Key aspects of investment analysis

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Abstract: This paper reviewed principally accepted methods applied to investment analysis. To describe every aspect of investment analysis fully would require far more space than available here, so we highlight only of few of its aspects.
This study collects several well-known bibliographies, contrasts them with each other and provides explanations for having done so. There are many questions about which authors and companies agree, including about how to apply certain methods, but on others there is disagreement.
Four dynamic methods (Net Present Value, Internal Rate of Return, Profitability Index, and Discounted Payback Period) are demonstrated from the viewpoint of application. Moreover, this study clarifies several sensitive questions, such as handling income taxes, inflation and uncertainty. Other examined issues are only mentioned at the end of this paper, and we will publish on these more thoroughly at a later date.

Keywords: net present value, internal rate of return, profitability index, payback period

Introduction

The capital investment analysis procedure is of primary importance in investment control. Once the investment has been made, it is largely a sunk cost and should not influence future decisions. The manager wants to obtain the maximum long-run cash flow from capital investments and to add further capital investments only when they will provide a net return in excess of the company's cost of providing the investment (*Anthony* et al., 1992).

Most proposals require significant amounts of new capital. Techniques for analyzing such proposals are described in many studies.

Different methods are used to analyse each type of investment because of differences in timing the expenses and their associated returns (*Kay – Edwards,* 1994).

In general, the most frequently used technique for large corporations is Internal Rate of Return (IRR) or Net Present Value (NPV) (*Ross* et al., 2005), (*Graham – Harvey,* 2001). According to Helfert (2001), the net present value (NPV) measure has become the most commonly used indicator in corporate economic and valuation analysis, and it is accepted as the preferred measure in the widest range of analytical processes.

An important point is that these techniques are in fact used in only about half of the situations in which, conceptually, they are applicable. There are several reasons for not using present value techniques in analyzing all proposals (*Anthony – Dearden – Govindarajan,* 1992).

- There is no feasible alternative to adopting the proposal. The necessity to comply with legislation is an example.
- The rationale for the proposal is something other than increased profitability. The need to improve employee morale or company image, or perhaps to meet safety regulations are good examples.

Companies usually have rules and procedures for the submission of capital expenditure proposals. These rules specify the approval requirements for proposals of various magnitudes and also contain guidelines for preparing proposals and general criteria for their approval (*Anthony* et al., 1992). Nevertheless, we have to say that in Hungary; only a few larger and developed companies have a working system for making investment decisions. Moreover, several firms do not use dynamic techniques, and in Hungary this statement is cumulatively true.

Discussion

When organizations evaluate the financial feasibility of investment decisions, the time value of money is an essential consideration. This is particularly true when a project involves cash flow patterns which extend over a number of years. This is called a discounted cash flow method. (*Budnick,* 1988) In order to discount all cash flows, an interest rate must be assumed for the intervening period. Frequently, this interest rate is an assumed minimum desired rate of return on investments. Sometimes this is a reflection of the known rate of return, which can be earned on alternative investments (e.g., bonds or money market founds). (*Budnick,* 1988) According to *Helfert* (2001), this rate is commonly based on a company's weighted average cost of capital, which embodies the return expectations of capital structure. From an economic standpoint, it should be the rate of return an inventor normally enjoys from investments of similar nature and risk. In effect, this standard represents an opportunity rate of return. In a corporate setting, the choice of a discount rate is complicated both by the variety of investment possibilities and by the types of financing.

The Net Present Value (NPV) method

The Net Present Value (NPV) of an investment is the present value of the expected cash flows, less the cost of the investment (*Ross* et al., 2005).

Cash inflows are treated as positive cash flows and cash outflows, including the initial investment as negative cash flows. If the NPV of all cash flows is positive at the assumed minimum rate of return, the actual rate of return from the project exceeds the minimum desired rate of return. On the contrary, if the NPV for all cash flows is negative, the actual rate of return from the project is less than the minimum desired rate of return (*Budnick,* 1988). While the NPV Rule has many advantages that have been explored in the literature, it also has numerous limitations. For example, the NPV Rule does not answer all our questions about the economic attractiveness of capital outlays. One of these is that the size of the NPV is affected by the size of the investment (*Helfert,* 2001), (*Warren,* 1982). The more central problem is that the concept of a NPV is awkward for a layman to understand. Most farmers have good ideas of what is meant by 'return on capital', but few will have a grasp of the implications of net present value. It is just that NPV is not a convenient yardstick. Ideally, we need an investment appraisal technique which will incorporate the discounting principle and yet give a percentage rate of return on capital, and such a technique is the IRR method (*Warren,* 1982).

Although this analysis allows one to determine whether a project satisfies the minimum desired rate of return criterion, it does not provide a measure of the exact rate of return. Methods for computing the actual rate of return are simple extensions of NPV technique (*Budnick,* 1988).

In the following, we present the most popular alternatives to NPV. "When it is all said and done, they are not the NPV rule; for those of us in finance, it makes them decidedly second-rate." (*Ross* et al., 2005)

The Internal Rate of Return (IRR) Rule

IRR is also called the marginal efficiency of capital or yield on the investment. (*Kay – Edwards,* 1994)

Naturally, the result of a given project will vary with changes in the economic life and the pattern of cash flows. In fact, the IRR is found by letting it become a variable that is dependent on cash flows and economic life. In the case of NPV and PI, we have employed specified return standard to discount the investment's cash flows. For the IRR, we switch the problem around to find the one discount rate that makes cash inflows and outflows exactly equal (*Helfert,* 2001). It is the discount factor that sets NPV to zero.

Once the IRR has been calculated, it can be compared with the cost of capital (*Warren,* 1982). Accept the project if the IRR exceeds the required return.

Unlike the NPV method, IRR can be used to rank investments which have different initial costs and lives (*Kay – Edwards,* 1994). Select alternative with the highest IRR.

As a ranking device for investments, the IRR is not without problem (*Brealey* et al., 2006), (*Fónagyet* et al., 2003), (*Helfert,* 2001), (*Katits,* 2002), (*Lee* et al., 1980), (*Ross* et al., 2005), (*Warren,* 1982).

- It does not distinguish between investing and borrowing.
- IRR may not exist or there may be multiple IRR, mainly not typical investments.
- Problems with mutually exclusive investments.
- The rate of return does not reflect the size of a project, it is the Scale problem.
- The timing problem. The NPV and IRR methods give conflicting ranking for projects.
- Assumption concerning the reinvestment rate

NPV versus IRR

Hardacer et al (2004) support the widespread recommendation by economists that NPV is the most appropriate investment criterion. When comparing investments with different time horizons, the corresponding recommendation is to use equivalent annuity as the choice criterion. This is simply the NPV averaged over the life of investment. In practice, the recommendation in favour of NPV is often not followed. Instead, the internal rate of return (IRR) is widely used in preference to NPV, mainly on grounds of ease if interpretation – this advantage is highlighted by *Ross – Westerfield – Jaffe* (2005) also –, especially for comparing investments of different scale. Hardacer et al (2004) mentioned also that the two criteria will not always rank alternative investments in the same order.

In general, NPV (ideally supported by the PI) is preferable on grounds of consistency, with IRR having values of convenience and ease of communication. (*Warren,* 1982) *Illés* (2002) emphasizes the disadvantages of NPV method and prefers IRR method. In deciding whether to use the IRR or the NPV method, it should be recognized that in most cases both give the same accepting or rejecting decision for a single project. The NPV method tends to be somewhat easier in terms of the computational procedures required. The IRR method has the advantage of expressing the result as a compound rate of return, which makes it easier to compare the project under consideration with financial instruments and other investment opportunities. In many cases where two or more projects must be ranked, it will be helpful to use both methods and draw a diagram of the results (*Lee* et al., 1980).

The Profitability Index (PI) method

In situations where a limited amount of capital is being allocated among several independent projects, it is sometimes helpful to rank them on the basis of the Profitability Index (*Lee* et al., 1980), (*Brealey* et al., 2006). After calculating the NPV of a series of projects, we might be faced with a choice that involves several alternative investments of different sizes. This choice is based on the same inputs, but differs in format, focusing on the relative size of the project (*Helfert,* 2001). There is no understanding

concerning the matter of PI. Contrary to other authors, according to *Brealey* et al. (2006), PI is NPV divided invested costs. It gives different explanation to this indicator. It has problems with mutually exclusive investments (*Ross* et al., 2005).

The Discounted Payback Period (DPP) Rule

The payback period of a project shows us the time it takes the project to "pay back" its initial investment, taking the time value of money account. This value is the number of years it takes before the cumulative forecasted cash flow equals the initial outlay. The payback rule says: only accept projects that "payback" in the desired time frame. This method is flawed, primarily because it ignores the timing of cash flow within the Payback Period, and the present value of payments after the payback period (*Brealey* et al., 2006), (*Ross* et al., 2005). It is a break-even condition in value creation. It is achieved at the specific point in time when the cumulative positive present value of cash benefits equals the cumulative negative present value of all the cash outlays (*Helfert,* 2001).

Handling income taxes

According to most authors, investments are better analysed using after-tax net cash flows; therefore all values should be on an after-tax basis in a practical application of methods. Whenever after-tax net cash flows are used, it is important that an after-tax discount rate also be used (*Kay – Edwards,* 1994), (*Lee* et al., 1980).

Although some companies evaluate projects on a before-tax basis, most find that the best analysis is on after-tax basis (Budnick, 1988). There are two things that must be considered when calculating after-tax cash flow: investment credit and depreciation. The interest of the credit increases cash outflows, so it reduces taxable income. Depreciation is not included in calculating net cash flows because it is a non-cash expense. However, depreciation is a tax-deductible expense which reduces taxable income and therefore income taxes (*Kay – Edwards,* 1994), (*Lee* et al., 1980).

Helfert (2001) not only emphasises the importance of depreciation as a tax shield effect in investment analysis, but considers accelerated depreciation possibilities and effects for return of investments as well. On the contrary, *Illés* (2002) emphasises the methodological problems of using after-tax cash flows; therefore, she puts before-tax cash flows forward.

Handling inflation

The most common error in investment appraisal is the calculation of the rate of return in real terms, i.e. not building inflation into cash flow or profit estimates, testing against a cost of capital (discount rate) expressed in nominal terms. The result is the rejection of many projects which would in fact have been worthwhile (*Warren,* 1982).

When accounting for inflation in capital budgeting, we should maintain consistency between cash flows and discount rate (*Ross* et al., 2005), (*Kay – Edwards,* 1994), (*Warren,* 1982), (*Brealey* et al., 2006), (*Helfert,* 2001). Thus, if no inflation is built into the basic calculation, the result should be compared with the cost of capital in real terms. In other words, if no inflation is calculated in cash flows, discount rate in real terms should be used, and conversely, if inflation is calculated in cash flows, discount rate in nominal terms should be used.

In many ways, this is the simplest solution to the inflation problem, as long as it can be assumed that the values of all inputs and outputs will rise in price at the same constant rate over the project life, and discounted by the nominal rate. In this way, we can take that situation into account also when costs are likely to rise faster than the prices of outputs. It is a common story in agriculture (*Warren,* 1982).

Handling risk and uncertainty

In most cases, the initial outlay can be estimated with reasonable accuracy. Estimates of the other cash flows are nearly always subject to some degree of uncertainty. It must be expressed consistently in developing the investment analysis (*Helfert,* 2001), (*Lee* et al., 1980).

Given the uncertainty that may exist about the future, it is often useful to make a sensitivity analysis, which asks a number "What if" questions. Such quesitons can be characterized thus: 'What changes in x will result from a given change in the level of y?', where x is a measure of profit, cash flow, capital or NPV and y is one of the components in that measure, such as input price, input volume, output prise, output volume, interest rate, and so on. This analysis involves changing one or more values in the net present value equation (called model) and the recalculation of not only the NPV, but other indicators as well (*Helfert,* 2001), (*Kay – Edwards,* 1994), (*Warren,* 1982).

The analysis will give an impression of the risk of the investment but, perhaps more importantly, it will also show the elements for which the balance is most sensitive. On the other hand, it is a technique which allows the manager to examine the likely effects of his worst, best, and most likely assumptions (pessimistic, expected, and optimistic cases) concerning the outcome of a project (*Warren,* 1982).

The problem with sensitivity analysis is that the underlying variables are likely to be interrelated, and we can not consider them properly.

There are other techniques to handle uncertainty (*Brealey* et al., 2006), (*Ross* et al., 2005), see them shortly below.

Scenario Analysis: Project analysis giving a particular combination of assumptions. It allows managers to look at different but consistent combinations of variables.

Simulation Analysis: Estimation of the probabilities of different possible outcomes. Monte Carlo Simulation is a tool for considering all possible combinations.

Break Even Analysis: Analysis of the level of any variable at which the company breaks even. Point at which

the NPV=0 is the break even point. It is calculated on a net present value basis, gives managers minimum targets.

Decision Trees: Allow us to graphically represent the alternatives available for us in each period and the likely consequences of our actions.

Further questions in connection with investment analysis

- Step for the analysis of investment, estimation of cash flows
- Handling investment financed by credits or other capital
- Comparing investment with unequal lives

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