

Evaluating Mutually Exclusive Projects with Capital Budgeting Techniques (Case Study)

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Abstract

This case deals with the capital budgeting techniques of Net Present Value (i.e. NPV) and Internal Rate of Return (i.e. IRR). In this case, students will compare two mutually exclusive projects using NPV and IRR, and choose the best project. They will learn about NPV and IRR methods and their advantages and disadvantages. Students will also learn the weakness of the IRR method when comparing two or more projects. Finally, they will evaluate the two projects assuming that the projects are independent projects rather than mutually exclusive ones. This is a hands-on experience for students who want to delve into project valuation.

Keywords: Project Valuation, Capital Budgeting, Net Present Value, NPV, Internal Rate of Return, IRR, NPV profile

JEL classifications: G30, G31, G32

Introduction

After graduating from an MBA Program on the East Coast, Michael Strahan had started working for a mining company. His company is evaluating two projects: One of them requires a smaller investment, and then will create a big, positive cash flow in the first year; and then smaller cash flows after that. The second project is a relatively bigger project. It will require a larger cash flow at the beginning, and then will bring in a relatively small cash flow in the first year. But, this second project will create much larger cash flows in the years after that.

Michael has been given the task of evaluating these two projects and choosing the best one for his company. Initially he thought that this would be an easy task for him. He would just try to accurately predict the cash flows from the two projects and then evaluate them using some of the “capital budgeting techniques” that he had learned when he was at school.

He visits Elizabeth, one of his colleagues, in order to clarify some issues that come to his mind. “Liz” he said, “I am tasked with evaluating two projects and then choosing the best one for our company. I am really excited because it seems like this decision will have a big impact on our company’s bottom line. Could you help me a little bit?”

Elizabeth has been working for the company for more than five years. She sure wants to help his colleague. She says “Sure, I can help you. Exactly what do you want to learn?”

Michael sighs “Elizabeth, when evaluating these two projects, I think I need to use some of the capital budgeting techniques that we had learned at school. For example, we had Net Present Value, Internal Rate of Return, Payback Period, and others. I am not sure which of these methods to use”.

Elizabeth responds “I read somewhere that NPV and IRR are the most commonly used methods to evaluate a project. The Payback Period has lots of disadvantages, so you shouldn’t use that one for sure”.

Michael responds “I don’t know what the advantages and the disadvantages of each of these methods. I guess, first, I need to get more information about them. But, if I remember correctly, the Payback Period ignores the time value of money, so it is not good”.

Elizabeth says “And it also ignores the cash flows that come after the payback period. In other words, if there is a very big positive cash flow that is expected to come some time in the future, the Payback method ignores that. So, it is kind of weak. There are also other weaknesses with that method.”

She adds “IRR also has some weaknesses. I don’t remember them, but you need to research. You don’t want to do something wrong here.”

Michael responds “I have read on the web that IRR has two main weaknesses. So, I guess I need to learn about those weaknesses”.

“In order to get a better picture, you also need to look at the NPV Profiles of the two projects. For each project, you just try different discount rates to find the corresponding NPVs, and then draw a graph that shows the discount rates on the horizontal axis and the NPVs on the vertical axis” Elizabeth adds.

Michael sighs “I didn’t know that. I don’t remember anything about the NPV Profile. Ahh, this assignment is getting tougher by the minute...”

Elizabeth encourages his colleague “You can do it. Don’t worry. Start working on it and don’t hesitate to request help from us.

“Thanks Liz for offering help. I am now starting to work on it. I think I will see you a few times in the coming days!”

Elizabeth responds “No problem. I am here for help, 24/7”.

NPV and IRR

Michael’s boss told him that these are “mutually exclusive projects” (meaning that the company will accept only one of them). Michael thought that going over some of his class notes may refresh his memory. After scrambling through his notes, he noticed that he skipped the lecture where the professor explained capital budgeting techniques. “No problem” he thought. “I can search the web to find some information on these so called “mutually exclusive projects”.

Michael has found some explanations for NPV and IRR on the internet. On a website (businessdictionary.com), Michael finds a straightforward explanation of Net Present Value: “The difference between the present value of the future cash flows from an investment and the amount of investment. Present value of the expected cash flows is computed by discounting them at the required rate of return”.

Another website (Investopedia.com) explains NPV and its calculation as follows:

“Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of a projected investment or project.

The following is the formula for calculating NPV:

$$NPV = \sum_{t=1}^T \frac{C_t}{(1+r)^t} - C_0$$

where

C_t = net cash inflow during the period t

C_0 = total initial investment costs

r = discount rate, and

t = number of time periods

A positive net present value indicates that the projected earnings generated by a project or investment (in present dollars) exceed the anticipated costs (also in present dollars). Generally, an investment with a positive NPV will be a profitable one and one with a negative NPV will result in a net loss. This concept is the basis for the Net Present Value Rule, which dictates that the only investments that should be made are those with positive NPV values”.

The same source explains IRR as follows: “Internal rate of return (IRR) is another metric commonly used as an NPV alternative. Calculations of IRR rely on the same formula as NPV does, except with slight adjustments. IRR calculations assume a neutral NPV (a value of zero) and one instead solves for the discount rate. The discount rate of an investment when NPV is zero is the investment’s IRR, essentially representing the projected rate of growth for that investment. Because IRR is necessarily annual – it refers to projected returns on a yearly basis – it allows for the simplified comparison of a wide variety of types and lengths of investments”.

NPV Profile

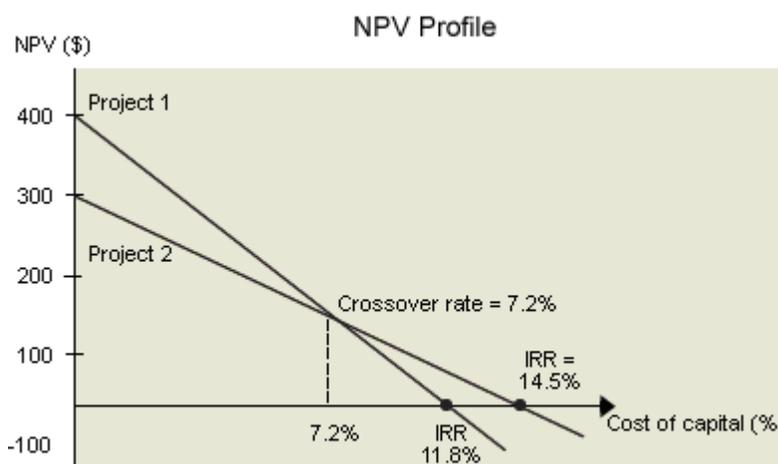
Michael now remembers NPV and IRR more clearly, but he saw somewhere a term “NPV Profile”. “What was the meaning of this? I cannot remember this” Michael murmurs. “I don’t want to miss anything in my report, so I need to find what NPV Profile means” he talked to himself.

He checks his textbook (Ross et al, 2014) and some websites (boundless.com and Investopedia.com) to find out about NPV Profile.

He finds that “The NPV Profile is a graph with the discount rate on the x-axis and the NPV of the investment on the y-axis. Higher discount rates mean cash flows that occur sooner are more influential to NPV. Since the earlier payments tend to be the outflows, the NPV profile generally shows an inverse relationship between the discount rate and NPV. The discount rate at which the NPV equals 0 is called the internal rate of return (IRR)”.

Investopedia.com gives the definition of the NPV Profile and also shows an example:

“NPV profile is a graph that illustrates a project's NPV against various discount rates, with the NPV on the y-axis and the cost of capital on the x-axis. To begin, simply calculate a project's NPV using different cost-of-capital assumptions. Once these are calculated, plot the values on the graph. Since the IRR is the discount rate where the NPV of a project equals zero, the point where the NPV crosses the x-axis is also the project's IRR”.



source: Fundamentals of Financial Management

The Decision

Michael has requested some help in estimating the two projects' cash flows from his colleagues. The expected cash flows for the two projects are finalized as follows:

Expected CFs associated with the two projects:

T	Project 1	Project 2
0	- \$20 million	- \$30 million
1	+ \$12 million	+ \$5 million
2	+ \$8 million	+ \$15 million
3	+ \$5 million	+ \$20 million

He knows that for similar projects, his company has used a required return of 12%, so he decides to use that required rate of return in his calculations.

To impress his boss, he wants to do a detailed analysis. He wants to answer all of the following questions:

1. He decides to use the IRR method first. He wants to see which project is better according to the IRRs. After some calculations, he finds that one project looks better than the other when IRRs are compared. Which project is he talking about?
2. Is IRR an acceptable method to compare two mutually exclusive projects?
3. Is NPV an acceptable method when comparing two mutually exclusive projects?
4. Later, he visits one of his colleagues and talks about his findings. His colleague recommends him to check the NPVs also. He says “O.K. Why not? Confirming my

findings with the other method would be nice”. What does he find? Do NPVs confirm his earlier findings?

5. Are both methods (i.e. NPV and IRR) good in these situations? What would you do? According to your opinion, which project is better for this company?
6. Does IRR always choose the same project whether a firm has a high cost of capital or a low cost of capital?
7. How about NPV? Does NPV always choose the same project whether a firm has a high cost of capital or a low cost of capital?
8. Michael finds his results confusing so he decides to prepare the NPV Profiles for the two projects. His colleague has just shown him how to prepare an NPV profile. How will the NPV profiles look like?
9. According to the NPV Profiles of the two projects, at what discount rate are these two projects equivalent?
10. Over what range of discount rates should we choose Project A? Project B?
11. If they were independent projects rather than mutually exclusive projects, what would we do?

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