

LIMITS AND EQUIVALENCE OF SOME ASSESSMENT CRITERIA OF INVESTMENT PROJECT'S ECONOMIC EFFICIENCY

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Abstract: When adopting the decision of allocation of capital among many alternative or concurrent projects, the assessment of each one's attractiveness is needed. With this purpose a set of criteria are used in the practice, the so called project efficiency assessment criteria. These criteria support the management to make difference between feasible and non-feasible projects. As a plus, using these criteria, we can perform a rating of the investment projects on their attractiveness.

1. FOREWORD

The project represents and will remain the main implementing instrument of technologic transfer and a strategy's mean of operationalising. When other criteria are not priority, the economic criterion is the reference to consider a project as feasible and on which many projects are hierarchized on the attractiveness point of view.

Any project in which capital investments are performed – conventionally costs which suppose results scheduled on period longer than one year- is subject of economic assessment which must estimate the return of the invested capital. The practical means and the indicators for evaluate the capital return are so numerous by the diversity of formulas and procedures that a systematization and a delimitation which make easy their use without errors on decisions and interpretations became very difficult.

2. TYPES OF PROJECTS UPON THE SCHEDULING OF CASH FLOW

Main A start point to see the limits and equivalences of some indicators in the assessment of the project's efficiency is represented by their classification on the cash flow scheduling, independently on their nature and the project's dimension [7].

Using the convention of discrete placement at one year interval of arrows, at the start of the period, under axis for negative flows and at the end of period, above the axis, for positive flows, we can distinguish four models of representation of cash flows:

-the general model (Fig. 1) – many periods with negative cash flows with different amount of money –investments in the first stage scheduled on many years, running in condition of net positive cash flow , even if some capital investments are performed;

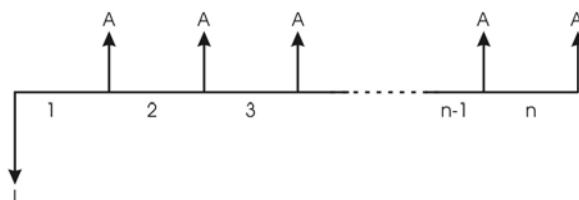


Fig. 1

-the particular model 1 (Fig. 2) – after an initial stage which preserves the mode of repartition of money according to the general model, a first particular case appears, when the positive flows are uniform on the all period in which the assessment is preformed;

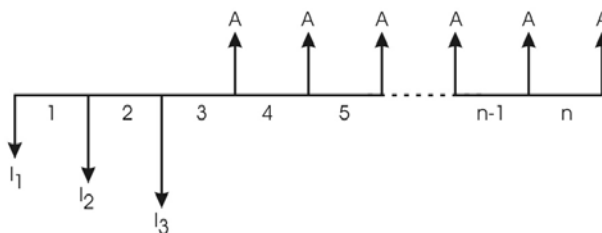


Fig. 2

-the particular model 2 (Fig. 3) – the initial stage of investment is a particular case, the entire amount of cash is invested at the start of the first period, the present moment, and in the running stage the flows are no uniform , as in the general case;

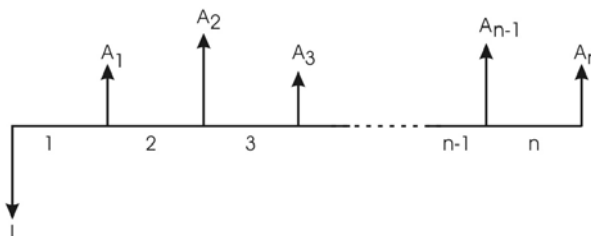


Fig. 3

-the particular model 3 (Fig. 4) – the initial stage is as in the particular model 2 and in the running stage as in the particular stage case 1, After a unique investment in the e actual moment, at he beginning of the firs period, many periods follow at the end of which positive flow appears, the same for all the periods.

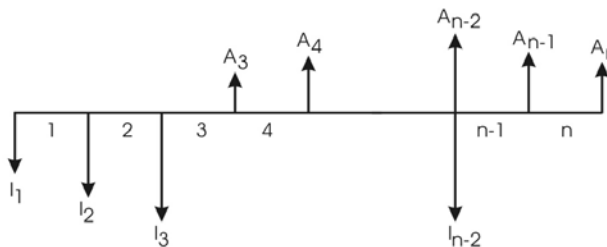


Fig. 4

In order to assess the economic efficiency of the project in which the influence of the factor time will be considered, a prediction of the scheduling of annual cash flows will be necessary, based on certain hypotheses which not are the subject of the present paper. We arrive then to associate to the project one of the models of scheduling, and related to it to adopt an appropriate method of assessment of capital return.

In the work [7] cited before, four basic models are presented for the assessment of the return of invested capital, Internal rate of return (IRR), External rate of Return (ERR), Annual Value (AV) and Net Present Value (NPV). In other works, in addition to the two mentioned methods (IRR and NPV), other 11 methods are presented, under the title economic efficiency assessment criteria : Rate of Return (RR), Payback Period (PP), Discounted Payback period (DPP) , Net Present Value (NPV) , Net Future Value (NFV), Net Annual Value (NAV) , Profitability Index (PI) Internal Rate of return (IRR) Wealth Growth Rate (WGR) , Growth Rate of Return (GRR) and Hoskold Formula (VP) [4] [5].

Our paper intend to contribute to the clarification of some aspects related to the conditions in which each criterion is applied, the approximation of the criterions in case of non respect

of imposed conditions and the conditions in which many criteria lead to the same decisional results, case in which the selection of the criterion being done on considerations of simplicity and subjective preferences.

3. COMPARABILITY OF CASH FLOWS

As it will be shown above the criteria of economic assessment of investment projects which take into account the factor time are based on the time scheduling of cash flow which are differentiated in positive and negative or input and output cash flows. It must be observed that we use the term of cash flow in order to avoid any particular interpretation of the concept cash flow.

Starting at the pointing statement that cash flows are positive or negative or input and output ones we identify in fact a hypothesis referring to the conditions in which the assessment of the project takes place and implicitly of the applicability limits of the selection assessment criteria.

The cash flow can be positive or negative, (input or output) relatively to the system in which the project is considered. In the case that the project supposes an identity project-new company which will function in a well known economic and financial environment the cash flow both positive or negative has a certain magnitude and nature different from the case then the project will be implemented in an existing company or will be integrated in particular conditions, in the larger system of an economy (allowances, fiscal facilities, taxes, redevencies, and other particularities regarding the inputs or outputs of cash flow). The simple precising that the assessment is related to the project itself and it is economic or financial do not solve the problems related to assessment conditions and from that appears the limits of applicability and validity of the assessment criteria.

When we proposed to analyze the limits and equivalences of the project's assessment criteria we have had in mind not only their economic assessment, being aware that the decision to promote a project are based not only on economic criteria, and project's financing decisions supposes the continuation of the economic assessment with financial ones which ensure optimal combinations of investment opportunities, financing sources and politics of share dividends.

By this delimitations, the economic efficiency criteria of the projects will be analyzed on the hypothesis of forming of positive cash flow only by selling the products /services of the project without taking account of inflation and risks, and the negative ones includes only capital expenses, the running costs and the profit taxes. It is obvious that the difference between the two cash flows is a cash flow from which, at real functioning of the business resulted from the project, according to the fiscal and economic environment and the financial management, will appear negative cash flows or the interests on lend capital, dividends and other payments, representing different obligations of the company. In the economic assessment we will not take into account the interests to the lend capital and other payments, these belonging to the financial assessment. In continuation we will take into account the output flow of the profit tax, even that the numeric assessment of its value requires some financial- fiscal hypotheses.

A project which will be integrated into an existing company will encounter alterations of the cash flow at running expenses and profit before taxation. From this considerent, the economic assessment of the project will be performed based on the hypothesis of financial fiscal "independence". This hypothesis consist in the determination of the depreciation as an expense deductible from the gross taxable profit according to applicable fiscal legislation applicable to the project in normal situation and the taxation of the project after deducting the depreciation also in a normal situation.

In principle the net cash flow as it was defined above corrects in plus or in minus the economic value of the business resulted from the project. The value correction can be determined if both at the beginning of the year and at the end of the year we associate to the business the economic value of the project. It would be necessary to apply a method to establish the economic value of the business of the project at the beginning /end of each year of the projects life. With this occasion appears the problem of "economic depreciation". The economic depreciation will be in this case the difference between the economic value of the net active at the beginning of the year after the patrimonial model and the economic value of the same active at the end of the year. With this depreciation we diminish the net cash flow and the new cash flow resulted will represent the net profit in economic sense. The economic depreciation can be greater or less than comparatively with the depreciation legally deducted from the cash flow before the taxation of the profit. The delimitation regarding the economic depreciation is essential in the assessment of the limits and equivalence of criteria of assessment of the investments. The criteria which include the calculated depreciation according to legal regulations are not equivalent which ones do not include the depreciation in cash flow or include the economic depreciation.

4. FUNDAMENTAL CONCEPTS IN PROJECT ASSESSMENT

In the economic assessment of the investment projects many fundamental concepts are already contoured, concepts upon which the limits and equivalences of the assessment criteria must be appreciated.

Firstly, the fundamental objective of the management is not considered those which maximize the profit but those which maximize the value of the company. From this derive the adoption of the concept of forming the cash flow and of the criteria of assessment of economic efficiency of the projects. The mentioned objective is reached when the optimal combination of decisions referring to the investment opportunities, sources of financing and dividend sharing are insured.

Secondly, the economic assessments of the investment projects must take into account the influence of the factor time, the different types of risk which can influence the capital return and the dividend treatment policy.

Thirdly, the investment decision is related directly to the efficiency assessment of the related investment and the repartition of the available capital among alternative or concurrent projects. The adoption of the investment decision imposes the economic assessment of each project, in order to solve the problem of feasibility or attractiveness grade of investment in one or other project.

Fourthly, all the criteria of assessment of the economic efficiency of the projects are based on two fundamental principles:

- higher revenue is preferable to lower revenues;
- earlier revenues are preferred to later revenues.

Fifthly, all the assessment criteria are based on quantitative indicators of the efficiency which determine the start point of investment decision making which will take into account, supplementarily of other economic consequences, not included in the used indicators, such as the technologic progress and social aspects.

And, finally, at the adoption of the investment decision we must take into account the risk of realization of the project.

From all the aspects listed before, in our paper we will deal with the objective, quantitative, economic assessment of the projects, without taking into account the inflation and risk differences, which we will not treatise.

Taking into account the numerous criteria used in practice, concerning the assessment of the investment projects, we intend to support those who uses such criteria, to be able to

select, in full awareness, such criteria, and reduce at minimum the risk of bad decisions. In principle, a decision can be bad, when a project, considered feasible, and in reality it is not, and respectively, when a project is graded with certain attractiveness in a classification, and in reality his grade is different.

5. INTERDEPENDENCE BETWEEN THE ASSESSMENT CRITERIA IN PROJECT ASSESSMENT

In the assessment of investment projects, the focus is on two major topics:

- Decision of feasibility
- Position (ranking) of attractiveness

Acceptability (feasibility) means that the project assures a greater return than expected; as a result, the project enters a list of projects, from where a portfolio is optimisable.

Attractiveness means that the project places on a certain place – higher or lower – on a scale, place based on which the project is more or less attractive.

The limits of criteria are the result of the set of hypotheses in which the attractiveness or feasibility decisions are correct. The decision is correct if no other criteria, not even the strongest reverses the decision.

The equivalence of more criteria, means that it is met the same correct decision of attractiveness or feasibility in the limits of defined equivalency.

The classification of mentioned aspects is important for a decider because of at least two reasons:

- Not to adopt a criteria leading to a wrong decision, i.e. the acceptance of a rejectable project or placing on a higher scale of a project, which based on a stronger and more relevant criteria would occupy a lower position.
- Adopting an easier to interpret and to apply criteria, or a familiar one, whenever there are met the applicability limits.

All the assessment criteria of investment projects are usable independently as well as in combination. Therefore, it is important to establish the relations between them.

The following table highlights the analysis possibilities of some mentioned criteria, more or less used in project assessment, more or less familiar to the decider and compares these criteria based on a series of important indicators.

Criteria	RR	PP	DPP	NPV	PI	IRR	WGR	GRR	Vp
Question									
Profits (P) or cash flows (CF) are used?	P	P CF	P CF	CF	CF	CF	CF	CF	P
Is it based on time factor?	N	N	Y	Y	Y	Y	Y	Y	Y
Are reinvestment rate needed for estimates?	N	N	Y	Y	Y	Y	Y	Y	Y
Amortization fund are accentuated?	N	N	N	N	N	N	N	N	Y
Profit is given as rate?	Y	N	N	N	N	Y	Y	Y	N
Have multiple solutions?	N	N	N	N	N	Y	N	N	N
Compares projects with different investment	Y	Pos.	Pos.	N	Y	Y	Y	Y	N

value?									
Aware of profits after investment turnover?	Y	N	N	Y	Y	Y	Y	Y	Y
Determines market (stock exchange) value of the project?	N	N	N	Y	N	N	N	N	Y
Uses different rates for repeated investment?	N	N	Y	Y	Y	N	Y	Y	Y
Accentuates duration differences?	N	N	N	N	N	N	Y	Y	N

Next, a few relations between fundamental assessments criteria have to be analyzed due to their importance for assessment of the investment projects. We mention that the analysis will not include all of them. First, the time factor influenced criteria will be considered; second, the most important, in a group of similar criteria will be considered; finally, those will be considered which give the most accurate results. As a conclusion, from the listed criteria we will chose the one considered “strongest” that is meeting most of the hypotheses concordant to the project’s reality. We then amend some hypotheses reaching other applicable limits thus demonstrating that one or more criteria in the list are applicable or equivalent.

One of the general but strong criteria is Wealth Growth Rate. (WGR)

WGR represents the revenue rate which equals the up to date amount of the investments in the project with future reinvested positive cash flow, evaluated at the project’s finished economic life.

This definition of WGR criteria assumes that net positive annual cash flows are accumulated (reinvested) step by step with a determined revenue rate, and that the moment of evaluation is the moment of project’s finalization. If the project is characterized by the existence off more annual investment expense flows, those are actualized (updated to present n=0) by use of the same revenue rate like in the reinvestment. WGR’s size is determined by comparing in time updated investments and accumulated profits, so as the medium growth rate of the company to result from here.

$$\sum_{n=0}^N \frac{I_n}{(i+1)^n} = \frac{\sum_{n=0}^N CF_{N-n} (i+1)^n}{(i+WGR)^n} \quad (1)$$

Value off WGR is determined as the revenue rate for which the sum of updated investments is totally compensated by the sum of profits accumulation existing at the end of economical life of the project. Accordingly, WGR is determined with the equation:

From where

$$WGR = \sqrt[N]{\frac{\sum_{n=0}^N CF_{N-n} (i+1)^n}{\frac{I^n}{(i+1)^n}} - 1} \quad (2)$$

Where

- CF - net positive cash flow of the project for year (N-n),
- I_n - investment in the project for the year n

i - reinvestment rate.

In order to decide for the acceptability of the project, it is necessary that the calculated value of the WGR, compared to the revenue rate asked by the company is bigger. As revenue rate asked by the company, the accumulation rate used in calculating the WGR can be used.

The main advantage of this criterion is the objective comparison possibility of projects with different durations. This means that use of WGR method assumes that reinvestment of monetary flows of shorter duration projects is done repeatedly until the end of the longest project's life. Thus in project evaluation the same amount of time is considered.

Another fundamental and strong enough criterion is the Internal Rate of Return (IRR), which represents that actualization rate for which the sum of updated positive monetary flows is equal to the sum of updated negative monetary flows. So as, IRR is the actualization rate for which the following equality is true:

$$\sum_{n=0}^N \frac{+CF_n}{(i+1)^n} - \sum_{n=0}^N \frac{-CF_n}{(i+1)^n} = 0 \qquad \sum_{n=0}^N \frac{+CF_n}{(i+1)^n} = \sum_{n=0}^N \frac{-CF_n}{(i+1)^n} = 1 \qquad (3)$$

In other words, IRR REPRESENTS the limit rate of actualization for which the sum of actualized positive cash flows compensates exactly the sum of actualized negative cash flows.

Related to the analyzed criterion, the projects are considered acceptable if the magnitude of IRR is greater than the company's accepted revenue rate. If IRR is less than it, the project must be rejected. Because the accepted rate of revenue expresses the profit expected by the company from the new project, the choice of a project with an IRR greater than the accepted rate of revenue can lead to an increase of the share's value, i.e. of shareholders wealth.

When we speak about the IRR of a project, as it is normal, we have in mind the revenue rate to the performed investments. The investment is, a singular expense, which each year, is partially compensated by the net profit generated by the project. By this reason, at the calculation of IRR, we must take into account the uncompensated part of the investment. In such a way, the IRR is considered as a revenue rate at the uncompensated part of the investment, part which gradually reduces towards zero, during the advancement towards the last year of the project.

The use of the IRR criterion in the practice of project assessment is widely spread, this criterion being used more frequently than any other one. The main reasons of this large frequency can be synthesized as follows:

- the IRR criterion expresses the efficiency of the projects, contrarily to NPV criterion which express the general effect of the projects;

- IRR measures the internal economic efficiency of each project, the value of this criterion being determined by the moment of apparition and extent of positive and negative cash flow of the projects. In this manner, IRR eliminates the disadvantages produced by the choice of an external rate of actualization, taking account of the influence of time on the cash. Due to this circumstance, The IRR criterion is more used in unstable economic situation, when the selection of an external rate of actualization, precise and correct for the cash flow is difficult.

- the decision related to the acceptation or rejection of the project is based on the comparison which opposes the value of IRR determined with the limit accepted rate of profitability required by the company. This one must be correlated with the revenue rate of

the alternative projects, if they exist or are supposed, in contrary case, the limit required rate is a subjective value, and its use together with the project's internal rate of revenue do not assure a good base for the investment decision.

The third criterion taken into account is the Net Present Value (NPV) which represents the difference between the sum of actualized positive annual cash flows and the sum of negative actualized annual cash flow, i.e. :

$$NPV = \sum_{n=0}^N \frac{+CF_n}{(i+1)^n} - \sum_{n=0}^N \frac{-CF_n}{(i+1)^n} \quad (4)$$

If, for the analyzed project, NPV is positive, that means the project can be considered acceptable (feasible). The positive value of NPV means that in the conditions of used rate of actualization, the investment project, during its entire economic life, assures not only the integral return of invested capital, but also supplementary revenue. If the actualization rate used in the calculation of NPV is the minimal revenue rate expected by the investor, and for NPV a positive value is obtained, that means the decision problem related to the project's financing in the company can be solved correctly.

- The negative value of npv shows that the project do not assure a revenue at the level of the used rate of actualization and it is considered non feasible (unacceptable). As a conclusion, as the value of npv is grater, in the given rate of actualization, as the project is considered better.

- When we analyze projects characterized by the same dynamics of the positive cash flows, the npv criterion can be reduced to the actualized to the actualized sum of negative cash flows. These projects are related, frequently, to replacements of equipment, without affecting the production capacity of the company. From these projects will be selected the project which is characterized by the minimal value of the sum of actualized negative cash flows.

- The NPV criterion is used widely, at the assessment of investment projects, due to the following advantages:

- take into account the influence of time on cash;
- take into account all the cash flows of the project, regardless the period of return of investment;
- represents, in essence the monetary value etalon which can be used as indicator of comparison of projects assessed at the present moment;
- anytime, for a given actualization rate, the calculated NPV is unique.

The NPV criterion has also some inconvenient, which limits its use, i.e.:

- the appropriate rate of actualization to be used in calculations is difficult to be adopted, in unstable economic conditions (as it is known, using greater rates of actualization can lead to rejection of good projects, and vice versa, a reduced rate of actualization can lead to accept projects which later becomes unfeasible);

- the NPV criterion is expressed in monetary units, and its value represents an absolute economic assessment criterion.

The assessment of projects on this criterion cannot lead to a rating of them upon the invested capital return Analyzing different scale projects we can take false conclusions regarding the self value of each project (bigger company has bigger NPV, but it is not sure that this company is more efficient). in conclusion the criterion can be applied only to projects having the same scale.

The WGR criterion is considered a basic criterion in the assessment of investment projects, because allows the comparison of projects with different life duration. This criterion presents the advantages of each project by its internal rate of return which can be compared with the rate of reinvestment of the company or requested rate or return.

We can say that WGR is equal to the requested rate of reinvestment when $NPV=0$. For this reason, this criterion assures the adoption of the acceptance/rejection decision as the NPV criterion. Because the WGR criterion allows the comparison of projects with different durations, it is a better method of ranking the projects. E.g., the projects with the same NPV, but different duration, can be classified only on the basis of WGR criterion.

At the analyze of the same project, the criteria NPV and IRR offer the same answer to the question regarding the acceptability. However, must be highlighted, that these criteria are based on the actualization of cash flows and can lead to contrary results when we compare mutually exclusive projects.

The conflict appearing between these two criteria is the result of the adoption of different values for the actualization rate. The IRR criterion supposes that cash flows are reinvested with a rate of return equal to IRR (during the whole life of the project), while the NPV criterion supposes that cash flows are reinvested with a return rate equal to the actualization rate used.

In case of using the IRR criterion for projects with high IRR we suppose the existence of high reinvestment rate, while for the projects with low IRR, the existence of low reinvestment rate is supposed. In both cases the real reinvestment rate of the company which realizes the projects is ignored. Only in a random situation when the calculated IRR is equal to the company's reinvestment rate this deficiency is eliminated. We can conclude that even if the projects are characterized by different values of IRR it is unlikely that their reinvestment rate is significantly different.

Contrary to the IRR criterion the NPV criterion supposes that the actualization rate represents the reinvestment rate which remains unmodified during the project's life. This rate has the character of a minimum admitted return rate of the company. However, the real reinvestment rate is higher than the minimal required return rate. As a result there are not many advantages in using one and the same rate of return for all the analyzed investment projects.

6. CONCLUSION

The main objective of the management is represented by the maximise the company value. This objective is equivalent with the maximise the shareholders' wealth, respective with the maximise the ordinary shares cotation of the company to the value burse. The above mentioned objective is reached if it is assured the optimal combination of the decisions of financial management refers to the following:

- Investment opportunities;
- Financial sources;
- Dividends distribution.

It must be said that the equivalence of objectives does not mean that these are identical. To maximise the profit and/or to maximise the shares cotation do not regard to:

- Its time factor and influence over the hoped gains.
- Different types of risk that may affect the coming again to made investment.
- Dividend politics.

The decision of investing is linked to evaluation of the efficiency of foreseen investments and to allocation the capital available between the alternative projects or concurrent projects. It is important to say that reparting the available capital on projects presumes that all projects of investments analysed do not differ regarding the risk of accomplishing inside

the company and that to adopt a certain project or others (or of a certain group of projects) does not change the global risk that characterises the company.

To adopt the decision of investment imposes to be evaluated each alternative project. At the evaluation of the projects, in global practice it is used a series of criteria known as evaluation criteria of the efficiency of the investment projects (Rate of Return, Payback Period, Discount Payback Period, Net Present Value, Net Future Value, Net Annual Value, Profitability Index, Internal Rate of Return, External Rate of Return, Wealth Growth Rate, Growth Rate of Return).

The criteria helps to be solved the problem of feasibility and the grade of attractiveness of the investment into a project or other. With the help of these criteria there can be order all the projects of investments that are the object of the analyse after their grade of attractiveness.

All the evaluation criteria are based on two main principles:

- Greater gains are preferable to small gains.
- Earlier gains are preferable to later gains.

It is important to say that all the criteria of evaluating the projects are based on quantitative indicators of the efficiency, but they are sure that they do not assure to be fundamental the decision of investment. These criteria determine the general orientation for adopting the decision that should be completed and may be corrected by taking into consideration the qualitative information regarding other economical consequences of accomplishing the projects, the technical and scientific progress, the social aspects, etc. Also, to adopting the decision it must be taken into account the risk of accomplishing the project.

As a result of the analyse of the methods and criteria for evaluating the economical efficiency of the projects, it may be concluded that each criterion has its own field of applicability, and to choose the correspondent criterion depends on the projects particularities and conditions of accomplishing them.

As it was mentioned above, for evaluation of the projects we may take into consideration that it must pay attention to the risk. Also, we must take into account that to fundament the decisions of investments is influenced also by the factors that are not good for numerical quantification, their way of taking into consideration crossing to the field of company management competence.

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