

Decision Criteria¹
QuickSheet²

Decision Criteria are those elements to be considered when seeking to choose from a selection of potential investment projects and generally include the following:

- **Net Present Value (NPV)**
- **Present Value (PV)**
- **Internal Rate of Return (IRR)**
- **Modified Internal Rate of Return (MIRR)**
- **Profit Index**
- **Payback Period**
- **Discounted Payback Period**

$NPV = \sum \frac{Cash\ Flows_i}{(1+r)^t} - \sum \frac{Costs_i}{(1+r)^t}$	<p>The Net Present Value (NPV) of a project or transaction is the present value of the expected future cash flows, discounted for rate and time, less the present value of the costs or investment required to acquire the investment. We most often compare the NPV to 0 when we're considering NPV as one of the Decision Criteria. If a project has an NPV = 0, then the project's internal rate of return (IRR) is equal to the discount rate (expected rate of return) used in the estimation. If the NPV is greater than 0, the IRR is greater than the discount rate, and if the NPV is less than 0 the IRR is less than the discount rate. It's important to note that when the NPV is 0, the investors have earned a return equal to the discount – the rate they expected to earn. It does not mean they have not earned a return.</p>
$PV = \sum \frac{Cash\ Flows_i}{(1+r)^t}$	<p>The Present Value (PV) of a project or transaction is the present value of the expected future cash flows, discounted for rate and time. It is the value of the project or investment or the price that must be paid to acquire the investment. If an investor does not have the ability to come up with the required amount, PV becomes one of the Decision Criteria.</p>
<p>IRR – there is no single equation for IRR</p>	<p>The Internal Rate or Return (IRR) is the actual return an investor may expect to receive given a set of expected future cash flows and costs based on the assumption that excess cash flows. It is calculated via an iterative process resulting in a rate and includes the effect of reinvesting excess cash flows at the calculated rate. Even though an investor may have a</p>

¹ The Decision Criteria QuickSheet is intended to present an abbreviated presentation of the included concepts in corporate finance and is not intended to be a full or complete representation of the concepts, models, metrics or the underlying foundations from which they are built.

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	<p>stated discount rate (opportunity cost of capital, they may also have a required IRR that may or may not be the same as the discount rate. Used in this manner, IRR becomes one of the Decision Criteria.</p>
$\text{MIRR} = \sqrt[n]{\frac{\text{Future Value of Future Cash Flows}}{\text{Present Value of Costs}}} - 1$	<p>The Modified Internal Rate of Return (MIRR) is the expected return an investor may expect to receive given a set of expected future cash flows and costs based on the assumption that excess cash flows are reinvested at the investor's discount rate. It is useful as one of the Decision Criteria in the same way IRR is useful.</p>
$\text{Profit Index} = \frac{\text{Present Value of Future Cash Flows}}{\text{Present Value of Costs}}$	<p>The Profit Index is a ratio of the present value of an asset's expected future cash flows compared to the present value of the costs one might be required to pay to acquire it, or acquire a stake in it. When considered as one of the Decision Criteria the value of this index is often compared to 1, or the index at which the present value of the future cash flows is equal to the present value of the expected costs. An index of greater than one infers an NPV greater than 0; an index of less than 1 suggests and NPV less than 0, and an index value equal to 1 infers and NPV equal to 0.</p>
$\text{Payback Period} = \frac{\sum \text{Costs}}{\frac{\sum \text{Future Cash Flows}}{\# \text{ Periods}}}$	<p>The Payback Period is the number of periods required for an investor to recoup their cost for an investment or project given the nominal value of its estimated future cash flows. The equation shown gives the average Payback period, but a more rigorous assessment may reveal a somewhat different outcome when specific periodic cash flows are taken into consideration. Payback Period is useful as one of the Decision Criteria as an investor may require they receive a return of their investment within a certain time frame.</p>
$\text{Discounted Payback Period} = \frac{\sum \text{Costs}}{\frac{\sum \text{Discounted Future Cash Flows}}{\# \text{ Periods}}}$	<p>The Discounted Payback Period is the number of periods required for an investor to recoup their cost for an investment or project given the present value of its estimated future cash flows (discounted cash flows). The equation shown gives the average Discounted Payback Period, but a more rigorous assessment may reveal a somewhat different outcome when specific periodic cash flows are taken into consideration. Discounted Payback Period is useful as one of the Decision Criteria as an investor may require they receive a return of their investment within a certain time frame.</p>

Decision Criteria

Each of the **Decision Criteria** are helpful for investors and managers to objectively make a decision in the face of sometimes disparate costs, cash flows, and discount rates represented by multiple projects or investment options. Here's an example. Suppose you have to consider between three different projects in which your firm may choose to invest: Project 1) put in place a new production line at a cost of \$750,000 with expected future

cash flows of \$65,000 annually; Project 2) invest in a sales and marketing campaign at a cost of \$800,000 projected to increase total revenues by 7%, or Project 3) purchase a new work flow and operations management software suite at a cost of \$600,000 that promises to decrease costs by 2%. Given enough additional information we can identify the change in the firm’s cash flows in each case. We can also assign a reasonable discount rate for each project reflective of the firm’s cost of capital and possibly make some adjustment based on the likelihood the expected cash flows will materialize. With these data we can then calculate the PV, NPV, IRR, Profit Index, Payback Period and Discounted Payback Period for each project and then use these instruments to help us make our investment decision.

NPV, IRR and Profit Index Relationship

When we think about NPV, IRR and Profit Index we see they’re related values as follows. Knowing this helps us apply the Decision Criteria and make the project selection that best suits our investment needs.

NPV	IRR	Profit Index
> 0	> r	> 1
= 0	= r	= 1
< 0	< r	< 1

Nominal Profit vs. Economic Profit

Suppose we’re considering a project in which we have expected cash flows for 2021 – 2023, have assigned a discount rate of 13% and somehow know we can sell the project for an amount at the end of 2023 as indicated in the following table. The equation this example uses is the NPV equation: $PV_{\text{Cash Flows}} - PV_{\text{Cost}} = NPV$. We’ve included both the benefits (cash flows) and costs in the same equation resulting in an NPV of \$0.

Period	Cash Flow	Sale Amount	Sum	Discounted Cash Flow	Running Total of Discounted Cash Flows
2020	-1382		-1382	-1382	-1382
2021	200		200	176.99	-1205.22
2022	300		300	234.94	-970.27
2023	400	1000	1400	970.27	0.00

Does this mean this project isn’t expected to make any money? No, it means the project is expected to make the discount rate, no more and no less. After all, the project cost us \$1,382 and we received cash flows and sale proceeds totaling \$1,900 (200+300+400+1,000) and anyone would agree we made \$518 in profits (1900 -1382), right? This is the **nominal profit** or the **accounting profit**.

An economist will look at this and tell us we have a \$0 **economic profit** because the economist has taken into account the opportunity cost of the capital we committed to the project... the discount rate. When we did this and calculated the present value of the expected future cash flows, include the sale proceeds and subtracted the present value of the cost, the resulting NPV = 0. So... NPV is synonymous with **economic profit**.