

Capital Budgeting: Net Present Value vs Internal Rate of Return

(Relevant to AAT Examination Paper 4 – Business Economics and Financial Mathematics)

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Capital budgeting assists decision makers in a company evaluate multiple investments of the company's capital. Capital budgeting is used to plan for the acquisitions of other companies, for the development of new product lines of business, for the expansion of the existing production plants or for the replacement worn-out equipment, and in planning decisions on whether or not to enter a new market line, whether to buy or rent production facilities, and any other investment project resulting in costs and revenues that are spread over a number of years.

Capital budgeting is the method used to assess a major investment or to see whether one option is better than another. There are several capital budgeting methods, each with advantages and disadvantages. In this article, we discuss the basic principle and the advantages and disadvantages of using the net present value technique and the internal rate of return technique.

Net present value (NPV) method

When using the net present value method of capital budgeting, one of most important factors is the estimation of net cash flows from an investment. The net cash flow is the difference between cash outflows and cash inflows over the life of the investment. First, cash flows should be calculated on an incremental basis, and include changes in operating cash flows and changes in investment cash flows. Second, cash flows must be measured on an after-tax basis. Third, non-cash expenses are also considered; for example, depreciation is an expense item but not a cash flow.

Example 1

NP Ltd is considering an initial investment of \$100,000 in order to open a new production line for a new product. The expected life of the production line is four years. Sales are estimated to be \$100,000 during the first year and to increase by 10% per year until the fourth year. The variable costs of the producing the product are 50% of sales and the additional fixed costs are \$15,000 per year. The simplified straight-line depreciation method is used to calculate depreciation. NP Ltd requires an after-tax return of 40% and also expects to recover \$10,000 of its working capital at the end of the fourth year.

The following gives the detailed information on the new product line:

	New product
Initial investment	\$100,000

Salvage value	\$10,000
Expected life	4 years
Annual operating costs	
Variable costs in the first year	\$50,000
Fixed costs	\$15,000
Sales during the first year	\$100,000

The estimated cash flow from this investment are summarized as follows:

Estimated cash flow

	Year			
	1	2	3	4
	\$	\$	\$	\$
Sales	100,000	110,000	121,000	133,100
Less: Variable costs	50,000	55,000	60,500	66,550
Fixed costs	15,000	15,000	15,000	15,000
Depreciation	25,000	25,000	25,000	25,000
Profit before tax	10,000	15,000	20,500	26,550
Less: Income tax	4,000	6,000	8,200	10,620
Profit after tax	6,000	9,000	12,300	15,930
Add: Depreciation	25,000	25,000	25,000	25,000
Net cash flow	<u>31,000</u>	<u>34,000</u>	<u>37,300</u>	40,930
Add: Salvage value				10,000
Recovery of working capital				10,000
Net cash flow in year 4				<u><u>60,930</u></u>

We need to assign a discount rate to evaluate each of the competing alternatives for a firm's capital to decide whether or not a firm should undertake an investment. The discount rate is estimated using the cost of capital of the investment to the firm.

Net present value capital budgeting gives us the present value of the expected net cash flows from the investment, discounted at the firm's cost of capital, minus the investment of capital needed today.

For example, if NP Ltd expects a cost of capital of 12%, the net present value of the investment can be seen above, and the initial investment is \$100,000, then the net present value of the new production line is:

$$\begin{aligned}\text{NPV} &= \\ &= \$120,054.68 - \$100,000 \\ &= \$20,054.68\end{aligned}$$

This investment can add \$20,054.68 to the value of NP Ltd, so NP Ltd should undertake this investment.

We can use the net present value method to compare investments. The project with the highest net present value is the better alternative.

A disadvantage of the net present value technique is that the decision depends on the cost of capital: it is not easy to calculate this.

The internal rate of return (IRR) technique

The internal rate of return technique is an alternative to the net present value technique. The internal rate of return on an investment is the discount rate at which the net present value of the investment is zero. The investment should be undertaken only if the internal rate of return on the investment exceeds the cost of capital to the firm.

An advantage using the internal rate of return technique for capital budgeting is that the rate of return can be easily calculated and understood, especially by decision makers who may not have a financial background.

Example 2

Using the information in example 1, we can calculate the internal rate of return to be 22.05%. Since this exceeds the cost of capital, 12%, NP Ltd should undertake the investment.

Example 3

Suppose we have two mutually exclusive investments: investment A and investment B, which are independent investments. The internal rate of return and cost of capital are calculated for each below. If the cost of capital is 12%, then both investment A and B are acceptable because they both give a return greater than the cost of capital. In the other words, the cost of capital is the minimum acceptable rate of return.

Internal rate of return of two mutually exclusive investments

	Investment A	Investment B
Cost of capital , per year	12%	12%
Internal rate of return, per year	20.30%	22.10%

Example 4

If we are forced to choose only one investment from example 3, we would choose investment B because this has a higher internal rate of return than investment A. However it is not enough to use only the internal rate of return technique to determine which is the best investment out of two or more mutually exclusive investments. We should also use the net present value method. The net present value and internal rate of return for the two mutually exclusive investments are shown below.

Table 3: Internal rate of return and net present value of two mutually exclusive investments

	Investment A	Investment B
Net present value at 12% discount rate	\$137,872	\$126,168
Internal rate of return, per year	20.30%	22.10%

Investment B has a higher internal rate of return than investment A, so we have seen that we should undertake investment B. What about when we consider the net present values? From the above, we can see that investment B has a higher internal rate of return but lower net present value than investment A.

The internal rate of return may give a different decision than the net present value calculation when evaluating two or more mutually exclusive investments. The reason for this is that under net present value, the reinvestment assumes cash flows are reinvested at the cost of capital; under the internal rate of return, the reinvested rate is assumed to be reinvested at the internal rate of return. This is a disadvantage of the internal rate of return technique as it yields overstated rates of return because it assumes cash flows are reinvested at the internal rate of return.

Conclusion

The net present value and the internal rate of return techniques will always give the same decision on an independent or single investment. The internal rate of return on the investment exceeds the cost of capital only if the net present value is positive. In other words, the internal rate of return on an investment is smaller than the cost of capital only when the net present value is negative. For two or more mutually exclusive investments, decision makers should use the net present value technique instead of the internal rate of return because the former uses the cost of capital as the reinvestment rate.