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Taking Risk into Account in the Evaluation of Economic Efficiency of Investment Projects: Traditional Methods

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Abstract

The article discusses traditional methods of evaluating investment projects, which are most frequently used in the corporate practice. There are many deficiencies that are held against those evaluation criteria, but there are also undisputable benefits ascribed to them. This article deals with their relation to risk, with the inclusion of risk in the evaluation of economic efficiency of investment projects.

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1. Introduction

The global market and consolidating position of Europe on such market place high demands on the level of knowledge and its transfer into new, progressive concepts, methods and tools of the financial management. At the same time, the dynamic economic environment in which firms act increases the level of uncertainty and risk in all business activities, including investment ones. The importance of integrating central principles of such activities, their objectives and stimuli into one system grows.

It concerns in line with the value-based management theory a complex mastering of all essential factors having immediate impact on the value of the firm, with various level of their integration. It means in relation to the investment decision-making that evaluation of investments cannot be made in isolation without any reference or

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relation to the firm as a whole, its value, and general performance position. Risk, earnings and time remain key factors of investor's decision-making in it. Quality of investment action effects estimate is primarily a function of the said three variables, as well as of the ability of the management to express their mutual relations and impact on the firm as subtly as possible.

The creation of value as the integral aim of the firm takes the form by selection and choice of adequate methods and techniques of its estimate. The basic methodological apparatus for value estimation is formed by models of discounted cash flows, which are at the same time a central point of investment decision-making and currently have the widest application area at global level. The real options methodology, taking risk into account and enabling flexible decision-making, has been so far a rare tool of investment projects evaluation and quantification of firm value estimate in the practice of Slovak Republic and surrounding countries.

From the perspective of integration objectives – complexity and mutual interconnection with regard to the basic objective of the firm – it is important to determine the interface between indicators of economic efficiency of investments and methodology for determination a value of the firm, whereby the same reference rate as for other corporate activities will be provided for investment activities and at the same time synergy effects and benefits for the whole will step out of anonymity.

The understanding of risk, traditionally decomposed to individual components according to risk factors and significance of their impact, is under conditions of integrated management system preferentially focused on the creation of value and potential threat to the same.

This article discussed benefits, limits and application problems of individual methods for evaluation of economic efficiency of investment projects with the assessment of risk acceptance rate. Special attention is paid to the methodology of real options as a promising tool of investment decision-making. The aim of this article is to assess current real possibilities of investment decision-making tools and to expand its theoretical-methodological basis with the value criterion.

2. Basic attributes of investment decision making

The basis of investment decision-making, i.e. making decisions about whether a particular investment project should be accepted or not, or which one of proposed variants of the project should be carried out, is the calculation of selected criteria of its economic efficiency. Such criteria usually measure the return or profitability of resources spent for the project implementation. The most frequently used indicators are based either on achieved profit, which is generated in individual years of project operation and determined from the profit and loss statement (indicators of capital return), or, and this is more frequent case, on cash flows constituted by monetary incomes and expenses during the whole life of the project, i.e. during construction of the investment, during its operation and upon its liquidation.

Determination of cash flows of investment projects plays a key role in their evaluation and belongs to the most demanding tasks of capital budgeting. That is due especially to the fact that there is a larger number of quantities transformed into cash flows of projects and usually there are more subjects preparing the project engaged in quantification of such quantities. A risk of incorrect estimate of amount and structure of cash flows is therefore created. Unjustified optimism is a frequent cause of such situation in practice; it appears that managers base their investment decisions oftener on unfeasible scenarios than on rational assessment of costs and expected profits of a project (Lehutová, Krizanova, Kliestik, 2013). Underestimation of the probability of unfavourable development of factors affecting results of the project results in biased determination of values of indicators of such project's economic efficiency.

Correct identification of cash flows represents a preparatory, starting phase of investment evaluation. Quality evaluation of economic efficiency of a project is connected with the requirement to separate investment decision-making from financial decision-making (Fotr, Souček, 2005). The basic approach to evaluation is then based on the assumption of full own funding of the investment and cash flows used for evaluation of its economic efficiency include investment and operating cash flows with the exclusion of financial flows. Those serve for the assessment of financial stability of the project in relation to the chosen form of its funding. It concerns testing the ability of the project to pay from its incomes debit interest, repayment of credits, leasing instalments, etc. In case the assumption

of funding the project solely by own capital does not apply, the importance of another aspect of decision-making, namely the liquidity, grows.

As we have already mentioned, reliable and objective estimate of project cash flows is crucial in investment decision-making. That could mean in the context with firm value or shareholder value that the firm accepts projects not leading to growth, but rather to the reduction of its value, or accepts projects with risk that is too big and the implementation of which could put the existence of the firm in danger. That means that in addition to identification of structure and amount of cash flows we should identify also factors having immediate impact on the project value and firm value, so-called value drivers (Kislingerová, 2004).

Risk understanding is multi-dimensional in the investment decision-making. At the general level, it is related to business risk, to upside risk and downside risk, from other aspect to a systematic, market risk, which cannot be diversified and to which every business subject is exposed, but also to a specific risk, corresponding to both particular conditions of the firm and to specifics of the investment project. More detailed classification of risk can be found in Brealey and Myers (2000), Gitman (2003), Kislingerová (2001) and Kliestik (2004).

The investment project risk is, similarly as the business risk, related to the probability of occurrence of deviations of key parameters of investment decision-making (economic results of project, cash flows, economic efficiency indicators, etc.) from their expected values. There are basically two causes of occurrence of deviations: 1. uncertainty of economic life; every human activity is related to uncertainty, it is related to dynamics and variability of the environment in which the human society exists and a reliable estimate of factors affecting the success rate of a project is not possible due to the uncertainty, 2. management behaviour, e.g. inadequate knowledge of processes generating risk factors, application of unsuitable methods of estimating their future development, taking incorrect decisions in various spheres of economic activity, choice of inadequate methods of evaluation of project's economic efficiency, usage of unsuitable information sources and others (Kliestik, Bartosova, 2005).

The time factor is present in the investment decision-making as an individual variable. Time is one of dimensions in which the economic process takes place and within a certain context represents a special risk factor positively or negatively affecting economic quantities and their mutual relationships.

Prophylaxis and reaction to risk is caution. Caution means reasonable estimate of phenomena, which takes into account potential risks and losses with the aim to prevent their transfer into the future. It is a philosophy that is applied as part of the project risk management and leads to a whole number of prophylactic measures. From the perspective of time, work with risk forms part of project preparation from its start until the final decision about the acceptance of the project and its implementation, or until its refusal, respectively. However, the project risk management is conceived in a much wider extent; it is a complex, systematic procedure, which, in addition to identification and analysis of risk factors and determination of the importance of their impact, includes also continuous evaluation of risk and operative management thereof during the implementation and operation of the respective project. Work with risk is de facto finished only with the liquidation of the project.

Risk is transposed into efficiency criteria in the stage of evaluation of the economic efficiency of the project, which means that further consideration of risk factors and their number is a matter of structure of a particular indicator, its mathematical formulation and economic interpretation (Kollar, Kliestik, 2014). At the same time, the risk premium might not be explicitly expressed in the indicator.

Literature specialized on these issues often contains differing classification of methods of evaluation of economic efficiency of investment projects, but also different approach to risk and uncertainty. We will start from the assumption that risk is part and consequence of uncertainty and that the probability of occurrence of unfavourable economic results can be foreseen and estimated with a certain degree of inaccuracy (the identification of uncertainty with zero probability to determine consequences of investment decision is in our case substituted with estimate inaccuracy).

With regard to the analysis of methods of evaluating the project efficiency we will be interested in their ability to take risk into account and to express such risk mathematically and at the same time to create a relation to the firm value. In addition, we will evaluate also the possibility of flexible decision-making about a project and other aspects of investment decision-making, which differ in individual methods.

3. Return indicators – relation to the risk and the shareholder value

These indicators belong to the category of typical financial analysis indicators and as traditional, so-called static methods are used also in the investment managerial decision-making. Their philosophy is based on the comparison of capital put into the investment and profit arising from its implementation, meaning that they measure the yield of capital used for funding an investment project.

The structure of such defined ratio indicator allows several modifications depending on the particular form of its numerator and denominator. Following modifications are most frequently used (Krajčovič, 2000) in the economic practice:

- return on equity (ROE); it is the ratio of earnings after taxes (EAT) or earnings before taxes (EBT) to equity invested into the project. This indicator expresses the rate of evaluation of own resources used for funding the project,
- return on assets (ROA); it is quantified as the share of total capital invested into the project and profit represented usually as earnings before interest and taxes (EBIT), or as a sum of earnings after taxation and taxed interest, i.e. taxed EBIT,
- return on investment (ROI); this is the return from long-term project funding sources, i.e. without the usage of short-term capital; the numerator usually uses the same category of profit as the previous indicator.

Compared to usage of indicators in the analysis of financial situation of a firm (where we use items of financial statement), indicators of return have in the investment decision-making certain specific position; both the determination of the amount of capital invested in the project related to the identification of investment costs and investment operation costs and distribution of those costs in time, as well as the connection to bookkeeping and its specific form (e.g. method of depreciation, evaluation of assets, etc.), can be problematic (Klietnik, Bartosova, 2004).

There is also another problem from the perspective of methodology, same as with classic financial analysis, namely the problem of "intersection" of flow and stock positions. Financial analysis deals with this issue by using mean values of stock indicators, whereby a better explanatory power is achieved. Another indicator, the accounting rate of return of project (ARR), attempts to remove this shortcoming in evaluating investments. This indicator works with mean values of partial indicators. It is represented by the following equation:

$$\acute{U}RP = \frac{\phi EAT}{\phi DM} \cdot 100 \quad (1)$$

Where:

$\acute{U}RP = ARR =$ accounting rate of return of project [%],

$\phi EAT =$ average annual earnings after taxation [€],

$\phi DM =$ average value of acquired fixed assets (investments) [€].

The average annual earnings of project after taxation is determined as arithmetic average of profits gained in individual years of its operation. Average value of fixed assets is determined as arithmetic average of price of assets under which it is recorded in accounting books (usually acquisition price) and its residual value at the end of useful life (Damodaran, 2001). The higher the profitability (return) of the project, the more – on the grounds of this criterion – economically efficient the project is.

In addition to specific form of national accounting system and its conventions, which represent a limiting element of return or profitability indicators, their main disadvantage is the fact that they ignore different time value of money and the risk related to it, which is in criteria based on discounted cash flows expressed by means of discount rate. Taking risk factors into account is made solely in prognoses of individual parameters creating input data of such indicators (Copeland, Antikarov, 2001). With regard to said restrictions indicators of profitability in investment decision-making are only of additional nature; they are fit especially for fast, informative assessment of

benefit of investment projects with short life, or in cases where data necessary for deeper analysis are missing. The advantage is in comprehensibility and relative simplicity of this method.

4. Firm profitability and value

The integration of indicators of investment project return with the firm value will be based on the assumption that the value is increased for the shareholder by every investment action which is profitable, i.e. brings earnings, whereas it is not enough for the return on investment to achieve positive value, but it is necessary to determine a reference rate, the value of which will represent the limit. Its choice is based on the philosophy of opportunity cost. According to the concept of value based management it is necessary, in order to maintain a firm, for the return of the owner to be at least at the level of alternative cost of capital the owner put into the firm, i.e. to be at least equal to the return from alternative investment with similar risk (Trigeorgis, 2001). By analogy we can formulate the condition for integrated evaluation of the investment project with shareholder value: it is necessary in order to maintain the firm value for the return of the owner from each performed investment project to be at least at the level of alternative cost of capital the owner invested in the project. Positive range between the return of the project and alternative cost of capital signalises growth of value and forms the basis of structure of the indicator economic value added (EVA).

EVA has in the evaluation of firm performance the following form:

$$EVA = (ROE - r_e) \cdot E \quad (2)$$

Where:

ROE = return on equity [%].1/100,

r_e = alternative cost of equity [%].1/100,

E = equity [€],

EVA [€].

For identification of increase in value for the owner from the investment:

$$EVA_i = (ROE_i - r_e) \cdot E_i \quad (3)$$

Where:

EVA_i = economic value added of the project [€],

E_i = equity used for funding the project [€],

ROE_i = return on equity of the project [%].1/100,

r_{ei} = alternative cost of equity [%].1/100.

In case of full funding of the project by equity the reference rate will be costs of equity, in case of simultaneous engagement of outside funds and equity it will be weighted average cost of capital (WACC). The weight is the share of the respective capital item in the financial structure of the project. As the outside capital is under our conditions usually a bank loan, costs of outside capital is represented in WACC by the interest rate (Cisco, Klietnik, 2013). Problematic issue can be - in both the first and the second instance - especially the estimate of costs of equity, which are connected with the investment project and its financial structure, whereas procedures known and applied in the financial theory and practice are related to the firm as a whole.

Specialized literature deals with analogous problem in the determination of discount rate for dynamic methods of evaluation, for instance Luehrman (1998), Petřík (2005) or Buc and Klietnik (2013). Problem solution is ideologically based on the classification of investment projects into two categories: 1. projects that form inseparable part of the existing firm and the financial structure of which does not significantly affect the financial structure of

the firm, here the project risk is identical to the risk of the whole firm and is well expressed by weighted average cost of capital of the whole firm (WACC), 2. projects that are relatively isolated from the firm activity, so-called greenfield projects, where it is necessary to take into account the financial structure of the project and its costs of capital. More in Damodaran (1994).

It is very difficult to estimate the behaviour of subjects providing capital in practice, all the more if we are considering different financial structure of the firm and the project. However, we are of the opinion that without regard to differences between them, requirements of creditors and capital investors will be based especially on the evaluation of firm creditworthiness and viability of the investment project. Such assumption removes at least the problem of the need for specific procedures for quantification of costs of equity (Kliestik, Lyakin, Valaskova, 2014).

Otherwise we can base the estimate of costs of equity of the project on the risk-free rate of return increased by the risk premium; that should take into account in form of risk premium both the firm risk and the risk of the project itself.

5. Static methods based on cash flows

Methods and techniques belonging to this group do not work with accounting risk and various forms thereof, what is an advantage, but on the other hand they do not respect, similarly as return indicators, risk and do not take into account the factor of time sufficiently, because they do not discount their inputs - cash flows expected during the implementation of the project.

The best known indicators, commonly used in practice because of undemanding calculation and comprehensible interpretation, include:

- payback period (PP); payment time means number of years required to compensate the initial investment by accumulated cash flows of the project (net earnings, i.e. the difference of incomes and expenses during the whole life of the project), whereas the distribution of cash flows in individual years of the project life is not even; therefore the calculation is made "manually" without using equation; modification of this indicator works with discounted cash flows and takes into account individual aspects of investment decision-making significantly better;
- average payback period is another application form of the payback indicator; it expresses the time in which the investment will be repaid in case of even performance of cash flows. This indicator has following form:

$$\phi PP = \frac{C_0}{\phi CF} \quad (4)$$

- average annual return – is given as a sum of cash flows of the project divided by the number of years of the investment life:

$$\phi CF = \frac{\sum_{i=1}^n CF_i}{n} \quad (5)$$

- average percentage return – is an alternative of the average annual return; it takes into account the amount of invested capital, expresses how many per cent of the invested capital returns to the firm annually on average:

$$\phi r = \frac{\phi CF}{C_0} \cdot 100 \quad (6)$$

Where (for all mentioned formulas):

ϕPP = average payback period [years],

$C0$ = investment costs [€],

ϕCF = average annual cash flow of the project [€],

CF_i = cash flows in individual years of the investment life [€],

$\sum_{i=1}^n CF_i$ = sum of cash flows in n years [€],

n = investment life [years],

ϕr = average percentage project return [%/year],

other symbols are the same.

As we already mentioned, none of the indicators explicitly takes risk into account, does not include the risk premium and does not discount cash flows.

Payback period and average payback period are indicators that have full-fledged economic interpretation only in connection with a certain limit (standardised) value similarly as in the case of return indicators. Such value is usually value for business or industrial sector to which the firm belongs, or value determined on the grounds of previous experience of the firm with investment activity (Kliestik, Birtus, 2005). The project is acceptable if the value is lower than the limit value. It generally applies that: the shorter the payment time, the more economically beneficial the project is. This criterion is applied especially in case of simultaneous evaluation of several projects or project variants.

Interconnection of the payback period to the firm value is missing, but we can build on the assumption that the shorter the payment time, the faster the value increase for the owner is generated, provided that the return of the project is at the same time acceptable according to other criteria.

We can use for this purpose mentioned indicators of project profitability or indicators of return based on the cash flow (CF). The structure of both indicator groups rests in the same attempt to express the benefit of invested means by comparing them with the achieved effect of the investment, which is the profit or cash flow.

It should be emphasized that with regard to the nature of profit and CF categories the cash flow represents more real return, because it is formed by performed cash flows, whereas profit can be overestimated due to non-collected claims (Ambrož, 2001). Comparison of the project return with costs of capital by which it is funded also includes certain indications of accepting risk. As we already mentioned, the range between them is in direct relation to the firm value.

Experience from the economic practice confirm that static methods, especially the payment time, belong to the most widely applied criteria of evaluation of economic efficiency of investment projects. However, it is recommended due to their shortcomings to use them only as additional criteria or separately in case of projects with short life, projects with high risk, or for initial assessment of the project.

6. Conclusion

The formulation of the basic aim of business activity has been for a longer time accepted by the theoretical circles as part of the value based management philosophy. According to this concept, the emphasis is placed on alternative methods of firm value quantification on the basis of DCF (discounted cash flow). This model is applied in the Slovak Republic conditions mainly in the FCFF (free cash flow to the firm) variant, or FCFE (free cash flow to the equity) variant, more rarely in EVA (economic value added) variant. It is the second structure of the indicator that is starting to be with regard to its benefits more and more implemented in both the theory and practice. From the perspective of defined objectives of the project, it is important to develop its interconnection with the methodology of real options and its application in the evaluation of investments efficiency in a particular firm.

There are currently various approaches to the theory of real options, which can be applied virtually to any sphere of business activity. Real options represent a tool which improves traditional DCF models both in relation to the firm value (they widen the view of the firm value with the component of option premium) and in relation to investment decisions. This fact makes them a promising tool of flexible financial management stimulating the creation of firm value in investment decision-making.

There are many works of foreign authors (see bibliography references) that deal with the options approach in the field of capital budgeting and its applications. Under our conditions, no-one is dealing with the issue of real options or their synthesis with the firm value to a more significant extent; theoretical level of elaboration on this issue is insufficient, modified and integrated procedures and solutions of particular applications for the economic practice are completely missing.

Creation of value is currently a key, generally accepted integral aim of the firm, which is specified by the selection and choice of adequate methods and techniques for estimating it. The basic methodological apparatus is formed by the discounted cash flow models, which are crucial also to the investment decision-making and today have the widest area of possible application at the global level. The methodology of real options, taking into account uncertainty and risk, has been so far only rarely used tool for evaluation of investment projects and quantification of the estimate of the firm value in the practice of Slovak Republic and surrounding countries. It can be expected that in addition to traditional evaluation methods, which still have a sufficient space in the evaluation of investment projects also in our country, the theoretical-methodological basis of investment decision-making will have to be extended with the integration of application of procedures with value criterion, especially in spheres of business activity which have a high risk rate and volatility of investment projects.

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