

Comparative Analysis of NPV and IRR in Financial Market Applications

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Abstract. This paper discusses the comparison between two popular investment rules: Net Present Value (NPV) and Internal Rate of Return (IRR). This study aims to determine which investment rule is more appropriate in financial market. This study is more suitable for people who don't know much about NPV and IRR but need to use them to evaluate something. This study analyses the advantages and limitations of both NPV and IRR, using factors such as cash flow, discount rate and project scale. In addition, this study also lists examples and practical applications of these investment rules to illustrate which investment rules are more suitable for which situations. By studying the advantages and disadvantages of NPV and IRR, this study aims to help people choose the most appropriate investment rule to make informed investment decisions in financial markets. This study has important practical significance for participants in financial markets to make project decisions.

Keywords: NPV; IRR; Investment.

1. Introduction

There are many investment rules and investment appraisals to take into consideration, but in this paper it is going to be about the NPV and IRR. They will be compared and explained. What's more, it will be explained where it is better to use these rules and why. Furthermore, we will include examples of other alternatives which could be more useful in the cases that the NPV or IRR is not much. These two are somehow similar rules but different at the same time. The NPV uses the sum of all PV in order to find out a value of a company, coupon bond, share or good, which consist of a formula based on the extracting all the costs (including initial cost) from the cash flow, dividing it by the discount factor to the power of time, where the discount factor is $1 + \text{discount rate}$. Where we start in year 1 ($t=1$) and finish in $t=X$ if it is an annuity, and $t=\text{infinity}$ if it is an perpetuity. On the other hand, the IRR determines at which discount rate the NPV will be 0 in both cases annuity and perpetuity. This is really useful since with this method we can find at which discount rate the project stops being profitable. This in order to calculate the rentability of some investment in goods or companies is really useful, helps to entrepreneurs to prevent losing money. They take into account the same factors as the NPV. In this one we substitute NPV for 0, and we leave r (discount rate) as an unknown number. With algebra it should be easy to find.

The hypothesis for this research question is, that NPV is good to calculate the value of a percentage of the company, an investment in a good such as new equipment, transports, lands, and many more. This is because NPV takes into account the discount rate (which would be the inflation), the period of time, the cash flow that this one will give us, and also the spends that it will cost that this will require (car needs gasoline). So for example in order to calculate if it is profitable and rentable to buy a van, it would be very useful to use NPV as an estimation. This could be done by estimating and summing the profits that this would give us as the years passes, over the discount factor to the power of the year. To this number we take away the costs of buying the van and the costs of maintaining it.

On the other hand, IRR would be better for the purpose of comparing different investing options and portfolios. The opportunity cost are the gains that we would lose if we invest in another portfolio, which is the same as the discount rate. So in order to calculate which option is more profitable in relation to the opportunity cost; the IRR would be useful. This is also because with IRR we can find the opportunity cost which makes the portfolio no more profitable. When this occurs means that one portfolio provides us less gains than losses, thus considering modifying our portfolio to be a great

option. Also the purpose of this research is to find other alternatives for the NPV and IRR, which could function better at some specific situation. There are many financial rules, but only the best ones will be chosen. Firstly, as mentioned, to evaluate the stocks, since the DDM helps investors determine whether a stock is overvalued or undervalued, this information is crucial for making informed investment decisions. Another value reason is the income investment, DDM is particularly useful. It helps identify stocks that offer attractive dividend yields and sustainable dividend growth, which can provide a steady income. What's more, risk assessment, research can help investors assess the financial health and stability of a company. Companies with a consistent history of paying dividends and growing them over time are often seen as more stable and less risky. DDM isn't just for investors; it's also relevant for companies themselves. Firms can use DDM to evaluate the impact of their dividend policies on shareholder value and make decisions about whether to pay dividends, repurchase shares, or reinvest earnings in the business. Finally, long-term investment strategy. It encourages a long-term perspective. It requires analysing a company's fundamentals and making assumptions about its future performance.

2. Methodology

2.1. NPV

One of the important indicators in dynamic evaluation of investment projects is NPV [1]. This indicator requires examining the cash flow that occurs in each period during the life of the project. The net present value is the accumulated value of the present value when the net cash flows of each period are discounted at a certain discount rate to the same point in time (usually the beginning of the period). NPV is the total present value of the sum of cash outflows and cash inflows minus the initial cost of investment. By comparing the NPV with the initial cost of the investment, one can assess whether the project is expected to generate positive or negative returns. If NPV is positive, this means the return will be greater than what the capital market requires, and the investment should be considered. If NPV is negative, the investment should not be considered. And the higher NPV indicates the project has a better investment return.

The formula for calculating NPV is

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1+r)^t} - CF_0 \quad (1)$$

In this formula, NPV is Net Present Value, CF_t is the cash flow in period t , r is the discount rate, CF_0 is the initial cost of investment.

2.2. IRR

IRR, by definition, can be considered as a discount rate that can make the net present value of an investment project equal to zero. Generally speaking, when the internal rate of return is greater than or equal to the benchmark rate of return, we will consider the project acceptable [2].

The formula to calculating IRR is:

$$0 = NPV = \sum_{t=1}^n \frac{CF_t}{(1+IRR)^t} - CF_0 \quad (2)$$

In this formula, CF_t is the cash flow in period t , r is the discount rate, CF_0 is the initial cost of investment. The company could use the NPV of the investment and find the discount rate that makes $NPV=0$. For project investors, the higher the return on investment, the more likely they are to invest, which is modified when the IRR is greater. In the investment decision-making process, we must consider the net present value of the project on the one hand, and the risk of the project on the other. Using this method, we can effectively combine the two as the basis for investment decisions [3].

For example, a company plan to invest a project, this project t requires the company to invest \$10,000 at the beginning. The company forecast that it will produce an inflow after operating costs of \$ 5,000 a year for 3 years. If the discount rate is 10%. The NPV of this project is:

$$NPV = \frac{5,000}{(1+10\%)^1} + \frac{5,000}{(1+10\%)^2} + \frac{5,000}{(1+10\%)^3} - 10,000 = 2434.26 \quad (3)$$

After calculating, the NPV of this project is \$2434.26, and then to find the discount rate that makes NPV=0. So the IRR of this project is 23.38%. The company can accept this project.

Beside NPV and IRR there are many popular investment rules we can consider such as Payback Rule.

3. Comparative Analysis of NPV and IRR

There are lots of methods that can help us to decide. but each of them is different with others. what condition should we choose best methods.

3.1. NPV

NPV has some advantages. NPV calculates the net value of the project to evaluate whether the project creates economic value. In contrast, internal rate of return only pays attention to the internal yield of the project and does not consider the absolute value of cash flow. In the investment, internal rate of return judging whether to accept a project is if internal rate of return bigger than cost of capital. But this is not the case in financing. But net present value's judgment criteria are always the same. Also, net present value can be used to determine the value of additional investment. By calculating the impact of new investment on the net present value of the project to judge whether it is worthwhile to make a chase. In contrast, internal rate of return only measures the return on investment, and cannot provide accurately information related to the decision -making of investments. So net present value has a wider applicability. however net present value is an absolute value, there is limitation to compare different scales projects from this value, because we can only see the number of the last net present value. And rate of return cannot be reflected in this project. Comparing projects with different scales becomes challenging. When using the net present value method for investment decisions, the choice of discount rate is crucial. Different project cash flows correspond to different discount rates, and different discount rates have their own applicable scope and limitations. Therefore, it is necessary to make a more prudent selection of each plan based on the actual situation and assumptions of the project [4].

3.2. IRR

The projects with high risk use internal rate of return are better. because of high risk, the companies are hard to find out the exactly cashflow for the year in the future. and in the method part we know that calculate the net present value need to find out the cashflow. So, without the accurate cashflow, it is difficult to find out the net present value. so high-risk projects need to use internal rate of return, and the companies should choose the project which with biggest internal rate of return and internal rate of return should be larger than hurdle rate. and the bigger internal rate of return can make sure the project has bigger error tolerant rate [5,6].

However, some conditions can make internal rate of return fail. firstly, the condition is decided on lending or borrowing. for example, sometimes two projects their internal rate of return is same, but one project is lending while another is borrowing, so one project has positive net present value while another has negative one. the condition that when total lending is bigger than total borrowing, the companies need to choose the projects with internal rate of return is smaller than hurdle rate. what's more, some condition will occur multiple rate of return error-tolerant rate. the internal rate of return is the discount rate when net present value equal to zero, but sometimes when net present value equal to zero there are more than one discount rate, so it also means there are more than one internal rate of return. and it is hard for companies to decide which internal rate of return need to bigger than hurdle

rate. finally, for the condition of mutually exclusive projects, the internal rate of return maybe will ignore the scale of projects [7].

4. Suggestion

When selecting investment projects, we should give priority to those projects with high positive NPV values. However, there are some conditions to be aware of when using the NPV method. First, future cash flows need to be reasonably estimated and calculated using an appropriate discount rate. Finally, when comparing different projects, the project with the higher NPV value should be selected.

Next is the IRR. Generally, we should choose projects with a higher IRR than other alternative projects. However, there are some conditions that need to be noted when using the IRR method [8,9].

Overall, whether it is the NPV or IRR method, other factors should be taken into consideration in the decision-making process. NPV is more applicable when evaluating long-term investment projects; while IRR is more advantageous when comparing projects of different sizes and durations. In addition, in situations where risks are higher or the market environment is unstable, the NPV method can better reflect the true value [10].

5. Conclusion

In conclusion, this research in this field has shed light on the important concepts of NPV and IRR as tools for evaluating investment projects. These two methods have been compared and their respective strengths and weaknesses have been analyzed. The findings of this study suggest that NPV is a robust method for assessing the value of investment projects, especially when evaluating long-term investments. It takes into account factors such as discount rates, time periods, cash flows, and expenses, providing a comprehensive view of the economic viability of a project. NPV is particularly useful for determining the value of a percentage of a company or assessing the profitability of investments in goods or equipment. On the other hand, IRR is better suited for comparing different investment options and portfolios. It helps identify the discount rate at which a project becomes unprofitable, allowing investors to understand the opportunity cost of their portfolios. However, IRR may have limitations in cases where cash flows are uncertain or where projects have different scales and durations. Further more both NPV and IRR should be used as part of a comprehensive decision-making process. NPV is valuable for assessing the intrinsic value or fair value of a project, while IRR can aid in comparing projects and understanding their relative returns. Additionally, other factors such as risk, market conditions, and the practicality of reinvesting cash flows should be considered alongside these methods. This research provides valuable insights into these financial evaluation tools and emphasizes the importance of making informed investment decisions by considering multiple factors and indicators.

However, this article also has certain shortcomings, such as focusing mainly on theoretical analysis in research methods and lacking more quantitative data comparison. In the future, when data is available, it can be enriched and expanded.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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