Net Present Value

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Net Present Value (NPV)

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1. Introduction

Net Present Value (NPV) is a core concept in finance used to evaluate the profitability of investments and projects. NPV compares the value of money received in the future to money invested today by discounting future cash flows back to their present value.

2. Definition of Net Present Value

Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. A positive NPV indicates that a project is expected to generate value above the required return.

3. Formula and Explanation

The general formula for NPV is:

$$NPV = \left(\Sigma_{t=1..n} R_t / (1 + r)^t\right) - C_0$$

Where:
- R_t = Net cash inflow at time t
- r = Discount rate (cost of capital)
- C_0 = Initial investment
- n = Number of periods (years)

Interpretation:
- NPV > 0 : Accept the project (value created)
- NPV < 0 : Reject the project (value destroyed)
- NPV = 0 : Break-even

4. Importance of NPV

NPV is widely used because it accounts for the time value of money and provides a direct measure of the expected value added by a project in currency units. It helps compare projects of different sizes and durations when the discount rate reflects their risk.

5. Steps to Calculate NPV

- Estimate the initial investment (C0).
- Forecast future net cash inflows for each period.
- Choose an appropriate discount rate (r).

- Discount each future cash inflow to present value: R_t / (1+r)^t.
- Sum the discounted inflows and subtract the initial investment.

6. Real-Life Example 1: Business Investment (Machinery)

A manufacturing firm is considering buying a new machine that costs ₹500,000. The machine is expected to produce the following net cash inflows over 3 years:

Year Cash Inflow (₹)

1 ₹200,000.00 2 ₹250,000.00 3

₹300,000.00

Assumed discount rate (r): 10% per year.

Present value calculations:

Year	Cash Inflow (₹)	Discount Factor (1+r)^t	Present Value (₹)
1	₹200,000.00	1.100000	₹181,818.18
2	₹250,000.00	1.210000	₹206,611.57

3	₹300,000.00	1.331000	₹225,394.44

Initial Investment: ₹500,000.00

Total Present Value of inflows: ₹613,824.19

NPV = Total PV of inflows - Initial Investment = ₹613,824.19 - ₹500,000.00 = ₹113,824.19

Since NPV > 0, the firm should accept the investment. The project is expected to add value.

7. Real-Life Example 2: Bond Investment

Suppose an investor considers buying a bond priced at ₹1,000 that pays ₹200 annually for 6 years. The investor's required return is 12%.

Cash flows and present values:

Year	Coupon (₹)	Discount Factor (1+r)^t	Present Value (₹)
1	₹200.00	1.120000	₹178.57
2	₹200.00	1.254400	₹159.44
3	₹200.00	1.404928	₹142.36
4	₹200.00	1.573519	₹127.10

5	₹200.00	1.762342	₹113.49
6	₹200.00	1.973823	₹101.33

Price paid: ₹1,000.00

Total PV of coupons: ₹822.28

NPV = Total PV of coupons - Price = ₹822.28 - ₹1,000.00 = ₹-177.72

Decision: Negative NPV — the bond does not meet the required return.

8. Real-Life Example 3: Infrastructure Project (Toll Road)

A government project for a toll road requires an initial investment of ₹10,00,00,000 (₹10 Crores). Expected annual toll revenue is ₹1,80,00,000 (₹1.8 Crores) for 8 years. Use discount rate 8%.

Year	Toll Revenue (₹)	Discount Factor (1+r)^t	Present Value (₹)
1	₹18,000,000.00	1.080000	₹16,666,666.67
2	₹18,000,000.00	1.166400	₹15,432,098.77
3	₹18,000,000.00	1.259712	₹14,288,980.34

4	₹18,000,000.00	1.360489	₹13,230,537.35
5	₹18,000,000.00	1.469328	₹12,250,497.55
6	₹18,000,000.00	1.586874	₹11,343,053.28
7	₹18,000,000.00	1.713824	₹10,502,827.11
8	₹18,000,000.00	1.850930	₹9,724,839.92

Initial Investment: ₹100,000,000.00

Total PV of inflows: ₹103,439,500.99

NPV = Total PV of inflows - Initial Investment = ₹103,439,500.99 - ₹100,000,000.00 = ₹3,439,500.99

Decision: Positive NPV — the toll road project appears economically viable.

9. Advantages and Limitations

Advantages:

- Considers time value of money.
- Provides a direct measure of expected value added.
- Useful for comparing projects with different cash flows and durations.

Limitations:

- Sensitive to discount rate selection; small changes in r can flip decisions.
- Requires accurate cash flow forecasts which are often uncertain.
- Comparing mutually exclusive projects of different sizes may need additional metrics (e.g., IRR, PI).
- Does not account for non-financial factors (social impact, environmental issues) unless monetised.

10. Applications of NPV

- Capital budgeting in corporations (machinery, factories).
- Real estate investment decisions.
- Public sector infrastructure and policy evaluation.
- Valuation of bonds and fixed income instruments.
- Startup and venture capital valuations where cash flows can be estimated.

11. Conclusion

NPV is a practical and widely used tool for financial decision-making. It quantifies expected value creation in absolute currency terms and helps investors and managers choose projects that increase shareholder value. Always

complement NPV with sensitivity analysis (vary discount rate and cash flows) and consider non-financial factors.

12. Appendix — Calculation Details

Summary of computed numeric results used above:

Item	Value (₹)
Machinery: Total PV of inflows	₹613,824.19
Machinery: NPV	₹113,824.19
Bond: Total PV of coupons	₹822.28
Bond: NPV	₹-177.72
Toll Road: Total PV of inflows	₹103,439,500.99
Toll Road: NPV	₹3,439,500.99

Notes: Currency values are shown in Indian Rupees (₹). All calculations rounded to two decimals where displayed.