

A Literature Review on the Net Present Value (NPV) Valuation Method

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ABSTRACT

Evaluating different projects is an essential part of capital investment for the firm's future success. Among several evaluation methods, the net present value (NPV) methodology enjoys the highest prevalence. NPV method allows investors to objectively evaluate the efficacy and appeal, as well as compare investment projects that differ in scope, duration, or predicted profit. This article aims to illustrate the basic characteristics of the NPV method, as well as the benefits and shortcomings while applying it. This work could give users comprehensive learning about NPV and facilitate investors to judge whether it is appropriate to choose the NPV method for specific projects management. Besides, the article also provided a comparison between several methods, such as the internal rate of return method, in which case users can better choose the most suitable methods or apply all of them together.

Keywords: *Net present value (NPV); Internal rate of return (IRR); Projects management; Evaluation methods; Capital budgeting techniques.*

1. INTRODUCTION

Nowadays, investment is an indispensable activity in the financial market. According to Mangiero and Kraten (2017), at the core of Corporate Finance, is the decision choice to invest in capital assets, either to grow the corporation's ability to create current goods or to replace outdated or worn-out equipment [1]. According to AlKulaib, Al-Jassar and Al-Saad (2016), this process is called capital budgeting, which companies utilize to approve long-term project capital investment. Capital projects are evaluated using both quantitative and qualitative information [2]. Qualitative information is kind of ambiguous and subjective because each investor and firm have different standards to evaluate, such as corporate culture, commitment to quality, etc. With regard to qualitative information, the best technique for evaluating a capital budgeting plan is to use the time value of money concepts [1]. There are five typical strategies for analysing a capital budgeting proposal: Payback periods (PP), discounted payback periods (DPP), internal rate of return (IRR), modified internal rate of return (MIRR), and net present value (NPV). Among them, NPV is the most popular method, which is the difference between the present value now and the present value at a future date [1]. Therefore, in this article, the analysis of NPV will be addressed, as well as

the comparison with other qualitative methods in capital budgeting. The article aims to offer a comprehensive introduction to the NPV method and enable everyone who needs to evaluate projects to use the NPV method correctly.

This paper is divided into four parts. First, introduction to the NPV method, that is how to calculate and what it is used for. The advantages and disadvantages will be separately developed in part two and part three. The fourth part is comparisons between the NPV method and other methods. In the end, a conclusion will be drawn and some limitations of this article will be noticed.

2. THE NPV METHOD THEORY

According to Arshad (2012), NPV is the net present value, which is the sum of all the future cash flows to determine the present value. When computing cash flows, both inflows and outflows are discounted at a certain rate. It's calculated by subtracting cash inflows from cash outflows or investment expenditures [3].

According to Archer and Ghasemzadeh (1999), in project management, NPV is used to estimate if a project's predicted financial return will be more than the current investment, indicating that the project is worthwhile [4]. A project's net present value is the sum

of the present values of all its cash flows, including inflows and outflows, discounted at a rate that reflects the risk of the project [3]. The expression is:

$$NPV = -CF_0 + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \dots + \frac{CF_n}{(1+i)^n} \quad (1)$$

where CF_t is the cash flow in period t , i is the discount rate, and n is the life of the investment project

After the calculation, how do make decisions using the result? According to Myers and Majluf (1984), generally, investments with a positive NPV are profitable and therefore eligible for consideration, while investments with a negative NPV will result in financial losses and may not be made [5]. When the NPV is zero, an extra interpretation is required. According to Mackevičius and Tomaševič (2010), because such an investment project has little effect, it is rarely offered in actuality [6]. The investor feels that even modest changes in the market condition might result in the project losing money. However, after such risk has been eliminated and there are no more profitable alternatives, the project might be pursued since the investor is uninterested in other possibilities that have the same impact [6]. When a company has a lot of possible projects, it uses the results to rank them from the highest to the lowest profitability index. Furthermore, the most significant activities should be carried out until the entire budget has been spent [2].

3. THE ADVANTAGES OF NPV

Firstly, according to Gallo (2014), it is obvious that the NPV method takes the time value of money into consideration. The value of money today is more than the value of tomorrow. If firms and investors ignore the rate and calculate with only the current value, then in the future the result will be overvalued, which might incur a loss to the firms or investors. Therefore, considering the time value of money is a significant part of capital budgeting process [7].

Secondly, according to Levine (2005), it also can be seen from the formula that the NPV method compels a project to consider costs and benefits beyond the time frame in which a project manager is responsible for its completion. There is usually a stewardship problem, which is project managers may place greater emphasis on the phases for which they are responsible than on succeeding phases. The NPV method mitigates that risk and demands that all of a project's relevant consequences be considered [8].

Thirdly, according to Hopkinson (2016), individual project NPVs can be added together to provide an NPV for a group of projects, in another word, all forecasts are aligned to a scale based on the current value of cash. This allows investors and/or projects to be compared equitably regardless of their duration or cash flow phasing, making it a helpful portfolio management tool [9]. Besides, it also serves as a foundation for the aggregation of groups of

unrelated initiatives. If there are two independent projects A and B, the NPV of this combination just equals the sum of project A's NPV and project B's NPV. Therefore, it is easy to just add them up and compare. A simple example is if the total NPV values is lower than one of the project's NPV, then it is unfavourable to invest in such a portfolio. Also, this property allows different options for the same project to be compared [6]. It is probable that the options are mutually exclusive because only one kind of combination that an investor can choose. Therefore, the NPV method can be used to calculate each combination's cost and benefits, thus finding an optimal combination between them.

Fourthly, according to Magni (2010), the NPV method can be used when the rate of return varies over the life of a project. To be more specific, the NPV technique offers a single rate (cost of capital) that can be applied uniformly and consistently to all investment proposals. The NPV method more realistically assumes that inflows are reinvested at the same rate as the market cost of capital [10].

Fifthly, the NPV method is an effective tool to support projects management. According to Wetekamp (2011), any unanticipated changes to the project timetable must be considered by project managers [11]. Furthermore, all of these issues must be considered while estimating the project's profitability. In terms of corporate governance, the NPV method contributes to the productive and successful projects management. It might serve as a motivator, pushing project managers to provide realistic project assumptions, and reminding project managers that the companies and projects cannot afford to fail in any way [11]. Therefore, to achieve overall success, project managers must generate reliable projections and apply an adequate risk management strategy.

4. THE DISADVANTAGES OF NPV

Firstly, the NPV method is full of estimations. Several steps are involved in the NPV expression, including choosing a suitable rate to employ in the discounting process, as well as identifying all of the risky and "riskless" additional cash flows that emerge from the project's inception through completion [2]. Estimating each figure in the formula is difficult, time-consuming, and the most important is full of uncertainty. For example, according to Juhász (2011), depending on the settings of the calculative rate of interest, the outcomes of a choice based on the absolute amount of NPV might change [12].

Secondly, it is critical thinking for the fifth advantage above. There may be an optimistic projection. Because the corporate finance team must meet with management to take into consideration the project's business context, managers may be too optimistic about the project's success. As a result, the cash flows analysed may be

excessive. As a result, within the considerable assumptions, this technique might have an upward bias when making assumptions.

Thirdly, according to Hui (2015), the NPV criteria overlooks the possibility of making improvements to the project as time goes on and additional information becomes available because the NPV criterion is based on the piece of information accessible at the time of making decisions. The piece of information (e.g. cash flows and cost of capital) can be attributed to the current product's marketability, price, technologies employed context and so on. In real life, projects that can be readily and affordably altered in response to large changes in these elements will add more to the firm's value than its NPV suggests [13].

Fourthly, NPV fails when comparing projects of different sizes. According to Le (2021), NPV is an absolute amount, not a percentage [14]. The example below will illustrate the idea. It is obvious that Investment B has a higher NPV than Investment A, is it mean the management should choose investment B? Not really. According to Yescombe (2014), the higher NPV is mere because of its larger size, the original investment. Because of the higher internal rate of return, investment A is better than Investment B. When compared to Investment A, the additional 1000 invested in Investment B yields a substantially lower return [15].

Table 1. NPV and different-sized projects

	Investment A	Investment B
Original investment	1000	2000
Cash flow 1 year later	1400	2600
NPV @ 10%	273	364
Internal rate of return	40%	30%

5. A COMPARISON BETWEEN NPV AND OTHER EVALUATION METHODS

As mentioned in the introduction part, there are five basic approaches for projects investment. Among them, the NPV and IRR methods both have a strong methodological basis and broad application in the evaluation area.

The theory of the IRR method is quite linked with the NPV method. The internal rate of return of a project is the discount rate at which the NPV is equal to zero. It is a metric that determines how profitable a project is. When a time value is taken into account, it is the discount rate at which the total present value of inflows equals the total present value of outflows [6]. The expression is below:

$$CF_0 + \frac{CF_1}{(1+d)^1} + \frac{CF_2}{(1+d)^2} + \dots + \frac{CF_n}{(1+d)^n} = 0 \quad (2)$$

Where d is the internal rate of return (IRR), $CF_{(t)}$ is the cash flow in period t .

Normally, using the NPV and IRR methods to analyse projects yields the same conclusions. However, compare the IRR expression with the NPV expression, it is well-noticed that the NPV formula is a linear transformation, but the IRR formula is not. According to Young (1983), this indicates that adding one more projected period to the IRR calculation might change its direction, and the extra period could affect the findings of the intermediate period [16]. Thus, the intermediary period cash flows might have a distinct influence on the end conclusion when the NPV and IRR methodologies are used [6].

Regards to the applicability, using IRR to rank investment projects and reject marginal projects has various advantages versus using NPV criteria with cash flow modifications. According to Yan and Zhang (2022), when discussing capital requirements with divisions, boards of directors, or other stakeholders, top managers will often choose to adapt in less obvious ways rather than more obtrusive ways. Meanwhile, the IRR is the more straightforward option. The higher the IRR, the larger the discounting of future cash flows. As a result, any overstatement that enhances the chances of project acceptance will reduce the weight on later cash flows, thereby minimizing the risk [17].

The NPV and IRR rules are frequently thought to be based on an implicit assumption regarding reinvestment cash flows generated during the project's lifetime. According to Bora (2015), the difference in implicit reinvestment rates is thought to be the root of the disagreement between the two approaches. The IRR approach assumes that the cash flows from the project can be reinvested at the project's internal rate of return, whereas the NPV method assumes that the cash flows can be reinvested at the opportunity cost of capital [18]. However, this happens seldom in actuality, and internal reinvestment rates differ. To demonstrate their claim, the modified internal rate of return (MIRR) technique is more dependable and realistic in such situations [6]. It is determined by the formula below:

$$MIRR = \sqrt[t]{\frac{FV^+}{FV^-}} - 1 \quad (3)$$

Where MIRR denotes the modified internal rate of return, FV^+ denotes the future value of positive cash flows, FV^- denotes the present value of negative cash flows, and t denotes the time elapsed between the first investment and the last income-earning period.

The implicit reinvestment assumption is rejected by everybody since it is based on the practice of compounding cash flows to the project's terminal date rather than discounting the beginning date. In any case, such reinvestments of cash flows have no effect on the

existing profitability of the enterprise under discussion. The cause for the ranking conflict between the IRR and NPV criteria is due to the varied timing of the project's cash flows, rather than a faulty reinvestment assumption [18].

6. CONCLUSION

In this paper, the basic characteristic, advantages, and disadvantages of the NPV valuation method is discussed. It is discovered that NPV is the most popular and widely utilized strategy for project analysis. Many investors would like to use this method because it is simple to compute and reinvest cash flows at cost of capital. Apart from this, the IRR method and the MIRR method are briefly introduced as a comparison with the NPV method. They are also useful since they provide a percentage-based response that is simple to comprehend. Although the other two methods, the payback method and the discounted payback method, are not discussed in this article, they are also interesting topics to explore. As projects management becomes more and more significant in the modern economy, there are many different approaches devoted to find the best investment plan. In the ongoing context, this article just introduces and concludes a very small part of the whole map. Projects management is a complex task with considerable uncertainties as well as risks. Therefore, this study might be useful for people conducting research on financial market investments and business decision-making procedures. However, there are many other in-depth types of research that need to be done to illustrate different consequences in different contexts, and various methods with different projects.

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