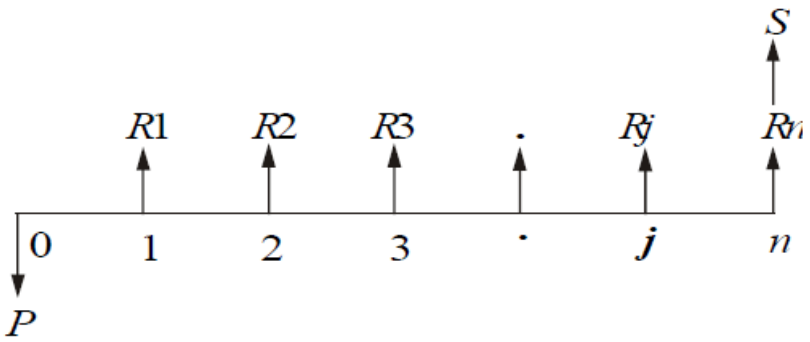
RATE OF RETURN METHOD

INTRODUCTION

The rate of return of a cash flow pattern is the interest rate at which the present worth of that cash flow pattern reduces to zero. In this method of comparison, the rate of return for each alternative is computed. Then the alternative which has the highest rate of return is selected as the best alternative. In this type of analysis, the expenditures are always assigned with a negative sign and the revenues/inflows are assigned with a positive sign. A generalized cash flow diagram to demonstrate the rate of return method of comparison is presented in Fig.

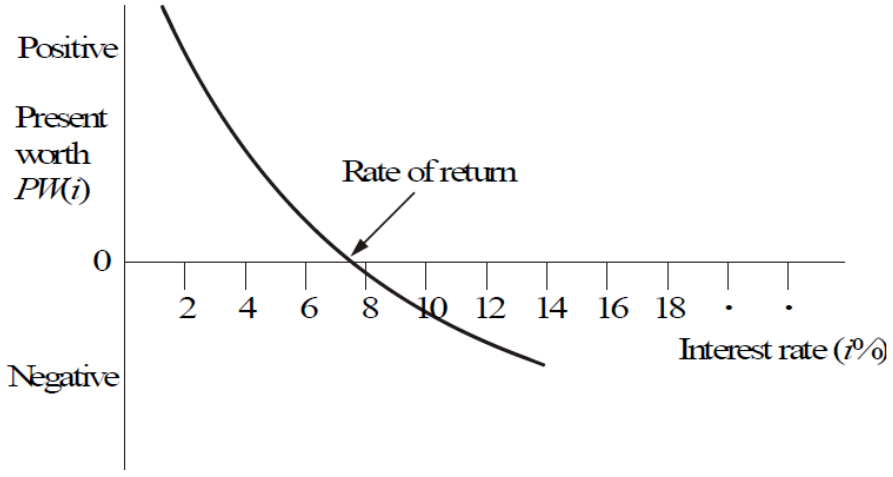


In the above cash flow diagram, P represents an initial investment, Rj the net revenue at the end of the jth year, and S the salvage value at the end of the nth year.

The first step is to find the net present worth of the cash flow diagram using the following expression at a given interest rate, i.

$$PW(i) = -P + R1/(1+i)^1 + R2/(1+i)^2 + \ldots + Rj/(1+i)^j + \ldots + Rn/(1+i)^n + S/(1+i)^n$$

Now, the above function is to be evaluated for different values of i until the present worth function reduces to zero, as shown in Fig.



In the figure, the present worth goes on decreasing when the interest rate is increased. The value of i at which the present worth curve cuts the X-axis is the rate of return of the given proposal/project. It will be very difficult to find the exact value of i at which the present worth function reduces to zero.

So, one has to start with an intuitive value of *i* and check whether the present worth function is positive. If so, increase the value of *i* until *PW*(*i*) becomes negative. Then, the rate of return is determined by interpolation method in the range of values of *i* for which the sign of the present worth function changes from positive to negative.

EXAMPLES

The concept of rate of return calculation is demonstration:

EXAMPLE A person is planning a new business. The initial outlay and cash flow pattern for the new business are as listed below. The expected life of the business is five years. Find the rate of return for the new business.

Period 0 1 2 3 4 5

Cash flow: -1,00,000 30,000 30,000 30,000 30,000 30,000

Solution

Initial investment = Rs. 1,00,000

Annual equal revenue = Rs. 30,000

Life = 5 years

The present worth function for the business is

When *i* = 10%,

PW(10%) = –1,00,000 + 30,000(*P*/*A*, 10%, 5)

= –1,00,000 + 30,000(3.7908) = Rs. 13,724.

When *i* = 15%,

PW(15%) = –1,00,000 + 30,000(*P*/*A*, 15%, 5)

= –1,00,000 + 30,000(3.3522) = Rs. 566.

When *i* = 18%,

PW(18%) = –1,00,000 + 30,000(*P*/*A*, 18%, 5)

= –1,00,000 + 30,000(3.1272) = Rs. – 6,184

i = 15% + [(566 – 0) / 566- (-6184)] * 3%

= 15% + 0.252% = 15.252%

Therefore, the rate of return for the new business is 15.252%.

EXAMPLE: A company is planning to expand its present business activity It has two alternatives for the expansion programme and the corresponding cash flows are tabulated below. Each alternative has a life of five years and a negligible salvage value. The minimum attractive rate of return for the company is 12%. Suggest the best alternative to the company.

Initial investment Yearly revenue

Alternative 1: 5,00,000 1,70,000

Alternative 2: 8,00,000 2,70,000

Solution Alternative 1

Initial outlay = Rs. 5,00,000

Annual revenue = Rs. 1,70,000

Life of alternative 1 = 5 years

The formulae for the net present worth of alternative 1 are as follows:

$PW_1(i)$ = –5,00,000 + 1,70,000(*P*/*A*, *i*, 5)

PW_1(15%) = –5,00,000 + 1,70,000(*P*/*A*, 15%, 5)

= –5,00,000 + 1,70,000(3.3522) = Rs. 69,874

$PW_1(17\%)$ = –5,00,000 + 1,70,000(*P*/*A*, 17%, 5)

= –5,00,000 + 1,70,000(3.1993) = Rs. 43,881

$PW_1(20\%)$ = –5,00,000 + 1,70,000(*P*/*A*, 20%, 5)

= –5,00,000 + 1,70,000(2.9906) = Rs. 8,402

$PW_1(22\%)$ = –5,00,000 + 1,70,000(*P*/*A*, 22%, 5)

= –5,00,000 + 1,70,000(2.8636) = Rs. –13,188

Therefore, the rate of return of alternative 1 is = 20.78%

Alternative 2

Initial outlay = Rs. 8,00,000

Annual revenue = Rs. 2,70,000

Life = 5 years

The cash flow diagram for alternative 2 is depicted in Fig. 7.10.

The formula for the net present worth of alternative 2 is:

$PW_2(i)$ = – 8,00,000 + 2,70,000(*P*/*A*, *i*, 5)

$PW_2(20\%)$ = – 8,00,000 + 2,70,000(*P*/*A*, 20%, 5)

= – 8,00,000 + 2,70,000(2.9906) = Rs. 7,462

$PW_2(22\%)$ = –8,00,000 + 2,70,000 (*P*/*A*, 22%, 5)

= – 8,00,000 + 2,70,000 (2.8636) = Rs. –26,828

Thus, the rate of return of alternative 2 is

i = 20% +

= 20.435%

Since the rate of return of alternative 1 is greater than that of the alternative 2, select alternative 1.

QUESTIONS

1. Consider the following cash flow of a project: *Year* 0 1 2 3 4 5 Cash flow –10,000 4,000 4,500 5,000 5,500 6,000 Find the rate of return of the project.

2. A person invests a sum of Rs. 2,00,000 in a business and receives equal net revenue of Rs. 50,000 for the next 10 years. At the end of the 10th year, the salvage value of the business is Rs. 25,000. Find the rate of return of the business.

3. A company is in the process of selecting the best alternative among the following three mutually exclusive alternatives: *Alternative Initial Annual revenue Life investment* (Rs.) (years)

*A*1 Rs. 5,00,000 1,00,000 10

*A*2 Rs. 8,00,000 1,40,000 10

*A*3 Rs. 3,00,000 70,000 10

Find the best alternative based on the rate of return method of comparison.

4. A shipping firm is considering the purchase of a materials handling system for unloading ships at a dock. The firm has reduced their choice to three different systems, all of which are expected to provide the same unloading speed. The initial costs and the operating costs estimated for each system are now tabulated. *System Initial cost Annual operating expenses*

*S*1 Rs. 6,50,000 Rs. 91,810

*S*2 Rs. 7,80,000 Rs. 52,600

*S*3 Rs. 7,50,000 Rs. 68,417

The life of each system is estimated to be five years and the firm's minimum attractive rate of return is 15%. If the firm must select one of the materials handling systems, which one is the most desirable?

5. A firm has identified three mutually exclusive alternatives. The life of all three alternatives is estimated to be five years. The minimum attractive rate of return is 12%. Find the best alternative based on the rate of return method. *Alternative A*1 *A*2 *A*3

Initial investment (Rs.) 2,00,000 2,80,000 3,60,000

Annual income (Rs.) 52,000 72,000 1,00,000