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Financial Analysis Using Discounting and Non-Discounting Techniques - I

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1. Introduction

In this session we are going to discuss the Accounting rate of return, payback method and the NPV method with their merits and demerits with a special focus on its computation also.

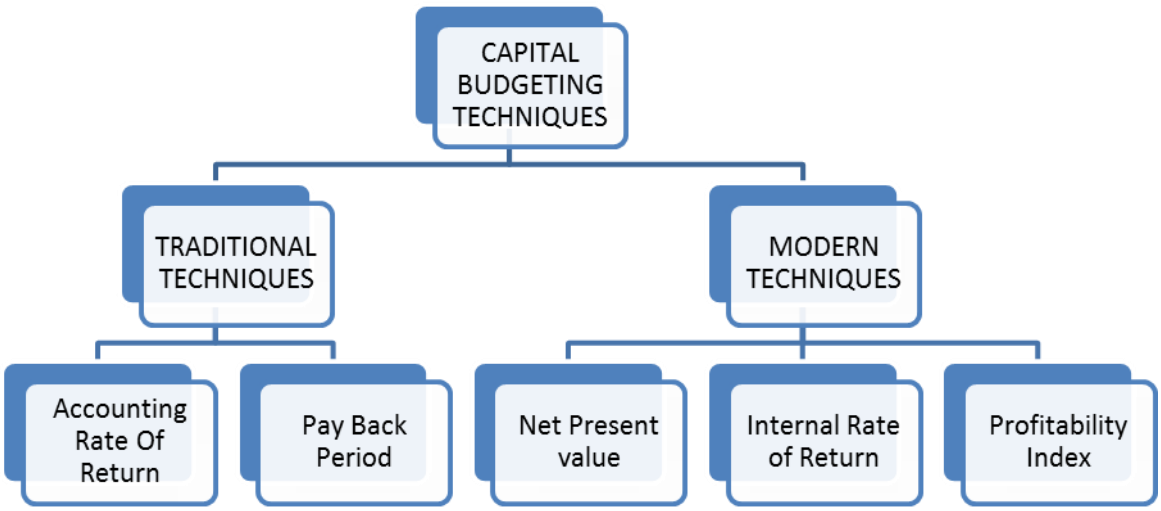
Meaning of Discounting and Non discounting techniques:

Let us first understand the meaning of discounting and non discounting techniques'

In the evaluation of projects, the investment evaluation techniques play a vital role. The selection of the right kind of projects is essential to ensure the wealth maximisation of share holder's. Not only this, since projects are committed for long term it is necessary to make a careful choice.

A wide range of criteria has been suggested to judge the worthiness of various projects or financial decisions.

These evaluation techniques can be divided into two:



Traditional techniques or non discounted techniques

Modern techniques or discounted techniques.

The traditional techniques are further divided into

Pay back period

Accounting rate of return

The discounted cash flow techniques are again sub divided into three

Net present value

Internal rate of return

Profitability Index

Payback period

As the name suggests, this method refers to the period in which the proposal will generate cash to recover the initial investment made. It purely emphasizes on the cash inflows, economic life of the project and the investment made in the project, with no consideration to time value of money. Through this method selection of a proposal is based on the earning capacity of the project. With simple calculations, selection or rejection of the project can be done, with results that will help gauge the risks involved. However, as the method is based on thumb rule, it does not consider the importance of time value of money and so the relevant dimensions of profitability.

Payback period = Cash outlay (investment) / Annual cash inflow

Lets take an example to understand this technique.

	Project A		Project B
Cost	2,00,000		2,00,000
Expected future cash flow			
Year 1	1,00,000		2,00,000

Year 2	1,00,000		5,000
Year 3	1,10,000		5,000
Year 4	None		None
TOTAL	2,10,000		1,10,000
Payback	2 years		1 year

Payback period of project B is shorter than A

Assume that a project requires an outlay of Rs 5000000 and yields annual cash inflow of Rs 1250000 for seven years. What would be the payback period?

Using the formula

$$PB = \frac{\text{Outlay}}{\text{Cash Inflow}}$$

= 4 years.

Unequal cash flows: In case of unequal cash inflows, the payback period can be found out by adding up the cash inflows until the total is equal to the initial cash outlay.

Suppose a project requires a cash outlay of Rs 2000000 and generates cash inflows of Rs 800000, Rs 700000, Rs 400000, and Rs 300000 during the next 4 years. What is the projects payback

When we add up the cash inflows, we find that in the first three years, Rs 1900000 of the original outlay is recovered. In the fourth year cash inflow generated is Rs 300000 and only Rs 100000 of the original outlay remains to be recovered. Assuming that the cash inflows occur evenly during the year, the time

required to recover Rs 100000 will be (Rs 100000/Rs 300000)*12 months= 4 months. Thus the pay back period is 3 years and 4 months.

Acceptance Rule:

Various firms use this technique of evaluating projects. The projects payback is compared with standard payback. The project would be accepted if it's payback is less than the standard payback. This technique gives highest ranking to the projects with lower PB and lowest ranking to the projects with high paybacks.

This method has certain virtues

Simplicity: This method is simple to understand and easy to calculate.

Cost effective: Requires less time and easy analysing which makes it cost effective.

Short term effects: A company can have more favourable short run effects on earnings per share by setting up a shorter standard payback period.

Risk shields: The risk of the project can be tackled by having a shorter standard payback period as it may ensure guarantee against loss.

Liquidity: The emphasis in payback is on the early recovery of the investment. Thus it gives an insight into the liquidity of the project.

In spite of these virtues, there are certain serious limitations

1. Cash flow after payback: payback does not take into account the cash inflows earned after the payback period.

Cash flows for the whole life of the project are not considered. Payback is the method which fails to measure the profitability of an investment project as it does not consider all the cash inflows of the project after the payback period.

2. Cash flow patterns: pay back fails to consider the pattern of cash inflows that is magnitude and timing of cash inflows. In other words, it gives equal weights to returns of equal amounts even they occur in different time periods.
3. Inconsistent with the shareholder value: payback is not consistent with the objective of maximising the market value of the firm's shares.

2. Discounted Payback Period

In a capital budgeting technique, the project should be evaluated on the basis of overall profitability of a project. In contrast to an NPV analysis, which provides the overall value of a project, a discounted payback period gives the number of years it takes to break even from undertaking the initial expenditure. The payback period only measure how long it take for the initial cash outflow to be paid back, ignoring the time value of money.

Projects that have a negative net present value will not have a discounted payback period, because the initial outlay will never be fully repaid. This is in contrast to a payback period where the gross inflow of future cash flows could be greater than the initial outflow, but when the inflows are discounted, the NPV is negative.

The discounted payback period is the amount of time that it takes to cover the cost of a project, by adding

positive discounted cash flow coming from the profits of the project. The advantage of using the discounted payback period over the payback period is that it takes into account time value of money.

When using the discounted payback period for decision making, a firm must first determine a discount rate at which to discount the future cash flow values of a specified period of time. The discounted payback period should be in terms of years. If the discounted payback period is less than the predetermined period of time then the decision rule is to accept the project. On the other hand, if the discounted payback period is greater than the predetermined period then the decision rule would be to reject the project.

Definition:

Discounted payback period is used to evaluate the time period needed for a project to bring in enough profits to recoup the initial investment.

Discounted Payback Period (DPP)

Mr. A is considering investing in a business.

The business will cost RS10, 00,000 to set up and is expected to generate the following yearly net cash flows:

Years	
1	(2,00,000)
2	3,00,000
3	3,50,000
4	4,00,000

5 15,00,000

The cost of capital is 10%.

Calculate the discounted payback period and comment on your answer.

Solution

Solution

Year	Cash Flows	Discount Factor @ 10%	Present Value of Cash Flows	Cumulative Present Value of Cash Flows
	Rs		Rs	Rs
1	2,00,000	0.909	-1,81,800	-1,81,800
2	3,00,000	0.825	2,47,500	65,700
3	3,50,000	0.751	2,62,850	3,28,550
4	4,00,000	0.683	2,73,200	6,01,750
5	15,00,000	0.621	9,31,500	15,33,250

Discounted Payback Period:

$$= (A - 1) + \frac{\text{Cost - Cumulative Present Value of Cash Flow}^{(A-1)}}{\text{Present Value of Cash Flow}^{A}}$$

$$= 4 + \frac{10,00,000 - 6,01,750}{9,31,500}$$

= **4.27 years** or 4 years and 99* days

* 0.27 x 365 = 99days

3. Accounting rate of return method (ARR)

This method helps to overcome the disadvantages of the payback period method. The rate of return is expressed as a percentage of the earnings of the investment in a particular project. It works on the criteria that any project having ARR higher than the minimum rate established by the management will be considered and those below the predetermined rate are rejected.

This method takes into account the entire economic life of a project providing a better means of comparison. It also ensures compensation of expected profitability of projects through the concept of net earnings. However, this method also ignores time value of money and doesn't consider the length of life of the projects. Also it is not consistent with the firm's objective of maximizing the market value of shares.

Example 1: An initial investment of Rs13,00,000 is expected to generate annual cash inflow of Rs 3,20,000 for 6 years. Depreciation is allowed on the straight line basis. It is estimated that the project will generate scrap value of Rs1,05,000 at end of the 6th year. Calculate its accounting rate of return assuming that there are no other expenses on the project.

Solution

Annual Depreciation = (Initial Investment – Scrap Value) ÷ Useful Life in Years

Annual Depreciation = (RS 13,00,000 – Rs 1,05,000) ÷ 6 = Rs

199167

Average Accounting Income = Rs3,20,000 – Rs 1,99,170 = Rs 1,20,830

Accounting Rate of Return= Average Income/ Investment

Accounting Rate of Return = 120830 ÷ 1300000 =9.3%

Example 2: Compare the following two mutually exclusive projects on the basis of ARR. Cash flows and salvage values are in thousands of Rupees. Use the straight line depreciation method.

Project A:

Year	0	1	2	3
Cash Outflow	-22000			
Cash Inflow		9,100	13,000	10,500
Salvage Value				1,000

Project B:

Year	0	1	2	3
Cash Outflow	-19,800			
Cash Inflow		8,700	11,000	8,400
Salvage Value				1,800

Solution

Project A:

Step 1: Annual Depreciation = (22,000 – 1,000) / 3 = 7,000

Step 2:

Year	1	2	3
Cash Inflow	9,100	13,000	10,500
Salvage Value			1,000

Depreciation* -7,000 -7,000 -7,000

Accounting Income 2,100 6,000 3,500

Step 3: Average Accounting Income = (2,100 + 6,000 + 3,500) / 3

= 3,867

Step 4: Accounting Rate of Return = 3,867 / 22,000 = 17.57%

Project B:

Step 1: Annual Depreciation = (19,800 − 1,800) / 3 = 6,000

Step 2: Year 1 2 3

Cash Inflow 8,700 11,000 8,400

Salvage Value 1,800

Depreciation* -6,000 -6,000 -6,000

Accounting Income 2,700 5,000 2,400

Step 3: Average Accounting Income = (2,700 + 5,000 + 24,003) / 3

= 3,366.66

Step 4: Accounting Rate of Return = 3,366.66 / 19,800=17.00%

Since the ARR of the project A is higher, it is more favourable than the project B.

Advantages and Disadvantages

Advantages

1. Like payback period, this method of investment appraisal is easy to calculate.
2. It recognizes the profitability aspect of investment.

Disadvantages

1. It ignores time value of money. Suppose, if we use ARR to compare two projects having equal initial investments. The project which has higher annual income in the latter years of its useful life may rank higher than the one having higher annual income in the beginning years, even if the present value of the income generated by the latter project is higher.
2. It can be calculated in different ways. Thus there is problem of consistency.
3. It uses accounting income rather than cash flow information. Thus it is not suitable for projects which having high maintenance costs because their viability also depends upon timely cash inflows.

4. Discounted cash flow method

The discounted cash flow technique calculates the cash inflow and outflow through the life of an asset. These are then discounted through a discounting factor. The discounted cash inflows and outflows are then compared. This technique takes into account the interest factor and the return after the payback period.

- Net present Value (NPV) Method

This is one of the widely used methods for evaluating capital investment proposals. In this technique the cash inflow that is expected at different periods of time is discounted at a particular rate. The present values of the cash inflow are compared to the original investment. If the difference between them is positive (+) then it is accepted or otherwise rejected. This method considers the time value of money and is consistent with the

objective of maximizing wealth for shareholders. The operational criterion for wealth maximization is increase in share price.

It should be noted that the cost of capital, K, is assumed to be known, otherwise the net present, value cannot be known.

NPV = PVB – PVC

where,

PVB = Present value of benefits

PVC = Present value of Costs

Net present value (NPV) of a project is the potential change in an investor's wealth caused by that project while time value of money is being accounted for. It equals the present value of net cash inflows generated by a project less the initial investment on the project. It is one of the most reliable measures used in capital budgeting because it accounts for time value of money by using discounted cash flows in the calculation.

Net present value calculations take the following two inputs:

- Projected net cash flows in successive periods from the project.
- A target rate of return i.e. the hurdle rate.

Where,

Net cash flow equals total cash inflow during a period, including salvage value if any, less cash outflows from the project during the period.

Hurdle rate is the rate used to discount the net cash inflows. Weighted average cost of capital (WACC)is the most commonly used hurdle rate.

The net cash flows may be even (i.e. equal cash flows in different periods) or uneven (i.e. different cash flows in different periods). When they are even, present value can be easily calculated by using the formula for present value of annuity. However, if they are uneven, we need to calculate the present value of each individual net cash inflow separately.

Once we have the total present value of all project cash flows, we subtract the initial investment on the project from the total present value of inflows to arrive at net present value.

Thus we have the following two formulas for the calculation of NPV:

When cash inflows are even:

$$NPV = R \times \frac{1 - (1 + i)^n}{i} - \text{Initial Investment}$$

In the formula,
R is the net cash inflow expected to be received in each period;
i is the required rate of return per period;
n are the number of periods during which the project is expected to operate and generate cash inflows.

When cash inflows are uneven:

$$NPV = \left[\frac{R_1}{(1+i)^1} + \frac{R_2}{(1 + i)^2} + \frac{R_3}{(1 + i)^3} + \ldots \right] - \text{Initial Investment}$$

Where,
i is the target rate of return per period;

R_1 is the net cash inflow during the first period; R_2 is the net cash inflow during the second period; R_3 is the net cash inflow during the third period, and so on ...

Decision Rule

In case of standalone projects, accept a project only if its NPV is positive, reject it if its NPV is negative and stay indifferent between accepting or rejecting if NPV is zero.

In case of mutually exclusive projects (i.e. competing projects), accept the project with higher NPV.

Lets understand with Examples

Example 1: Even Cash Inflows: Swati ltd is evaluating the purchase of a new machine costing Rs 20,00,000. The machine would be depreciated on a straight line basis over 6 years with Rs 2,00,000 as salvage value. The Machine is expected to increase sales by Rs 12,00,000 and operations costs (not including Depreciation) by Rs 4,00,000 annually. The firm's tax rate is 35% and it uses a 10% discount rate. Calculate NPV of the decision to purchase the machine.

Solution:

First we will calculate the depreciation

$$\frac{2000000-200000}{6}$$

=Rs 300000 every year.

Now, Calculation of Annual CFAT	
Sales	12,00,000

Less Cost	4,00,000
Depreciation	3,00,000
Profit before Tax	5,00,000
Less tax	1,75,000
Profit After Tax	3,25,000
Add Depreciation	3,00,000
Cash Flow After Tax (CFAT)	6,25,000

In the last step, we would calculate the present value of annuity of Rs 6,25,000 for 1-6 years

= 6,25,000X4.355=27,21,875

Present value of Salvage at the end of sixth year

= 200000X .564=112800

Present Value of Total inflow= 2721875+112800=2834675

Decision Making: Since the present value of cash inflows is greater than the initial investment, Project has positive NPV and hence, the project should be accepted.

Uneven Cash Inflows:

An initial investment of Rs 83200 on plant and machinery is expected to generate cash inflows of Rs 34110, Rs 40700, Rs58240 and Rs 20650 at the end of first, second, third and fourth year respectively. At the end of the fourth year, the machinery will be sold for Rs9000. Calculate the net present value of the investment if the discount rate is 18%.

Solution

PV Factors:

Year 1 = 1 ÷ (1 + 18%)^1 ≈ 0.8475

Year 2 = 1 ÷ (1 + 18%)^2 ≈ 0.7182

Year 3 = 1 ÷ (1 + 18%)^3 ≈ 0.6086

Year 4 = 1 ÷ (1 + 18%)^4 ≈ 0.5158

Year	1	2	3	4
Net Cash Inflow	Rs34110	Rs40700	Rs58240	Rs20650
Salvage Value				9000
Total Cash Inflow	Rs34110	Rs40700	Rs58240	Rs29650
× Present Value Factor	0.8475	0.7182	0.6086	0.5158
Present Value of Cash Flows	Rs28,908.225	Rs29,230.74	Rs35,444.864	Rs15,293.47
Total PV of Cash Inflows	Rs1,08,877.299			
− Initial	−			

Investment	83,200			
Net Present Value	Rs25,67 7.299			

Net present value accounts for time value of money and this makes it a more sound and strong approach than other investment appraisal techniques which do not discount future cash flows such as payback period and accounting rate of return.

Net present value is even better than some other discounted cash flows techniques such as IRR. In situations where IRR and NPV give conflicting decisions, NPV decision should be preferred.

Weaknesses

It is sensitive to changes in estimates for future cash flows, salvage value and the cost of capital.

Net present value does not take into account the size of the project. For example, say Project A requires initial investment of Rs 40 million to generate NPV of Rs10 million while a competing Project B requires Rs 20 million investment to generate an NPV of 8 million. If we base our decision on NPV alone, we will prefer Project A because it has higher NPV, but Project B has generated more shareholders' wealth per Rupee of initial investment (Rs 8 million/ Rs20 million vs Rs10 million/ Rs40 million).

5. Summary

Capital budgeting decisions are very important decisions as they are not easily reversible and involves huge expenditure. The techniques which are employed to evaluate them are categorized into discounting techniques and non discounting

techniques. The traditional techniques have certain limitations such as ignoring time value of money, ignores quality of benefits and not considering the benefits of the total project duration and so on. These drawbacks are overcome by NPV method and which is adjudged to be the best in capital budgeting evaluation.