NPV, IRR, and Discounted payback period

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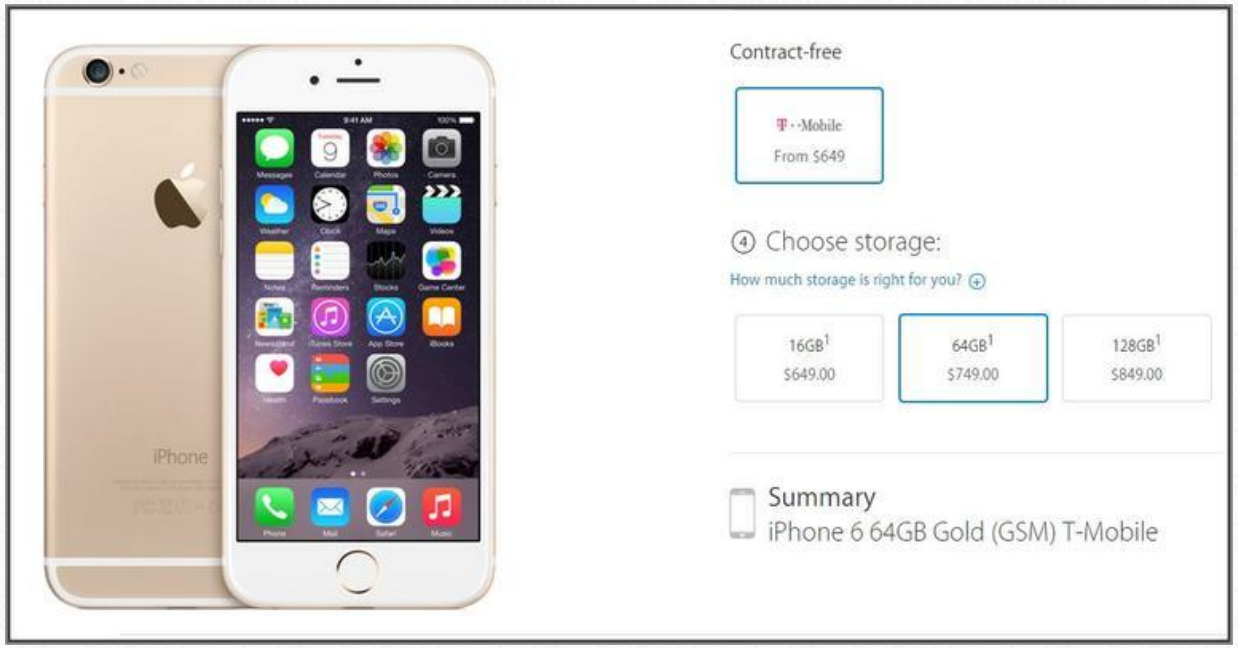
(Rex)

IPhone 6 and NPV



Net Present Value (NPV)

Net present value (NPV) is a sophisticated capital budgeting technique; found by subtracting a project's initial investment from the present value of its cash inflows discounted at a rate equal to the firm's cost of capital.

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1 + r)^t} - CF_0$$

NPV = Present value of cash inflows – Initial investment

Net Present Value (NPV)

Decision criteria:

- If the NPV is *greater than* $0, *accept* the project.
- If the NPV is *less than* $0, *reject* the project.

If the NPV is greater than $0, the firm will earn a return greater than its cost of capital. Such action should increase the market value of the firm, and therefore the wealth of its owners by an amount equal to the NPV.

Net Present Value (NPV): NPV and the Profitability Index

For a project that has an initial cash outflow followed by cash inflows, the profitability index (PI) is simply equal to the present value of cash inflows divided by the initial cash outflow:

$$\text{PI} = \frac{\sum_{t=1}^{n} \frac{CF_t}{(1 + r)^t}}{CF_0}$$

When companies evaluate investment opportunities using the PI, the decision rule they follow is to invest in the project when the index is greater than 1.0.

Internal Rate of Return (IRR)

The **Internal Rate of Return (IRR)** is a sophisticated capital budgeting technique; it is the rate of return that the firm will earn if it invests in the project and receives the given cash inflows.

$$\$0 = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t} - CF_0$$

$$\sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t} = CF_0$$

Internal Rate of Return (IRR)

Decision criteria:

- If the IRR is *greater than* the cost of capital, *accept* the project.
- If the IRR is *less than* the cost of capital, *reject* the project.

These criteria guarantee that the firm will earn at least its required return. Such an outcome should increase the market value of the firm and, therefore, the wealth of its owners.

Discounted Payback Period

- A discounted payback period gives the number of years it takes to break even from undertaking the initial expenditure.

$$\text{Discounted Cash Inflow} = \frac{\text{Actual Cash Inflow}}{(1+i)^n}$$

$$\text{Discounted Payback Period} = A + \frac{B}{C}$$

Where,
A = Last period with a negative discounted cumulative cash flow;

B = Absolute value of discounted cumulative cash flow at the end of the period A;

C = Discounted cash flow during the period after A.

Discounted Payback Period

Example

An initial investment of $2,324,000 is expected to generate $600,000 per year for 6 years. Calculate the discounted payback period of the investment if the discount rate is 11%.

Solution

Step 1: Prepare a table to calculate discounted cash flow of each period by multiplying the actual cash flows by present value factor. Create a cumulative discounted cash flow column.

Year n	Cash Flow CF	Present Value Factor $PV\$1 = 1/(1+i)^n$	Discounted Cash Flow CF×PV$1	Cumulative Discounted Cash Flow
0	$ −2,324,000	1.0000	$ −2,324,000	$ −2,324,000
1	600,000	0.9009	540,541	− 1,783,459
2	600,000	0.8116	486,973	− 1,296,486
3	600,000	0.7312	438,715	− 857,771
4	600,000	0.6587	395,239	− 462,533
5	600,000	0.5935	356,071	− 106,462
6	600,000	0.5346	320,785	214,323

Step 2: Discounted Payback Period = 5 + |-106,462| / 320,785 ≈ 5.32 years