

A Capital Budgeting Problem: NPV vs IRR

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Abstract

This case deals with capital budgeting. It deals with evaluation of a project using Net Present Value (NPV) and the Internal Rate of Return (IRR) methods. Students will learn about NPV and IRR methods and their advantages and disadvantages. They will learn how to compute the NPV and the IRR of the project. They will also learn about the problems with the IRR method. Finally, students will prepare the NPV Profile of the project and use it to more critically evaluate the project. This is a hands-on experience for students who want to learn more about capital budgeting.

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

JEL classifications: G30, G31

Introduction

Jack Strow has just started working under the Assistant Treasurer of a firm. His firm is considering a short-term capital investment. His boss Caroline (who is the current Assistant Treasurer) assigned him the task of evaluating this project. The deadline is in two days.

In order to get some help, he visits Julia, one of his colleagues. “Julia, I need your help” Julia responds, “O.K. How can I assist you?”

“I am tasked with evaluating a project and then possibly comparing that project to another potential investment. I know, it should be an easy task, but unfortunately I have already forgotten about these topics. Could you please help me a little bit?” Jack asks.

Julia says “No problem. Give me like fifteen minutes. First I will wrap up my current work and then I can visit you in your office.”

“Thanks Julia! See you over there then.”

Fifteen minutes later, they were in Jack’s office. Jack starts the conversation “Julia, I don’t remember where to use the Net Present Value (i.e. NPV) method versus the Internal Rate of Return (i.e. IRR) method. Can we use any of these methods to evaluate a project?”

“First, you need to remember that NPV gives you a dollar value. It is the present value of all expected cash flows from a project. If NPV is +\$10 million for example, making this investment is expected to add a \$10 million value to our firm. So, it is a good project. On the other hand, if NPV is negative, then our firm will lose value if we make this investment. On the other hand, IRR gives us the percentage return. If IRR is greater than our required return, then it is a good project that would add value to our firm. In other words, NPV would be positive for that project. On the other hand, if IRR is less than our required return, then we shouldn’t invest in that project, because NPV would be negative” Julia responds.

Jack confirms “Yes, I remember these a little bit, but I guess I still need to read more.”

Julia adds “So the answer to your question is yes. As long as you are talking about a single project, both NPV and IRR would work. For a single project, both NPV and IRR will reach the same decision. For example, if NPV is positive, meaning that it is a good project, so we

should accept it, then IRR should be greater than the required return, which also means that we should accept the project.”

Jack continues “Also, there is the issue of comparison. If I need to compare two projects and choose the best one, what should I do? Again can I use both NPV and IRR for comparisons?”

Julia answers “For comparisons, you need to be careful. You can compare the two projects’ NPVs and choose the higher NPV project. So no problem with comparing the NPVs. But, it is risky to compare the IRRs. You cannot directly compare the IRRs and then choose the higher IRR project. Sometimes, the higher IRR project is not the higher NPV project. In other words, sometimes, NPV chooses one project and IRR chooses the other project. I think you need to read more about the “mutually exclusive projects.” Search the web for “mutually exclusive projects” and you will understand why using IRR can be problematic when comparing projects.”

Jack thanks “O.K. Thank you Julia for all your advice. Now, I think this task is not that simple. I need to do lots of reading. I don’t want to mess everything up!”

“I am sure you can do this. Just be careful. And before you submit your work, I can look at it, if you’d like.”

“Thanks Julia. You helped me so much!”

NPV and IRR

To refresh his memory on capital budgeting techniques, Jack has looked at some financial websites. He has found explanations for NPV and IRR on these websites. On one of these websites (businessdictionary.com), he finds the following explanation for 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.”

On the other hand, 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 formula for calculating NPV is as shown below:

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

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

Jack knows that a positive net present value indicates that the present value of expected positive cash flows from the project exceeds the present value of expected negative cash flows (including the initial investment) from the project. He knows that if a project has a

positive NPV, it is expected to add value to the company. On the other hand, a negative cash flow means that the project makes the company to lose value.

Jack has learned from these sources (which includes these websites plus the website www.boundless.com and the “Essentials of Corporate Finance” textbook) that “Internal rate of return (IRR)” is another metric commonly used as an NPV alternative. He has learned that “the discount rate of an investment when NPV is zero is the investment’s IRR, essentially representing the projected percentage return for that investment.”

Although he now has gathered lots of information on these capital budgeting techniques, Jack thinks that he still needs to read more on these topics. He is especially interested in learning about how to compare two projects. “We learned about these mutually exclusive projects” at school but I forgot what were we doing when choosing the best project. Anyways, I guess I need more help” he sighs.

The Decision

Jack has requested some help in estimating the project’s cash flows from his boss. The expected cash flows for the project is finalized as follows:

Expected CFs Associated with the Project:

t	CF
0	- \$10 million
1	+ \$13 million
2	- \$2 million

Jack thinks that it is a simple task, so he should be done very soon with his analysis and his final report. He knows that they have previously used a required return of 10% for investments with similar risk to this one, so he wants to use that return in his calculations.

1. First, he wants to use the IRR method to find the expected % return from this investment. When he enters the cash flows into his calculator, he finds the IRR. By looking at this number, he knows whether his company should invest in this project. Just as he was writing his report, he remembered something from his MBA class. Maybe the decision is not as simple as he thinks. What do you think? Should he go ahead and submit his final report to his boss or should he continue analyzing the numbers?

Hint: Think about the problems with IRR. The IRR method is weak in some cases.

2. What type of problems does the IRR method have in general? Has Jack encountered any one of these problems?

3. When evaluating a project, does NPV and IRR always lead to the same conclusion (accept, or reject)? Why or why not?

4. When choosing between two projects, do NPV and IRR always lead to the same conclusion? Why or why not?

5. Jack decides to draw the NPV Profile for this project. After drawing the NPV Profile, “Ahha” he said. He now sees that the decision here can be made more easily with the NPV Profile. He finds that over a certain range of discount rates, the project is acceptable. What do you think the acceptable range of discount rates is for this project?

After Jack completes the task successfully, his boss assigned him a second task. He is saying that there is another investment opportunity: they may buy an independently owned mine that is on sale in the target area rather than starting one themselves. He wonders what the best project would be: opening a new mine themselves or purchasing the independently owned mine. The expected cash flows from the independently owned mine is as follows:

t	CF
0	- \$20 million
1	+ \$30 million
2	- \$7 million

6. Which method can be used to compare the two projects? Are both NPV and IRR applicable?
7. Jack figures out the best project for his company. Which project did he choose?
8. Remembering his previous analysis, Jack also wants to draw the NPV Profiles for each project and compare them graphically. By doing so, he is able to clearly see which project is better than the other. How do the NPV Profiles look like?
9. According to IRR, will Jack always choose the same project (even though the discount rate is higher or lower)?
10. According to NPV, will Jack always choose the same project (even though the discount rate is higher or lower)?
11. After drawing the NPV Profiles, Jack realizes that over certain range of discount rates the first project is better, otherwise the second project is better. Over what range of discount rates is Project 1 (i.e. starting a new mining operation) better?

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