assumed to be 360.
5. A person has two investment options offered by two different sources. First option has quarterly compounding whereas the second option offers half-yearly compounding. The effective rate of interest under both the schemes is same. Which option should he go for?
6. A free hold estate is bought for Rs. 25,00,000. At what rent should it be let so that the owner may receive 5% per annum compounded annually on his purchase money perpetually?
7. A pipeline is due for repairs. It will cost Rs. 5,00,000 and the repairs will last for four years. An alternative is to lay a new pipeline at a cost of Rs. 18,00,000 which will last for 15 years. Which alternative should be chosen if the cost of capital is 10%?
8. Find the size of a 15-year annuity at an interest rate of 24% if its present value is Rs. 30,00,000.

9. Find the growth rate of the earnings of a stock, which grows, to Rs. 402 from Rs. 300 in ten years.
10. An investor has two options before him to choose from
- Rs. 60,000 after 1 year;
 - Rs. 90,000 after 4 years.
- Assuming a discount rate of (i) 10%; (ii) 18% and (iii) 22%, which option should be selected?
11. In order to receive Rs. 5,00,000 annually for 10-years, how much should be invested today if the required rate of return is 10%?
12. Find the present value of perpetuity of size Rs. 250 if the discount rate is 8%.
13. Consider the following cash flows:

Table 11.19

End of the year	Cash flow (Rs.)	
	Option I	Option II
1	8,000	12,000
2	8,000	9,000
3	8,000	8,000
4	8,000	6,000
5	8,000	5,000
Lump sum at $t = 0$	30,000	28,500

If the required rate of return is 10%

- Which alternative would you choose between lump sum and annual cash flows of option I?
- Which alternative would you choose between lump sum and annual cash flows of option II?

- (c) Which alternative would you choose between option I and option II?

14. Consider the following cash flow streams

Table 11.20

Year	Cash flow (Rs.)		
	I	II	III
1	125	150	125
2	140	155	130
3	160	161	132
4	180	168	132
5	205	176	140
6	-	185	145
7	-	195	150
8	-	206	-
9	-	217	-
10	-	210	-

- (a) What is the compound annual growth rate of each of the cash flow streams?
- (b) What is the annual rate of simple interest if the first row of the table represents initial investments for each of the three options?

15. An investor purchases 1000 shares of a company for Rs. 20,000 and pays 5% as brokerage. A year after, he is able to sell the stock for Rs. 28,000 and pays 4% as commission. During this period, he receives a dividend of Rs. 2000. What is his rate of return?

16. Consider the following information

Number of shares = 1,000

Expected market value of shares one year from now = Rs. 70,000

Expected dividend during one year = Rs. 2,500

Required rate of return = 12%

Find the present worth of shares.

17. Consider the following information

Earnings per share = Rs. 8

D/P ratio = 45%

Company's rate of return = 16%

Company's growth rate = 12%

Find the present worth of shares.

18. Calculate the overall cost of capital given the following information

Table 11.21

Particulars	Company X	Company Y
Total assets	Rs. 15,00,000	Rs. 15,00,000
Net profit	20% (of assets)	20% (of assets)
Tax	Nil	Nil
Cost of equity	15%	15%
Value of debt	Rs. 9,00,000	-
Cost of debt	10%	-

19. Consider the following data

Table 11.22

Proportion of debt	Cost of debt (%)	Cost of equity (%)
0	5	15
10	5	15
12	6	16
30	6	17
40	7	17

50	7.7	18
60	7.5	18
70	7.5	18
80	8	19
90	8	20
100	9	20

Find the optimal debt-equity mix.

20. A company's current earnings before interest and taxes are Rs. 10,00,000. The firm has an outstanding debt of Rs. 20,00,000 at a cost of 10%. The cost of equity is 15%. Find
1. The current value of the firm.
 2. The firm's overall cost of capital and the proportions of debt and equity.
 3. The firm is planning to sell Rs. 5,00,000 equity to retire debt of the same amount. This would reduce the cost of equity to 12%. However the cost of debt would not be affected. Should the firm implement the decision?
 4. For the given information, what should be the optimal debt-equity mix?
21. An all-equity company has current market value of Rs. 40,00,000. The equity capitalization rate is 14%. The firm is planning to undertake an investment of Rs. 8,00,000, which the firm wishes to finance, at least partly, through debt. The following alternatives have been proposed

Table 11.23

Debt (Rs. lakh)	Cost of debt (%)	Cost of equity (%)
1	10	14
2	10.5	14
3	11	15
4	11.8	15
5	12.3	16
6	13.4	18

7	14	19
8	15	20

If the current tax rate is 40%, which of the plans should be accepted?

22. Calculate the cost of equity capital for the following data

Table 11.24

Details	Years					
	0	1	2	3	4	5
Earnings per share (Rs.)	7.5	7.8	7.0	6.0	8.0	7.5
Dividends per share (Rs.)	6.0	6.0	6.0	5.0	6.0	6.0
Payout ratio (%)	77	73	7.5	65	60	67
Bonus	1:2					
Average price (Rs.)	50	52	55	43	48	46
Book value per share (Rs.)	40	41.5	52.5	33	35.5	37

23. A company has the following book value capital structure

Table 11.25

Source of capital	Value (Rs. in lakhs)
Equity capital (20 lakh shares, Rs. 10 per share)	200
Preference capital (11%) (10,000 shares, Rs. 200 each)	20
Retained earnings	150
Debentures (14%)	50
Term loan (12%)	80
	500

The next expected dividend per share is Rs.3.00, which is expected to grow at a rate of 7%. The market price of the share is Rs. 20. Preference stock redeemable after 10 years is currently selling at

Rs. 80.00. 50,000 debentures, each with book value Rs. 100, is currently selling at Rs. 500 and are redeemable after 5 years. The tax rate for the company is 40%. Calculate

- (i) The average cost of capital using
 - (a) Book value weights;
 - (b) Market value weights.
- (ii) The marginal cost of capital schedule for the firm if it plans to raise Rs. 500 lakh from the next year given the following information
 - (a) The amount is to be raised from equity and debt in the ratio of 3:2.
 - (b) The earnings to be retained next year are expected to be Rs. 80 lakh.
 - (c) The additional issue of equity capital will have an expected value Rs. 16.00 per share.
 - (d) The cost of capital for the debt to be raised will be 14% for first Rs. 100 lakh and 16% for the next Rs. 100 lakh.

24. The details of an investment are as follows

Table 11.26

Particulars	Value (Rs.)
Investment needed (Rs. lakh)	10
Cash flow expected after one year (Rs. lakh)	12
Life of the project (years)	one
Debt capacity of the project (Rs. lakh)	4
Interest on debt (%)	15.75
Tax rate of the firm (%)	40
Required rate of return (%)	12

Calculate the adjusted cost of capital of the project. Find whether or not should the project be accepted.

- 25 What do you mean by dividend policy of a firm? What are the major determinants of the dividend policy of a firm?
- 26 What do you understand by stable dividends? Why is a policy of stable dividends preferred?
- 27 Discuss how a stable dividend policy affects the market value of a firm?
- 28 Discuss the Walter's model of dividend policy. Illustrate the use of the model in demonstrating the relationship between the dividends paid and the market value of the firm.
- 29 Consider the following information

$$k_e = 10\%$$

Market value of the firm (v) = Rs. 20,00,00,000

Number of equity shares = 10,00,000

Net earnings of the firm = Rs. 25,00,000

Dividend paid = Rs. 15,00,000

A new investment proposal, promising a rate of return equal to 14% is under consideration. Should the company accept the proposal?

- 30 The cost of capital for an all-equity firm is 12%. The rate of return on investments is 18%. The number of equity shares of the firm is 50,00,000, each with a market value Rs. 20. The earnings per share are Rs. 8.
- Calculate the value of the firm using Walter's model if the D/P ratios are 0%, 20%, 50%, and 100%. Repeat the problem after interchanging the cost of capital and the rate of return on investments.

- 31 Consider the following information

$$k_e = 12\%$$

$$EPS = \text{Rs. } 16$$

$$r = 8\% \text{ (Rate of return on retained earnings)}$$

The company is considering the following alternative *D/P* ratios

- (i) 20% (ii) 50% (iii) 80%.

Which alternative should it choose?

What is the optimum *D/P* ratio?

32 Consider the following information

Table 11.27

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<i>EPS</i> (Rs.)	30	28	25	17	25	18	12	15	0	20

- (i) Criticize the following dividend policies
- A constant *D/P* ratio of 50%;
 - Dividend of Rs. 10 per share, increasing to Rs. 14 if the *EPS* increases beyond Rs. 18 for two consecutive previous years;
 - In addition to a minimum dividend of Rs. 10, each year when the *EPS* exceeds Rs. 18 per share, 50% of the difference between the *EPS* and Rs. 18.
- (ii) Which dividend policy would you recommend?

33 Comment upon the performance of the following firms from the same industry

Table 11.28

Year	ABC Ltd.			XYZ Co.		
	<i>EPS</i> (Rs.)	<i>DPS</i> (Rs.)	Market price (Rs.)	<i>EPS</i> (Rs.)	<i>DPS</i> (Rs.)	Market price (Rs.)
1	6	1.5	35	6	2	35
2	2	0.80	25	2	2	33
3	7	2.80	40	7	2	32

4	6	2.40	35	6	2	33
5	10	4	45	10	3	35

What do you recommend for ABC Ltd.?

- 34 The market price of the shares of a firm is Rs. 20 each. The earnings per share are Rs. 6. If the cost of capital is 10%, and the D/P ratio 60%, what is the rate of return on investing the retained earnings according to Gordon's model?