Evaluation Method Based on NPV and IRR

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ABSTRACT

In the modern market, many companies need to choose the most profitable project among different projects. Even in different industries such as catering, service, employment and so on also need to make the right choice. So developing an effective business strategy, analyzing and forecasting financial performance, and developing an effective working capital structure are very important. In this paper, I first meet the definition of the decision-making tools NPV and IRR. Then I compare the NPV and IRR which can help the managers to make a good choice in complex market conditions. At last, I use some examples to evaluate these two methods which can be benefit to decision-making. I hope this paper can provide some implications to corporate managers, investors, and regulators.

Keywords: *Net present value, Internal rate of return, Annualized net present value, Common year method*

1. INTRODUCTION

When choosing a project, I usually need to make many comparisons and measures to select the project that is beneficial to the development of the company. It is an important investment process that can help the company make the correct decision to enlarge the assets. Maximizing the market value of the corporation is the basic aim of the investment decision process and it is also what shareholders expect managers to do. Based on previous literature research, it can be seen that there are many methods to determine which project is worth choosing, but the most famous method is NPV and IRR. It is worth pointing out that NPV and IRR are not fit in all the cases. Especially in some mutually exclusively projects, NPV and IRR ranking conflict is generally possible [1]. In other words, if use NPV as the criterion, a should be accepted, but if use IRR as the criterion, b should be accepted. This result is mainly due to the complexity of the market situation and the variability of the data. The evaluations of NPV and IRR should take into account.

This paper aims to focus on the difference between NPV and IRR, to provide some implications to corporate managers, investors, and regulators. Having in mind what people understand and how they apply the method, the evaluations of the NPV and IRR will also be mentioned. The remaining paper structures are as follows: Section 2 is the literature review on NPV, including its advantages such as maximizing company value and considering the cost of capital and risk factors. Then the disadvantages such as it rarely focus on long-term projects, it cannot compare two projects which have different sizes and different life, and prone to forecasting errors. Section 3 is the literature review on IRR, including its advantages such as its uses of temporal value of money and it is simple to use. The disadvantages of IRR are that it is not fit for the mutually exclusive projects and the project projections may differ from reality. Through these investors can clearly understand NPV and IRR and then put them into practice. The project can be economically analyzed by calculating the net present value and internal rate of return on investment. Section 5 is cases of NPV and IRR respectively. Section 5 is the conclusion.

2. THE LITERATURE REVIEW ON NPV

2.1. Definition of NPV

The net present value which is called NPV is the difference between all discount returns to the present value of the initial investment. In other words, it refers to the sum of the present value of net cash flows for each year calculated at an established discount rate during the project calculation period [2]. As a kind of internal assessment, NPV is very useful in accounting and finance and can play a huge role in investing, reducing costs, and evaluating new businesses [3]. Its goal is to calculate the project's surplus [4]. The net present value rule indicates that managers increase shareholders' wealth by accepting all schemes that are valued more than the assumption [5]. If the NPV of the project show reveals bring out to be

positive which means it is profitable and acceptable but if the value is negative then that project is not feasible for the company. Therefore, when investors are faced with multiple choices and do not have enough investment amount, they can choose projects with higher returns discount to now. The formula is shown as equation (1):

$$NPV= \sum_{t=0}^{n} \frac{CFt}{(1+r)^{t}} \qquad (1)$$

CFt = net cash flow in year t

i = discount rate

n = the project period

2.2. Advantages

2.2.1. It can maximizes company value

Through NPV, managers can see the profitability of a project, then make the correct choice [6]. The discount rate needed to calculate NPV is determined by the lowest rate of return of the company, which can effectively reduce the loss of the company. It takes into account every cash flow the project involves at the time of investment. Unlike the IRR method which ignores cash flows beyond the payback period when doing calculations. This advantage of NPV means that investors can obtain data that is more valuable to the project. Through observation and comparison of data, investors can determine which project is more worthy of investment and profit of the company.

2.2.2. Capital costs and risk factors are taken into account

The value of money may change as time passes. Its value may increase during the time or decrease because of inflation [7]. NPV analysis is sensitive when mentioning the accuracy of future cash inflows that an investment or a project will bring.

Under this circumstance, net present value can work to make clear this risk so that investors can get a clearer picture of the projected output of the project over the life of the investment and make future projections accurately on account of the consideration of risk and capital cost. This advantage makes it easier for investors to know if a potential activity is sufficient possible for profit [8]. Because of the information the NPV offers, the company can avoid some unnecessary risks to a certain extent and determine if a specific activity makes sense.

2.3. Disadvantages

2.3.1. NPV rarely attention long-term projects due to future uncertainties

An investment ratio product by net present value

typically pays close attention to the projects which are short-term. Net present value is highly sensitive to the discount rate when forecasting the company's future cost of capital [8]. Due to the volatility of market conditions, if the hypothetical numbers are too far out of line with future developments, the outcome will be missing the appropriate opportunities. That's why NPV notices short-term projects instead of seeking long-term activities. It is worth adding that the company will underestimate the long-term profitability of a project if they evaluate a project in a short-term period.

2.3.2. Accurate decision cannot be made based on NPV if the amount of investment of projects is not equal

NPV method is not useful when a company compares two projects of different size. For example, if you have a 1million dollar and a 10 million dollar project to be considered, you cannot evaluate them directly based on the value they will create in the future. In this case, the NPV method does not recommend applying because 50% earned from 1 million dollars is not as much as 10% earned from a 10 million dollar project but it is apparent to find that the 1 million dollar project has more potential. Therefore, using the NPV method to compare two projects which have different sizes may produce a certain losses.

2.3.3. Decision made by NPV may be inaccurate when the two project cycles are different

This shortcoming is similar to the last one. When two projects are unequal-lived, the project selection will require careful consideration. For instance, although a project which has three years may earn less than a project that has six years, the return on equity of the three years project may be higher than another one. From another perspective, if investors continue to invest in this three years project, it might bring more equity to the company. Based on this problem, a more appropriate solution will be given later.

2.3.4. Prone to Forecasting Errors

What makes the NPV hard to calculate is that the risk level of the project changes over time. Analyzing the professional literature, one can also point out the fact that the risks of a project can vary greatly during different periods. If a company chooses a project because the risk is low in the early stage but ignores the high risk in the later stage, it will make the company bear a significant loss. The influencing factors may be people's choice tendency or some uncontrollable external conditions. Generally speaking, calculating the discount rate accurately is difficult when faced with changeable market conditions. Because the calculation of net present

value is closely related to the discount rate, the result can be unreliable to use if inaccurate data is selected.

3. THE LITERATURE REVIEW ON IRR

3.1. Definition of IRR

Internal rate of return which is called IRR is the discount rate when the total present value of capital inflow equals the total present value of capital outflow. Namely, this discount rate is calculated when the present value of all the cash flows equals zero [9]. It is easy to calculate because investors do not need to consider external factors. It is usually used to estimate the profitability of a company or investment project [3]. In this way, the growth rate that a project can create can easily be found. It can also be thought of as an investment's desired rate of return, and the larger the better. In general, the project is feasible when the IRR is greater than or equal to the required rate of return [2]. It is calculated as equation (2):

$$NPV = -CF0 + \sum_{n=0}^{n} \frac{CF_n}{(1+i)^n} = 0 \qquad (2)$$

CF0 = initial cost (first net cash flow)

CFn = cash flow year to t

i = discount rate

n = the project period

3.2. Advantages

3.2.1. Use of temporal value of money

The first and the most important advantage of IRR is that it factors in the temporal value of money when evaluating a project. People can calculate the IRR by calculating factors such as cash flow at different periods so that it is convenient to compare the industry benchmark investment return rate. The IRR can come in handy when measuring the profitability of an investment project. It is also the highest interest rate we would expect for investment and is therefore a good use of the time value of money [10]. Investors can understand the future movement of funds through this method and compare the two projects to choose the one that is more profitable.

3.2.2. It is simple to use IRR

This method is quite easy to understand. By analyzing the definition of this data investors can choose the project whose IRR exceeds the cost of capital, but not otherwise. It is easy for managers to observe and accept a fit project [11]. Another way to analyze this advantage is that a hurdle rate is not required. Once investors need to predict or calculate data which do not exist, the result can only

rely on guesses about the future, it is not accurate. But IRR is not relying on the hurdle rate, so the risk involved in calculating the hurdle rate is reduced, thus improving the accuracy of selecting the right project.

3.3. Disadvantages

3.3.1. It is not fit for mutually exclusive project

When comes to two mutually exclusive projects, it is difficult to compare and make the correct choice. It would be an irresponsible decision if investors chose one project simply because it had a higher IRR than the other. What's more, it may lead to wrong conclusions and losses if you judge directly from this method. Because NPV is more comprehensive, it is more effective to evaluate projects than IRR [12].

3.3.2 Project projections may differ from reality

The single discount rate ignores the varying future rate. In other words, it doesn't take into account prevailing interest rates in the market, which results in some discrepancy between the calculation and reality [3]. This approach only considers profitability and ignores the cost of capital. If your main goal is to determine future profitability then IRR is a good way to do it. But if you want to know how quickly you can recoup your costs and make a profit, the IRR doesn't provide any information [13]. More seriously, this approach assumes that earnings are reinvested at the same internal rate of return over the remaining life of the project, a decision that does not take into account fluctuations in cash flows. This assumption may be inconsistent with reality, and profitability is unreasonable.

4. RELATIONSHIP BETWEEN NPV AND IRR

Both NPV and IRR methods are mainly used for capital budgeting, which can expand the capital of the company. Faced with the choice of projects, these two methods can help investors choose projects that bring profits to the company [14].

Both approaches are very effective in schemes involving independent investment projects. In this case, the outcomes of the two schemes do not compete, and they can easily give investors the right choice. As defined, if NPV is positive, the project will be accepted. Similarly, when the IRR is greater than or equal to the required recovery rate, projects are accepted for expanding the company's assets.

When faced with two mutually exclusive projects, these two approaches may give contradictory results. This could be due to differences in project costs or cash flow timing and patterns. When faced with this situation, it is better to choose projects with higher NPV through

the cost of capital. Because a company's goal is to maximize the benefit of shareholders, doing so has a positive effect on both the stock price and shareholders. NPV can provide more detailed data than IRR because it separately discounts the individual cash flows of a project [15].

5. A CASE STUDY ABOUT NPV

Based on the above discussion, I can clearly understand the basic knowledge about NPV and IRR. Here is a case of choosing a project which has different project validity periods. And there are two solutions to resolve the situation and help us to understand these methods deeply.

5.1. Use ANPV to solve the situation

In real life, the situation is varied. Managers won't always see examples that are the same as the model. When comes to unequal-lived and mutually exclusively projects, the annualized net present value is often used as

an efficient method for choosing a correct investment project. It can help managers to choose a suitable project more intuitively than using NPV. By doing so, managers can fairly compare the net present value of unequal-lived projects.

So what is ANPV? ANPV is equal to the NPV divided by PVIFA. And PVIFA is the present value of interest factor annuity which is related to the discount rate. In another word, ANPV is like the mean value, but the denominator is not the life of the project.

The following data is a good example which can use ANPV. These projects have different lives, so that compare the NPV directly is not correct. The first thing is to calculate the NPV of each project and then divide PVIFA. Like project A, the PVIFA is the sum of the first three years' PV factor for 10%. Then calculate the ANPV of project B. By comparing ANPV, it is easy to find project A is the better choice. In this case, calculating ANPV makes it more intuitive to see which project is worth choosing. The list of those parameters is presented in table 1.

Table 1: Cash flow about two projects (unit: ten thousand yuan)

Year	0	1	2	3	4	5	6
Project A	50000	20000	28000	35000			
Project B	60000	30000	25000	20000	19000	13000	8000
PV factor for 10%	1	0.909	40.826	0.751	0.683	0.621	0.564

5.2. Use common year method to solve the situation

The second method is the common year method. It is a little more bit difficult than the last method. As the table shows, project A has three years but project B has six years. Through observation, I can find that the NPV of project a is less than that of project b. If the company simply chose project B, it could lose a lot of money by making the wrong decision. Using the common year method would solve this problem.

So the first thing is to find the least common multiple of these two projects which is six. Then reset project B in the third period. And it is equal to the cash flow of the third period minus the initial investment. What is left is to repeat the cash flow of the previous three periods. By resting the two projects reach the same life span and compare their NPV. It is clear that project A is the better choice.

I can easily find that the data in table 2 can help to understand. The results I draw from this approach are completely different, so this approach is useful and necessary when facing the limitations of NPV.

Table 2: Cash flow about two projects (unit: ten thousand yuan)

Year	0	1	2	3	4	5	6	NPV
Project A	50000	20000	28000	35000				17618
Project B	60000	30000	25000	20000	19000	13000	8000	28525
PV factor for 10%	50000	20000	28000	-15000	20000	28000	35000	30855

6. CONCLUSION

The net present value and the internal rate of return are the two most common methods when choosing a project. The net present value and the internal rate of

return are different, one is the evaluation method using the absolute value, and the other is the evaluation method using the relative value. However, these two methods both have some certain disadvantages. Among them, the net present value focuses on the earning of the project, while the internal rate of return attention to the effect of

the project. In contrast, NPV considers the differences in different periods and the variable data; therefore NPV is a richer concept than the IRR alone. Therefore, NPV is more reliable than IRR when the results of the two methods conflict when making decisions. Investors select NPV and IRR as the efficient method for evaluating investment projects, not only in choosing projects. But when comes to unequal-lived and mutually exclusively projects, the evaluation of these two methods should be considered which is ANPV and the common year method. For independent projects, net present value and internal rate of return are consistent and recommended.

So at the beginning of managers' choice, they should analyze comprehensively of the business plan. This process can help investors get appropriate investments faster and enlarge the scale of the company to make money. The practice shows that a mature company needs to have an adequate analysis of the market and use appropriate calculation tools to determine an investment plan, so as to reduce the loss caused by decision-making errors. I hope this paper can provide some implications to corporate managers, investors, and regulators.

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