Reports on Economics and Finance, Vol. 1, 2015, no. 1, 145 - 156
HIKARI Ltd, www.m-hikari.com
http://dx.doi.org/10.12988/ref.2015.51216

Risk and Uncertainty in the Investment Decisions*

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Abstract

Effectiveness of investment enterprises is determined in connection to the future economic conditions, which results in connection with the uncertainty and hazard. New, future conditions are shaped by many factors which are difficult to predict and determine and in the same way it is hard to quantify the direction and strength with which they will influence on the particular elements of summary of investment effectiveness. One of the fundamental aims of undertaking the investment enterprises is the maximization of project's value as well as the enterprise which realizes it. However the objective cannot be achieved by any means. Beside the time factor concerning the rate of accumulating capital of risk level must be taken under consideration which is connected with making the decision and accomplishment of the investing enterprise. The purpose of this article – on the basis of uncertainty and risk terms and their connections – is to determine the crucial methods of risk quantification and their classification. Accepting the assumption that risk cannot be eliminated completely, the appropriate direction of action is its acceptance in assessment of forming the further profits from investments.

Keywords: risk, investments, effectiveness

1 Introduction

Being one of the subsystems, the investment sphere stays in relation which is strong and in different with the whole economic process, influencing strongly on

* Publication financed by funds granted to the Management Faculty of Cracow University of Economics under the scheme for subsidising university research potential.

its effectiveness. The crucial problem is choosing among many possibilities to realize the investing enterprises, those which are characterized by their high effectiveness in the particular conditions. It is helpful to use the economic and financial assessment considered to the accomplishment of enterprises including the summary of investment economic effectiveness which is understood as formalized way of comparing quantified elements and amounts concerning the determined investing purpose.
The economic and financial effectiveness of investment enterprises is determined in connection with future conditions of economy which result in connection to uncertainty and hazard. New, future conditions are shaped by many factors which are difficult to predict and determine and in the same way it is hard to quantify the direction and strength with which they will influence on the particular elements of summary of investment effectiveness.

It is difficult to predict the changes of future prosperity, level of expanses and prices, currency rates, duty, taxes, loan interest rates, changes in technique and technology, organization and demand and supply of goods and services, as well as many other factors having influence on the summary of investment effectiveness. One of the crucial and final purposes of undertaking such investment enterprises is maximizing the value especially in the context of capital management. However, the objective cannot be achieved by any means. Beside the time factor concerning the rate of accumulating capital, the risk level must be taken under consideration which is connected with making the decision and accomplishment of the investing enterprise.

2 Risk and uncertainty in the process of taking the investment decisions

Investing is this kind of activity which can bring increased effects in the future on the basis of the benefits postponed in time. The benefits obtained in present time can be considered as constant, and the benefits being possible to achieve in the future are regarded only as the probable. Due to the fact that the investment decisions concern the future events, it is necessary to predict the changes which can appear on the market – in surroundings of subjects taking the decisions about the realization of investment enterprise. The reason and source of necessary foreseeing of these changes is the fact that allocation of the investment sources in the market economy is realized mainly by the mechanism of shaping the competitiveness conditions influencing on varying the level of profits and in this way it causes the flow of material and financial means between different application areas. The market influences on leading investment activity when signals which flow out from it, find their reflection in the decision of business entities, but the effectiveness of this influence is dependent on competitiveness existence, as well as the capital market, market balance including the investment market and the possibilities of free flow of material and financial means to different applications [18]. The indicated market influence on the investment activity

can be presented in the form of simplified scheme (see Fig. 1.), it is crucial though to pay attention to the fact that the market mechanism – influencing on the process of taking investment decisions – does not always inform the investor properly about the future directions and effectiveness of defined projects of investment enterprises. The reason of such situation is the fact that market mechanism is characterized by the current conditions of realized economic process, and the investment enterprises refer generally to the long horizon of time in which the change of process character develops [20]. Concluding and predicting in reference to the shape of the future economic surrounding can be only its approximation. In this context, correct conducting the analysis of changes which took and take place in the surroundings, introduction of the appropriate line of trends and their extrapolating into the future which is not sure though [11].

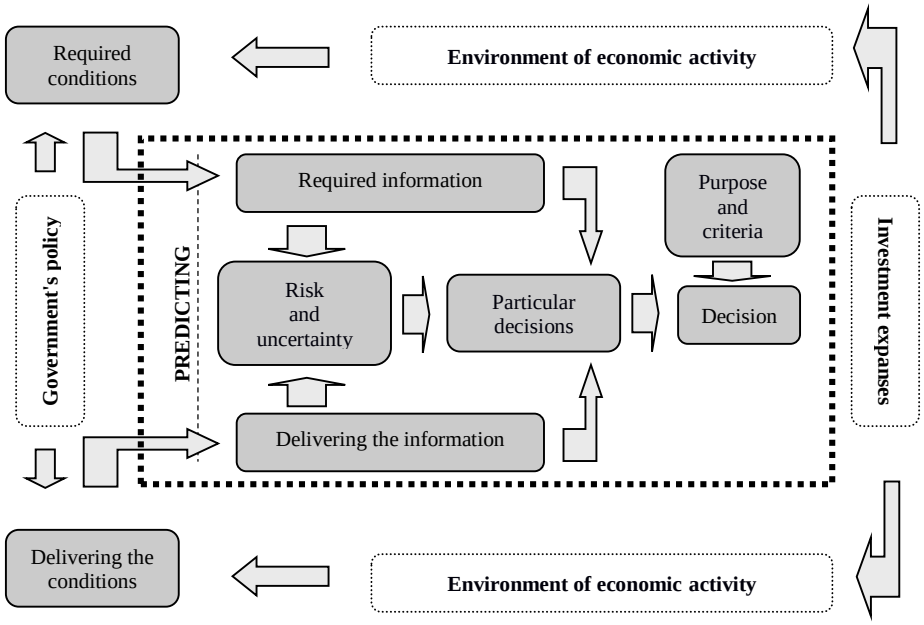

Figure 1. Scheme of market influence on the investment decisions of enterprises
Source: [9]

In the situation when at least one from its defining factors is unknown, but the rest is known, the probability of its appearance can be defined as risky, while the probability can be either measurable or can be only noticed by the decision–maker. Concerning further, it should be adopted that the risk is connected with the possibility of obtaining the aimed effects or bearing unintended expenditures, or even loss. Any investment decisions must include the systematic analysis of risk factors and the major sources of risk, the macro– and microeconomic factors (of the competitive surroundings and the actual exclusively for the particular enterprise).

In this context, as the general regularities can be indicated that [8]:

- the more the enterprise and its developing plans are sensitive for the macroeconomic factors, the less possibilities of influence it has on their forming and in this way its activity becomes less risky,
- the more sensitivity on the microeconomic factors the enterprise and its developing projects reveal, the possibilities of their changes increase as well as the potential risk decreases,
- the systematic analysis of risk[1] and determining the expected effectiveness of endeavour allow for the realization of risk and effectiveness as the final basis of sense assessment in reference to taking the developing decision.

The crucial term from the point of view of investor taking the investment decisions is the problem of relationship of risk, in their undertaking, with the effectiveness of endeavour which is to be realized [19]. Concerning it, mostly the investor puts lower risk over higher and current profit over future in presence of unchanged other conditions. Therefore, while making the decisions, investor should apply three major indicators [5]:

- higher risk is accompanied by awaiting for the higher profit,
- the increase of risk brings the possibility of loss,
- the border of the rational decision, from the point of view of risk, is created by the situation, in which the probability of achieving the benefits is equal the probability of loss equal to the value of that benefit.

The risk of investment endeavours can be generally considered in three dimensions, i.e. as [4]:

- the risk of singular investment endeavour,
- the risk of investment enterprise connected with mutual influence of obtained goods risk on undertaken endeavour and vice versa,
- the market risk and possibilities in multi directions of investing the capital.

Identification of those three dimensions of risk perception has the crucial practical meaning, because it is hard to probe that the investment endeavours of high risk level considered separately can be at the same time the endeavours of low risk level on the market, which means that diversification of enterprise's assets can lower the risk level of the particular investment enterprise in the significant way.

3 Relationships between risk and uncertainty

Risk connected with taking the investment activity results from the fact that the prospective summary of economic effectiveness in investment enterprises requires predicting the way of forming in the future many elements and parameters (price,

[1] The method of SWOT analysis, analysis of sensitivity or statistical methods can be used here.

expanses, currency rates, interest rates, level of technique and technology, etc.). If these values did not change – if they were „certain" – there would be no risk. However, they all change in time and their prediction is connected with higher or lower level of uncertainty – uncertainty is then the cause of risk. Uncertainty is the incommensurable phenomenon and appears in long periods, but the risk is measurable phenomenon and is connected mostly with short periods. The measurement of risk is value of potential loss (or lack of profits), which would appear if there was no variant chosen in taking decision, which would turn to be more beneficial in case of its realization.

Uncertainty is the category of multi–layer structure[2]. The structure indicates the difficulties of ambiguous and adequate reflection of uncertainty factors in operating and development of enterprise [16]. One of the attempts to approach to the issue of uncertainty is the structural and functioning concept which allow to identify the basic dependencies appearing between various factors responsible for its shaping. In this attitude, it is believed that uncertainty is generated by factors being inside the enterprise as well as by the outside factors [6]. The inner uncertainty can be defined by its three kinds: agents' uncertainty, uncertainty to subjects and structural uncertainty[3]. The outside uncertainty concerns the surroundings as the generator of disorders in functioning and development of enterprise. The inner and outside uncertainties of „enterprise" system interpenetrate and convert into the uncertainty referring to the value of expected profit. The balance between the expected benefit and uncertainty constitute the criterion of undertaking any economic activity [2]. In this context, benefit is presented as the effect of correct future prediction by the entrepreneur – or in other words – benefit is the compensation for bearing the uncertainty by the entrepreneur [14].

The crucial problem is the connection of risk with uncertainty. On one hand, risk is the result of uncertainty experienced by the decisive subject and on the other hand the value of capital engaged in the realization of decision. There is a strict connection between uncertainty and risk[4]. These categories concern the chronological and alternatively phases appearing one after another (uncertainty and risk) of the same decisive process. One can agree with the conclusion that risk

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[2] The principal layers of uncertainty for the system "enterprise" are scarce resources, insufficient information, ambiguous situations, unspecified issues and unpredictable behavior.

[3] Economic uncertainty apparent from the limited predictability and ambiguity of human behavior in the business environment, in its regulatory subsystem and subsystem real. Uncertainty associated to subjects is available with the unreliability of real processes, and structural uncertainty stems from the interaction between system elements "enterprise".

[4] Mostly, the conclusions are formulated in reference to the fact that risk appears when the probability of appearing of certain results is known, therefore the situations in which the distribution of probability is not known, are treated as uncertain.

is the function of uncertainty [15], wherein the higher the scope of uncertainty is, the bigger risk it is connected to and otherwise. Further, it can be accepted that risk does not exist where uncertainty does not appear and where any capital is not engaged [17]. It should be noticed though that risk increases together with the amount of capital engaged in the undertaken endeavour and it reveals in the form of entrepreneur's income decrease in case of unsuccessful endeavour [13]. But it is not reasonable as it may seem to accept the conclusion formulated by many authors that only risk has features of dynamic phenomenon, while the uncertainty carries the features of static phenomenon. Uncertainty is also the dynamic category which is decreased or increased together with flow of new information while the changes of uncertainty often have the step, discontinuous character, which is the result of the fact that social economic reality is not being changed steadily.

Risk being inseparably connected with economic activity and investments is not any special phenomenon or state – aberration. It is the matter of interests of risk management [21], whose aim is to warranty safety for enterprise and keeping its value [12]. Broadly defining, management of risk is the system of methods and activities leading to lowering the level of risk influence on the enterprise functioning and aiming at this to take the optimal decisions. To make it effective, it should be the solution with the systemic features [1].

4 Manners of investment risk measurement

The starting point in analysis of risk in investment decisions is dependency of its level on time. In this respect the following conclusion should be accepted that together with lengthening the time horizon, the uncertainty of predictions increases. Taking into consideration the basic category used in analyses of investment endeavours i.e. predicted flows of net money can be indicated that despite indication by them certain expected values, in the future the scope of those flows and similarities increase with time passing. Together with time flow, the expected value of net money flow decreases, but the probability of achieving the varied result from the expected value increases which presents the increase of bearing risk (see Fig. 2.). For carrying out the compensation of the increasing risk tendency (alignment of recent flows with earlier ones) the increasing interest rate in the summary of discount is used, therefore the existing relationship between risk and time is included: risk is higher in lower rather than shorter time horizon.

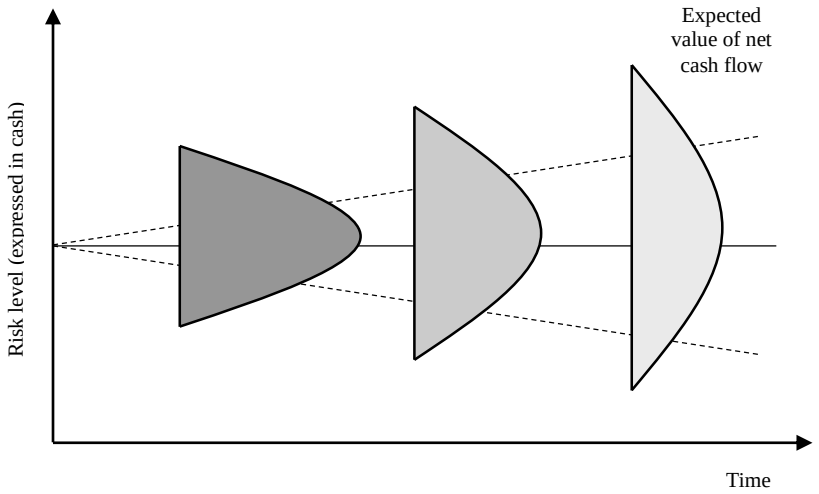

Figure 2. The relationship between time and the level of risk
Source: [3]

Introduction of developed methods of effectiveness assessment in the investment endeavours results in abandoning the determinative attitude in estimating the level of their economic profitability, for the probabilistic attitude, which means accepting the basic variables of the assessment on many possible levels, together with referring probabilities of existence. Among the factors, which have the influence on choosing the method of risk analysis in the investment endeavours, the following should be enumerated:

- scope of risk, availability and range of information as well as numerous data,
- conditions of investing including time horizon,
- collection of available methods of risk analysis in the particular conditions and terms of their application.

The methods used in the analysis of risk in the investment endeavours can be divided by accepting the various criteria:

- application of the risk analysis technique,
- the manner of defining the risk during the decisive process,
- the scope of available information and statistical data.

From the point of view of applied technique of risk analysis, the following can be distinguished as:

- method of correcting the effectiveness – including the risk by percentage corrections of chosen parameters and variables appearing in the methods of effectiveness assessment in investment endeavours,
- method of sensitivity analysis – conducting the changes of chosen parameters' size and variables of effectiveness assessment method and researching the influence of those changes on economic profitability, together with indication of the critical values and the safety margins determining the effectiveness level,

- probabilistic and statistic methods – using the theory of probability and statistics in risk analysis,
- methods of simulation – determining the influence of many variables on economic profitability of endeavour and introducing the simulation of risk level.

Including the manner of risk recognition in the decisive process, the following are distinguished:
- direct methods – including risk directly in the decisive criteria connected with the determined method of assessment in investment endeavour (not being the decisive criteria),
- indirect methods – allowing to obtain additional information about investment endeavour risk level (not being the element of decisive criteria but being separate element of decisive process).

Taking into consideration the range of available information (including numerous data), the following are distinguished:
- measures of volatility (standard deviation, coefficient of variation, analysis of simulation, analysis of scenarios),
- sensitivity measures (risk assessment in the discount rate, equivalent of certainty for cash flow, returning period for flow risk),
- hazard measures (*VAR method*).

In the practical applications, the most common usage is found by the methods of risk analysis in investment enterprises, including especially the sensitivity analysis, analysis of scenarios and analysis of statistics. Due to the necessarily higher level of relevant and instrumental preparation on the site of people and subjects conducting the analyses, the method of simulation is used in lower level. The direct methods are applied in the more limited way including the equivalent of certainty and discount rate with risk.

Analysis of sensitivity
Indirect method, is to examine the impact of future changes in shaping of basic investment project variables, on the level of its effectiveness. The implicit assumption is that during the implementation and operation accepted values of its variables can adopt levels other than expected. This analysis provides a basis for determining the sensitivity of the results to changes in the assessment of the effectiveness of different variables. The result of the use of sensitivity analysis is the information used in making an investment decision, containing the size of absolute deviations and relative terms, limits, flexibility and safety margins.

Analysis of scenarios
As an indirect method is performed with the use of aggregated or non–aggregated recognition. The essence of this method is to identify scenarios assuming the acceptance by an independent explanatory variables occurring in the algorithm of the method of assessing the effectiveness of investment projects, specific values in

the future. The information obtained through sensitivity analysis is used in this case, drawing up on the basis of possible options (scenarios) of the future development of the independent variables. Scenario analysis is the most common stage of work needed to be done to apply the probabilistic methods on the basis of the information obtained.

Analysis of statistics (probabilistic and statistic method)

The essence is the assumption that the risk of the investment project can be determined by estimating the dispersion of possible outcomes with respect to a central value, which is the expected value. The risk level of the investment project in accordance to this assumption is the higher, the higher the dispersion of results with respect to the expected value is. The risk in these methods is defined therefore as a possible deviation from the expected value, which is the net benefit measured by a variety of methods of assessing the effectiveness of investment projects. As a measure of the risk, the variance or standard deviation are considered as absolute, and for projects of different scales, it is appropriate to refer to relative risk measures in the form of a coefficient of variation.

Analysis of simulation

Monte Carlo simulation analysis, as an indirect method of risk analysis of investment projects, eliminates the disadvantages of two basic scenarios – a limited number of scenarios studied and the assumption of a positive correlation between independent explanatory variables. With the use of a determined statistical distribution of dependent variable from simulation analysis, one can estimate the probability of achieving it, or the value of a particular time, or a value greater or less than the specified. In the first case the probability density curves which were evaluated in a method used for the simulation are used along with the parameters of the distribution (standard deviation, the expected value, etc.). In the latter case, standardized normal distribution is applied.

Method of border payback period

In the methods of direct analysis of investment risk, the risk is reflected in the algorithm of methods for assessing the effectiveness, i.e. the absolute criterion for decision–making based on that method. The method of marginal recoupment period takes into account the risk by setting arbitrarily short period of return on investment for projects with a high level of risk. The assessment to minimize the period of payback is the adoption of the assumption that if the value of measures assessing the effectiveness of forced limited period of calculation (the shorter the life cycle of the project) is greater than the minimum requirement of effectiveness, it will be larger (and more) also for the entire life cycle because for the typical endeavours after the border payback period, there are only positive cash flows.

Method of discount rate with risk

The theoretical premises of methods concerning the discount rate risks (*RADR*) refer to the theory of diminishing the marginal utility of money income and the

general reluctance of investors to take risks. Therefore, the higher level of risk may be accepted provided that the additional benefits (compensation) will be achieved. This compensation is included in the risk premium that has to be higher and in accordance with the greatness of risk level for the investment project. This implies a need to increase the discount rate. An increase of risk premium, thus raises the requirements for project investment, while ensuring higher safety margin projects.

Method of certainty equivalent

The method of equivalent of certainty in net cash flow (*CECF*) can be considered as an alternative methods of the discount rate with respect to the risk as it assumes that if the modification discount rate is difficult to achieve, you can modify net cash flows. Therefore the modification is to replace the forecast cash flow (risky cash flows) with the cash flows whose size will certainly be achieved, i.e. values without risk. The first certainty equivalent method evaluates the risk of net cash flows, and then determines the value of certainty equivalent, using the method: subjective, objective (statistical) and based on a discount rate risk.

5 Conclusion

Assuming that risk can not be eliminated entirely, the best method is its inclusion in trend analysis of the future benefits of investments, the financial condition of the company and its values. For this purpose successfully suitable is the sensitivity analysis, which is carried out to see whether it is possible to improve the performance indicators, the change of some variables in in calculating the efficiency of the investment project assessment. With the help of sensitivity analysis you can find the factors that are of utmost importance for the enterprise and identify opportunities for substitution of these factors that pose a risk. In other words, it is about creating certain provisions (alternatives) in the event of possible and unforeseen deviations in shaping the parameters of the summary. The indisputable principle of the market economy is the feedback risk and responsibility for current and future results of operations of the enterprise [10]. The ability to think and act in terms of the future requires interpretation and anticipation of uncertainty. It should be noted that risk leads to success if it is taken with full awareness of uncertainty, it is based not only on experience and intuition, but primarily on comprehensive analysis of opportunity (opportunities) and threats. It is accurate to say that the use of the opportunity inherent in the environment provides the success of the enterprise. The actions of the company should focus on maximizing the opportunity of additional, complementary and disruptive, and not on risk avoidance [7]. If the behaviour of the company will be focused on risk avoidance, then it will suffer the most and least justified from all possible – the risk of inaction.

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Received: December 20, 2015; Published: December 30, 2015