MAKING

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Abstract
In the process of investment decision making it is not only the question if some investment has to be made, but it has frequently appear the problem of selection the best investments between two or more alternatives. For selection of investments that compete to be implemented in an enterprise it is necessary to estimate those investments represent alternatives.
 The aim of this article is to understand the concept "time value of money"which is used in the evaluation of investments projects expected to provided benefits over a number of year and to develop a theoretical basis refering to the adequate models and methods, to find out which are the dynamic indicators used for evaluation the efficiency of investments.
Key words: investment decision, economic indicators ,net present value
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Introduction

An important characteristic of investments that is usually linked with the investment process is uncertainty of expected benefits. As longer is investment period, as higher is uncertainty of future effects.

If the leading principal investment goal is profitability, in the case when we have at disposal mutually exclusive investment projects, the investor would tend to invest available financial resources into economically most profitable solution. In the process of selection between possible investment project alternatives, the decision will be made in favour of the alternative with highest profitability degree, with greatest amount of profit in an enterprise. It is necessary to emphasize that it is started from preposition that management team makes choice between two possible investment alternatives economically justified in an absolute sense with given calculative interest rate. That is why the solving of this problem is in making choice of those investment projects which could be more profitable for the investor.

If management team has at disposal amount of financial resources sufficient for implementation of only one of possible two alternative investments, then profitability level of chosen investment alternative should not be lower than minimal profitability level investor would like to achieve in the process of investment into enterprise. In that case the investor limits itself into the project that promises the highest level of economic effectiveness. In that way there have been adjusted amounts of available financial resources with investment possibilities in an enterprise.

The concept "time value of money"[150] is used in the evaluation of investments projects expected to provide benefits over a number of years. Money can be thought of a having a time value. In others words, an amount of money received today is worth more than the same Ron amount if it were received a year from now.

Because of the fact that the processes and the phenomena from the investment field are influenced by the implications of the time factor, it is necessary to valuate dynamically the parameters of the investment projects (the investment value, the project incomes and costs, the profit or the net cash flow etc.).

The dynamic valuation of the effort and effect indicators within the analysis of the economic efficiency provided by the investment projects has a significant relevance, when the value indicators defining the investment activity involve an unfolding, an evolution in time and consists in recalculation of the investment parameters, their presentation depending on the reference chosen moment, an operation that requires the use of the up-dating procedures. So, the up-dating is a specific method for the dynamic valuation of the investments economic efficiency, giving the possibility to calculate certain adequate dynamic indicators[151] that allow expressing and estimating the economic efficiency of the investments.

1. Methods and Models for evaluation the efficiency of investments

Static models[152] - Only one period is being analysed while applying a static model. It is a particular period of exploitation that should be considered as an essential period of exploitation, or, in hypothetical terms, it is a medium period. In such a case, all the data from the planned period are received, which characterize the relative medium period. The question arises if it is justified to rely on one objective function or it is possible to ignore relations between other areas of enterprise activities in the process of decision making. Moreover, the problem of static model should be assessed critically[153].

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150 Moyer, C., & McGuigan, J., & Rao, R., Fundamentals of Contemporary Financial Management, Second Editions, Mason: Thomson, 2007, pg. 161
151 Bradu, M., Statistical-Financial Valuation Methods of the Investment projects, Theoretical and Applied Economics Review, 508, 2007, pp.49-52.
152 Perridon L., Steiner M., Financial economy of the enterprise, 10 Edition, Munich, 1999.
153 Blohm, H., Lüder, K., Weak establishments in the field of industrial investments and ways of their elimination, 7 Edition, Munich, 1991.

Dynamic models[154]- Investment projects are described by instalments and payoffs, which should be paid while realizing the projects in the particular period of time. The assumption is usually related with this, that major influence of alternatives is limited by definite specified instalments and payoffs. Their values can be determined in terms of time intervals. Instalments and payoffs accounting as well as the analysis of dynamic indices in the particular periods is an essential feature differentiating the dynamic models from the statistical ones. It should be noted, that the dynamic evaluation of utility model in comparison with the static model is closer to reality, because, in this case, several periods are analysed. Therefore, even though the application of the dynamic model requires more time, it is more efficient compared with the static model.

When we have to evaluate the efficiency of investment projects with a number of objective functions we use :

1. Methods based on quantitative measurements - consists in methods within multicriteria utility theory[155].

2. Methods based on initial qualitative assessments, the results of which later take a quantitative form. This group consists of analytic hierarchy method[156].

3. Methods based on quantitative measurements but using a few indices to compare the alternatives (comparison preference method). This group consists of comparison preference methods[157].

4. Methods based on qualitative data not using a shift to quantitative variables. This group comprises verbal decision analysis (VDA) methods[158].

It is possible to use methods from different groups of the classification above to analyze the effectiveness of investment policies. However, one should take into account peculiarities of individual investment problems.

A major goal of research is to develop a theoretical basis for creating a decision support system aimed to increase efficiency by applying multiattribute decision making approaches and mathematical modelling.

2. Dynamic indicators used in estimating the economic efficiency of the investments

The capital commitment (engaged capital/ up-dated total costs)

The capital commitment indicator expresses the initial total costs of the investments for building the projected production capacities and the ulterior costs for commissioning, for their operation minus the redemption expressed in the present value for a certain reference moment, usually, at the moment of beginning the investment works (t_0).

The time horizon for calculation of the engaged capital is (d+D), namely the duration of executing the investments works (d) and the duration of efficient operation for the investment objective (D). Therefore, the capital commitment is calculated according to the relationship[159]:

$$K_t^{up} = I_t^{up} + C_t^{up} = \sum_{t=1}^{d+D} \frac{I_t + C_t}{(1+r)} \quad (1)$$

where:

K_t^{up} – the total capital commitment up-dated at the moment t_0 ;

I_t^{up} – the total investments up-dated at the moment t_0 ;

C_t^{up} – total operation costs up-dated at the moment t ;

I_t – annual investments;

C_t – annual operation costs;

r – up-dating rate.

It is aimed to minimize the capital commitment at a given level of the storage capacity, total incomes and total economic advantages.

The Payback Period (PP)

The payback period of the investments is a segment of the useful life concerning the operation of the capacities provided through investments. The payback period of the investment represents the period of time that begins at the moment of commissioning the storage capacities, when the cumulated sum of the provided economic advantages equals the volume of the investments allocated in the project. In a dynamic approach one calculates the updated term of the investment payback, starting from the equality:

$$\sum_{t=1}^{d} \frac{I_t}{(1+r)^t} = \sum_{t=d+1}^{d+T} \frac{P_t}{(1+r)^t} \quad (2)$$

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154 Heinhold M. , The preliminary estimate and the account of profits and losses in examples, Schäfer-Poeschel publishing house, Stuttgart, 1997.

155 Triantaphyllou E., Multi-criteria decision making methods a comparative study, Kluwer Academic Publishers, Boston, 2000.

156 Saaty T. L., Fundamentals of Decision Making and Priority Theory with the AHP, RWS Publications, Pittsburgh, PA, USA, 1994

157 Roy B., Multicriteria Methodology for Decision Aiding, Kluwer Academic Publishers, Dortrecht, 1996, 293 p.

158 Larichev O. L, Olson D. L., Qualitative methods of decision making, Kluwer Academic Publishers, 2001.

159 Stoian M., Ene Nedea, Practica gestiunii investiţiilor, Ed. ASE, 2002, pg.92.

This one is the variant when the calculations are done from the beginning of the investment works on the assumption that the annual profits Pt are generated only after commissioning the objective. Therefore, during the execution period are partially put in exploitation certain storage capacities that will generate certain advantages. If the calculations are done at the moment of putting the objective into operation, then we have:

$$\sum_{t=1}^{d} I_t (1+r)^{d-t+1} = \sum_{t=1}^{T} \frac{P_t}{(1+r)^t} \ (3)$$

where T – term of payback the investments.

If more variants of the investments projects are compared, then is preferrable the project providing a minimum payback period.

The use of the payback term analysis in the economic and financial valuation of the investment decision is considered as a way to take into account the risk of the projected investments. By giving the priority to the more advantageous projects, characterized by short payback periods, it is accepted the conclusion that the future incomes and economic advantages will not be affected by incertitude and risk at the same scale as in case of variants with larger payback periods.

Another argument in the favor of this method is represented by the fact that the companies confronted with a cash shortage will give more importance to the rapid recovering of the invested funds and, respectively, to the possibility to satisfy other necessities.

The net present value (VAN)

This indicator, being a fundamental criterion for the economic and financial valuation of the investment projects, characterizes, as absolute value, the advantage gain of an investment project, the investor's gain for the invested capital expressed as cash-flow in present value.

Defined in comparison with the cash-flow, the VAN provided the scale of comparison between the total present cash-flow generated during the life of the project (CF^{up}) and the total investment effort provided by that project, expressed in present value (I_t^{up})[160].

VAN is an integral indicator of investment efficiency and strikes off the register the total surplus of cash-flow in comparison with the investment cost. The reference moment for the NPV calculation is that of the works start[161]:

$$VAN = CF^{up} - I_t^{up} = \sum_{t=1}^{d+D} \frac{CF_t}{(1+r)^t} - \sum_{t=1}^{d} \frac{I_t}{(1+r)^t} \ (6)$$

Defined by means of the net value, NPV expresses the algebraic sum of the present net value upon the horizon of time (d+D). By annual net value VN it is understood the difference between the annual volume of incomes (receipts) generated during the all operating period of time *Vt* and the volume of the total annual costs (investments and operation in the year *t* (Kt=It+Ct).

According to the criterion VAN, must be accepted the projects and the project variants for which VAN > 0. This fact means that the corresponding project has the capacity to reimburse during the economic life (D) the invested capital or, in other words, has the capacity to generate an income flow in excess, providing a certain volume of net value.

A project with VAN < 0 has to be rejected because its rentability will be smaller than the updating rate. VAN remains one of the best criteria for selecting the investment projects. But, in order to exclude the risk of certain incorrect decisions it is recommended the analysis of this indicator together with other ones, namely the profitability index, the internal rate of return, the updated term of the investment collection.

The profitability index (PI)

During the calculation and the analysis of the investment project one uses this index when the investment projects or the projects variants are differentiated between them through the necessary investment effort, because this index takes into account the size of the investments, the necessary investment costs, element that is not provided when we use the VAN indicator. The profitability index is calculated according to the relationship[162] :

160 Stancu I., Finante, Ed. Economică, Bucureşti, 1997, pg.291.
161 Cistelean L., Economia, Eficienţa şi Finanţarea Investiţiilor, Ed. Economică, Bucureşti, 2002, pg.319.
162Cistelean L., Economia, Eficienţa şi Finanţarea Investiţiilor, Ed. Economică, Bucureşti, 2002, pg.333.

$$PI = \frac{CF^{up}}{I^{up}} = \frac{\sum\limits_{t=d+1}^{d+D} \dfrac{CF_t}{(1+r)^t}}{\sum\limits_{t=1}^{d} \dfrac{I_t}{(1+r)^t}} \quad (7)$$

An independent investment project must be accepted only if *PI >1* and has to be rejected if *PI < 1*. The project having *PI = 1* (same as when *VAN = 0*) will provide the recovering of the investment expenditure only, without generating some profit. The more *PI* is the more profitable are the projects.

The internal rate of return (IRR)

This is defined as the updating rate that provided equality between the updated value of the net cash-flow incomes and the updated value of the investment costs. It results that *RIR* represents that discounting rate for which the *VAN* value is equal with zero.

The internal rate of return is one of the most significant indicators for the efficiency of the investments project, because it expresses the investment capacity to generate profit during the all operating period of the objective by fixing its economic power.

The *RIR* value can be calculated through the *interpolating method*[163]. The application of this method implies to find such two updating rates that for a rate r_{min} results an updated positive net value (VAN+), and for r_{max} an updated negative net value (VAN-). The values of the VAN level for these two updating rates are placed within a rectangular system of coordinates, expressing on X-axis various updating rates, and on Y-axis the progress of the updated net value.

The difference between rmax and rmin must not exceed 5 percentage points. Otherwise, by using a larger distance an error will be generated. RIR will be larger than the real value. Given the fact that the differences between r_{max} and r_{min} are small enough, we can take into consideration the existence of a linear dependence between VAN and the updating rate (r). Therefore, for finding with exactness the RIR one uses the relationship:

$$RIR = r_{min} + (r_{max} - r_{min}) * \frac{VAN(+)}{VAN(+) + VAN(-)} \quad (8)$$

When we compare alternatives of investment projects or project variants, characterized through *VAN* close values the priority is given to the project (variant) having a maxim RIR.

Conclusion

A complex analysis of methods and techniques currently used by the researchers of various countries to determine the efficiency of investments was made.

In the analysis of the economic efficiency concerning the investment projects, a significant importance has the number of the analyzed projects, either a sole project or a set of investment portfolio when there are independent projects and projects that exclude themselves reciprocally is in discussion. The analysis of a sole project is a particular case of a portfolio of investment projects when the criteria *VAN,RIR* and *PI* leads to the same conclusion concerning the acceptation or the rejection of the investment project. This happens because between these indicators there are relationships of interdependence.

Selection between two alternative investments can be also done on the basis of the rate of effective invested capital compounding, i.e. on the basis of their internal rates of return. An investment is economically more effective if its internal rate of return is higher than determined calculative interest rate. In other words, for investor one investment is more favorable if the rate of effective invested capital compounding is higher than required degree of minimal compounding (determined by level of calculative interest rate).

In the case of selection between two alternative investments, we could conclude that for investor the more favorable investment is the one which enables higher rate of effective invested capital compounding. Similarly as in the case of net present value method utilization, procedure of economic effectiveness comparison between two alternative investments on the basis of their internal rate of return depends on the fact if analyzed investments represent full alternatives, or they differ in investment amounts, or expected utilization period. In the cases when those two parameters (investment amount and utilization period) are the same in two investments, criterion for selection of economically more effective investment alternative is the following: Investment I is economically more effective than Investment II if it has higher internal rate of return.

If they have equal projected investment values, equal period of exploitation and equal annual cash flows by particular years, then we can conclude those investments represent full alternatives. In that case, decision on selection could be made on the basis of the model for comparison of economic indicators for particular alternatives. For one model it is important to be given starting suppositions concerning type and conditions of financing into

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163 Stoian, M., & Ene N., Practica gestiunii investiţiilor, Ed. ASE, Bucureşti, 2002.

particular alternatives. Then, it is necessary to be defined the business goal and appropriate constraints. It is evident that establishment of an investment model is aiming at achievement of the basic economic goal- maximal degree of invested capital compounding.

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