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Go with the cash flow: Calculate NPV and IRR in Excel

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Applies to

Microsoft Office Excel 2003

Have you been losing sleep figuring out the best way to maximize profitability and minimize risk on your business investments? Stop tossing and turning. Relax and go with the flow.

Cash, that is. Take a look at your cash flow, or what goes into and what goes out of your business. Positive cash flow is the measure of cash coming in (sales, earned interest, stock issues, and so on), whereas negative cash flow is the measure of cash going out (purchases, wages, taxes, and so on). Net cash flow is the difference between your positive cash flow and your negative cash flow, and answers that most fundamental of business questions: How much money is left in the till?

To grow your business, you need to make key decisions about where to invest your money over the long term. Microsoft Excel can help you compare options and make the right choices, so you can rest easy both day and night.

See Also

[Business Financial Statements](#)[Financial functions](#)[IRR](#)[MIRR](#)[NPV](#)[XIRR](#)[XNPV](#)

Asking questions about capital investment projects

If you want to take your money out of the till, make it working capital, and invest it in the projects that make up your business, you need to ask some questions about those projects:

- Is a new long-term project going to be profitable? When?
- Is my money better invested in another project?
- Should I invest even more in an ongoing project, or is it time to cut my losses?

Now take a closer look at each of those projects, and ask:

- What are the negative and positive cash flows for this project?
- What impact will a large initial investment have, and how much is too much?

In the end, what you really need are bottom-line numbers you can use to compare project choices. But to get there, you must incorporate the time value of money into your analysis.

My papa once told me, "Son, it's better to get your money as soon as possible and hold on to it as long as possible." Later in life, I learned why. You can invest this money at a compounded interest rate, which means your money can make you more money— and then some. In other words, *when* cash goes out or comes in is just as important as *how much* cash goes out or comes in.

Answering questions by using NPV and IRR

There are two financial methods you can use to help you answer all these questions: net present value (NPV) and internal rate of return (IRR). Both NPV and IRR are referred to as discounted cash flow methods because they factor the time value of money into your capital investment project evaluation. Both NPV and IRR are based on a series of future payments (negative cash flow), income (positive cash flow), losses (negative cash flow), or "no-gainers" (zero cash flow).

NPV

NPV returns the net value of the cash flows— represented in today's dollars. Because of the time value of money, receiving a dollar today is worth more than receiving a dollar tomorrow. NPV calculates that present value for each of the series of cash flows and adds them together to get the net present value.

The formula for NPV is:

$$\text{NPV} = \sum_{i=1}^n \frac{\text{values}_i}{(1 + \text{rate})^i}$$

Where n is the number of cash flows, and i is the interest or discount rate.

IRR

IRR is based on NPV. You can think of it as a special case of NPV, where the rate of return calculated is the interest rate corresponding to a 0 (zero) net present value.

$$\text{NPV}(\text{IRR}(\text{values}), \text{values}) = 0$$

When all negative cash flows occur earlier in the sequence than all positive cash flows, or when a project's sequence of cash flows contains only one negative cash flow, IRR returns a unique value. Most capital investment projects begin with a large negative cash flow (the up-front investment) followed by a sequence of positive cash flows, and, therefore, have a unique IRR. However, sometimes there can be more than one acceptable IRR, or sometimes none at all.

Comparing projects

NPV determines whether a project earns more or less than a desired rate of return (also called the hurdle rate) and is good at finding out whether or not a project is going to be profitable. IRR goes one step further than NPV to determine a specific rate of return for a project. Both NPV and IRR give you numbers that you can use to compare competing projects and make the best

choice for your business.

Choosing the appropriate Excel function

What Excel functions can you use to calculate NPV and IRR? I thought you'd never ask. There are five: NPV, XNPV, IRR, XIRR, and MIRR. Which you choose depends on the financial method you prefer, whether or not cash flows occur at regular intervals, and whether or not the cash flows are periodic.

Note Cash flows are specified as negative, positive, or zero values. When you use these functions, pay particular attention to how you handle immediate cash flows that occur at the beginning of the first period and all the other cash flows that occur at the ends of periods.

Function syntax	Use when you want to	Comments
NPV (rate, value1, value2, ...)	Determine the net present value using cash flows that occur at regular intervals, such as monthly or annually.	Each cash flow, specified as a <i>value</i> , occurs at the end of a period. If there is an additional cash flow at the start of the first period, it should be added to the value returned by the NPV function. See Example 2 in the NPV Help topic.
XNPV (rate, values, dates)	Determine the net present value using cash flows that occur at irregular intervals.	Each cash flow, specified as a <i>value</i> , occurs at a scheduled payment date. Requires the Analysis ToolPak add-in .
	Determine the internal rate of return using	Each cash flow, specified as a <i>value</i> , occurs at the end of a period. IRR is calculated through an iterative search procedure that starts with an estimate for IRR — specified as a <i>guess</i> — and then repeatedly varies that value until a correct IRR is reached. Specifying a <i>guess</i> argument is optional; Excel uses 10% as the default value.

IRR(values, guess)

cash flows that occur at regular intervals, such as monthly or annually.

If there is more than one acceptable answer, the IRR function only returns the first one it finds. If the IRR doesn't find any answer, it returns a #NUM! error value. Use a different value for the *guess* if you get an error or if the result is not what you expected.

Note A different guess might return a different result if there is more than one possible internal rate of return.

Each cash flow, specified as a *value*, occurs at a scheduled payment *date*.

XIRR is calculated through an iterative search procedure that starts with an estimate for IRR — specified as a *guess* — and then repeatedly varies that value until a correct XIRR is reached. Specifying a *guess* argument is optional; Excel uses 10% as the default value.

XIRR(values, dates, guess)

Determine the internal rate of return using cash flows that occur at irregular intervals.

If there is more than one acceptable answer, the IRR function only returns the first one it finds. If the IRR doesn't find any answer, it returns a #NUM! error value. Use a different value for the *guess* if you get an error or if the result is not what you expected.

Note A different guess might return a different result if there is more than one possible

internal rate of return.

Requires the [Analysis ToolPak add-in](#).

**MIRR(values,
finance_rate,
reinvest_rate)**

Determine the modified internal rate of return using cash flows that occur at regular intervals, such as monthly or annually, and consider both the cost of investment and the interest received on the reinvestment of cash.

Each cash flow, specified as a *value*, occurs at the end of a period, except the first cash flow, which specifies a *value* at the beginning of the period.

The interest rate you pay on the money used in the cash flows is specified in *finance_rate*. The interest rate you receive on the cash flows as you reinvest them is specified in *reinvest_rate*.

More information

To learn more about using NPV and IRR, see Chapter 8, "Evaluating Investments with Net Present Value Criteria," and Chapter 9, "Internal Rate of Return," in *Microsoft Excel Data Analysis and Business Modeling* by Wayne L. Winston. [Visit Microsoft Learning](#) to learn more about this book.

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