

- **Discounted Cash Flow (DCF) Technique** NPV, IRR and PI are the discounted cash flow (DCF) criteria for appraising the worth of an investment project.
- **Net Present Value (NPV)** method is a process of calculating the present value of the project's cash flows, using the opportunity cost of capital as the discount rate, and finding out the net present value by subtracting the initial investment from the present value of cash flows.

Under the NPV method, the investment project is accepted if its net present value is positive ($NPV > 0$). The market value of the firm's share is expected to increase by the project's positive NPV. Between the mutually exclusive projects, the one with the highest NPV will be chosen.

NPV methods account for the time value of money and are generally consistent with the wealth maximisation objective.

- **Internal Rate of Return (IRR)** is that discount rate at which the project's net present value is zero. Under the IRR rule, the project will be accepted when its internal rate of return is higher than the opportunity cost of capital ($IRR > k$).

IRR methods account for the time value of money and are generally consistent with the wealth maximisation objective.

- **NPV and IRR** NPV and IRR give same accept-reject results in case of conventional independent projects. Under a number of situations, the IRR rule can give a misleading signal for mutually exclusive projects. The IRR rule also yields multiple rates of return for non-conventional projects and fails to work under varying cost of capital conditions. Since the IRR violates the value-additivity principle; since it may fail to maximise wealth under certain conditions; and since it is cumbersome, the use of the NPV rule is recommended.
- **Profitability index (PI)** is the ratio of the present value of cash inflows to initial cash outlay. It is a variation of the NPV rule. PI specifies that the project should be accepted when it has a profitability index greater than one ($PI > 1.0$) since this implies a positive NPV.
- **NPV and PI** A conflict of ranking can arise between the NPV and PI rules in case of mutually exclusive projects. Under such a situation, the NPV rule should be preferred since it is consistent with the wealth maximisation principle.

- **Payback** is the number of years required to recoup the initial cash outlay of an investment project. The project would be accepted if its payback is less than the standard payback. The greatest limitations of this method are that it does not consider the time value of money, and does not consider cash flows after the payback period.
- **Discounted Payback** considers the time value of money, but like the simple payback it also ignores cash flows after the payback period. Under the conditions of constant cash flows and a long life of the project, the reciprocal of payback can be a good approximation of the project's rate of return.
- **Accounting Rate of Return** is found out by dividing the average profit after-tax by the average amount of investment. A project is accepted if its ARR is greater than a cut off rate (arbitrarily selected). This method is based on accounting flows rather than cash flows; therefore, it does not account for the time value of money. Like PB, it is also not consistent with the objective of the shareholders' wealth maximisation.
- Following table provides a summary of the features of various investment criteria.

SUMMARY OF INVESTMENT CRITERIA

I. Discounted Cash Flow Methods

1. *Net present value (NPV)*: The difference between PV of cash flows and PV of cash outflows is equal to NPV; the firm's opportunity cost of capital being the discount rate.

$$\text{NPV} = \left[\frac{C_1}{(1+k)} + \frac{C_2}{(1+k)^2} + \frac{C_3}{(1+k)^3} + \dots + \frac{C_n}{(1+k)^n} \right] - C_0$$

$$\text{NPV} = \sum_{t=1}^n \frac{C_t}{(1+k)^t} - C_0$$

Acceptance rule

- Accept if $\text{NPV} > 0$ (i.e., NPV is positive)
- Reject if $\text{NPV} < 0$ (i.e., NPV is negative)
- Project may be accepted if $\text{NPV} = 0$

Merits

- Considers all cash flows.
- True measure of profitability.
- Based on the concept of the time value of money.
- Satisfies the value-additivity principle (i.e., NPV's of two or more projects can be added).
- Consistent with the share-holders' wealth maximisation (SWM) principle.

Demerits

- Requires estimates of cash flows which is a tedious task.
- Requires computation of the opportunity cost of capital which poses practical difficulties.
- Sensitive to discount rates.

2. *Internal rate of return (IRR)*: The discount rate which equates the present value of an investment's cash inflows and outflows is its internal rate of return.

$$\left[\frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots + \frac{C_n}{(1+r)^n} \right] = C_0$$

$$NPV = \sum_{t=1}^n \frac{C_t}{(1+r)^t} - C_0 = 0$$

Acceptance rule

- Accept if $IRR > k$
- Reject if $IRR < k$
- Project may be accepted if $IRR = k$

Merits

- Considers all cash flows.
- True measure of profitability.
- Based on the concept of the time value of money.
- Generally, consistent with wealth maximisation principle.

Demerits

- Requires estimates of cash flows which is a tedious task.
- Does not hold the value-additivity principle (i.e., IRRs of two or more projects do not add)
- At times fails to indicate correct choice between mutually exclusive projects.
- At times yields multiple rates.
- Relatively difficult to compute.

3. *Profitability index (PI)*: The ratio of the present value of the cash flows to the initial outlay is profitability index or benefit-cost ratio:

$$PI = \frac{PV \text{ of Annual Cash Flows}}{\text{Initial investment}}$$

$$PI = \frac{\sum_{t=1}^n \frac{C_t}{(1+k)^t}}{C_0}$$

Acceptance rule

- Accept if $PI > 1.0$
- Reject if $PI < 1.0$
- Project may be accepted if $PI = 1.0$

Merits

- Considers all cash flows.
- Recognises the time value of money.
- Relative measure of profitability.
- Generally consistent with the wealth maximisation principle.

Demerits

- Requires estimates of the cash flows which is a tedious task.
- At times fails to indicate correct choice between mutually exclusive projects.

II. Non-Discounted Cash Flow Criteria

4. *Payback (PB)*: The number of years required to recover the initial outlay of the investment is called payback.

$$PB = \frac{\text{Initial Investment}}{\text{Annual cash flow}} = \frac{C_0}{C}$$

Acceptance rule

- Accept if $PB < \text{standard payback}$
- Reject if $PB > \text{standard payback}$

Merits

- Easy to understand and compute and inexpensive to use.
- Emphasises liquidity.
- Easy and crude way to cope with risk.
- Uses cash flows information.

Demerits

- Ignores the time value of money.
- Ignores cash flows occurring after the payback period.
- Not a measure of profitability.
- No objective way to determine the standard payback.
- No relation with the wealth maximisation principle.

5. *Discount payback*: The number of years required in recovering the cash outlay on the present value basis is the discounted payable period. Except using discounted cash flows in calculating payback, this method has all the demerits of payback method.
6. *Accounting rate of return (ARR)*: An average rate of return found by dividing the average net operating profit [EBIT (1 – T)] by the average investment.

$$ARR = \frac{\text{Average net operating profit after tax}}{\text{Average investment}}$$

Acceptance rule

- Accept if $ARR > \text{minimum rate}$
- Reject if $ARR < \text{minimum rate}$

Merits

- Uses accounting data with which executives are familiar.
- Easy to understand and calculate.
- Gives more weightage to future receipts.

Demerits

- Ignores the time value of money
- Does not use cash flows.
- No objective way to determine the minimum acceptable rate of return.

Net present value (NPV) method is the most superior investment criterion as it is always consistent with the wealth maximisation principle.