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The economic efficiency, the risk and the risk determining methods in the investment decision

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Abstract : Investments represent one of one country's economic growth determining factors. The evolution of economy strongly depends on their volume and structure, which means on one hand the development of added value, respectively GDP, and on the other hand, it stimulates the growth of production and services, hence economic growth. One cannot conceive economic growth without an upward dynamics of investments and without an important percentage of investments in one country's GDP. Knowing the different risk types and their calculus methods will allow the investor to invest in projects that generate higher incomes compared to the risk they generate.

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JEL Classification: G01; G32; F36

1. Economic efficiency indicators

Economic efficiency is one of the various ways of efficiency concept utterance, which utters the capacity of one good, action, activity, product to satisfy the user's needs. (Tașcă , R. 2009.p31)

The investment effort regards the investment and production process and the economic effect includes the direct or indirect results of the efforts.

The factors that bear upon the economic efficiency of investments are:

- Selecting of investment projects
- Compliance of the terms in the investment project

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- Project implementation at lower costs

The ratio between the effort and the result represents an important element in choosing the best investment options, but it is not the only criterion of selection. More indicators are mentioned in the specialty literature, indicators that support the choice of the best decision regarding the investment process as following:

- **True to the nature of the economic efficiency indicators:**

♦ **Natural indicators** which allow the quantification of the quantitative characteristics of the investment process and which differ from a field to another; the most frequent indicators are: the length of the investment implementation, the number of employees, the production capacity, the raw materials consumption etc. these indicators can also be classified in 3 groups as follows:

- **Considering their economic significance:**

- the indicators of working means: useful surface, the equipment usage coefficient, the production capacity of the equipment etc.

- the indicators of labour force: time spent for the manufacturing of one good, the percentage of the automated work in one employee's working time etc.

- the indicators of the activity results: the technical features of the product, the production volume expressed in natural units etc.

- exploitation indicators: the raw materials and other materials consumption, labour productivity in natural expression etc.

- **Considering the inclusion sphere:**

- general indicators: labour productivity, production capacity of equipment etc.

- specific indicators: specific material consumption etc.

♦ **Value indicators** that valuably reflect the ratio between the investment effort and the gained effect of the investment objectives implementation. **These indicator can also be classified as follows:**

- Basic indicators that, considering their content, mark the general aspects of the investment efficiency, that can be used in any field: the production value, the specific investment, the investment liquidation etc.

- Additional indicators, that complete the basic indicators: the automation degree, the specific utilities consumption, the nature of the used energy etc.

♦ **Considering the calculus method, the economic efficiency indicators can be classified as follows:**

- Indicators that are not mentioned in the appraisal methodology of the economic efficiency: the economic efficiency, the recovery speed, the internal investment efficiency rate etc.
- Indicators that are provided by the actual regulation, which are used to examine the investment projects: inauguration capacities and terms etc.

∗ **Depending on the level of the economic analysis of the investment projects, the indicators can be:**

- Indicators that are set on a macroeconomic level, which allow the projects analysis for each economic field or for the general national economy.
- Indicators that are set on a microeconomic level, which allow the analysis of the economic agents.

From an economic point of view, the economic efficiency can be defined as an objective and quantitative ration of the effect and the efforts of achieving the effects.

Ee = Ef/Er – maximum, the maximization of the obtained effects for each unit of allocated or consumed resource

Ee= Er/Ef – minimum, the minimization of resource consumption for each effect unit obtained.(Mungiu-Pupazan, C. ,2010, p.144)

The necessity of economic efficiency calculations in the investment process

The calculation of economic efficiency is needed in order to establish the expenditures and the results of the investment project. The correct establishment of the investment expenditures are very important for the decision process because once they are used for constructions, equipment etc, they become irreversible, in most of the cases they cannot be redirected any more towards other fields so that they are more favorable.

In order to estimate the financial advantages of an investment project, one may use expected information for a specific period of time of the objective lifetime. The investments use two types of information as follows:

- information regarding the investment costs (almost certain)

- information regarding possible gained effects as the result of investments (expected)

Depending on the adopted development strategy, one can identify the needed investment effort but gaining the expected efforts of the investment includes a certain degree of uncertainty, of risk.

In the dynamic environment where the investment decision is to be taken, together with the investor's decision to gain the highest profit compared to the financial effort, the project evaluation from the economic efficiency point of view represent the key element.

2. Risk types of the investment decision

Due to the fact that the economic environment is uncertain, the economic efficiency calculation should also take into consideration the risk that rises from the investment, which is to be assumed by the investor.

In the market economy of the 21st century, uncertainty and risk are two variables investors cannot ignore. The investor has to study and calculate the risk in order to know it and choose the less risky investment option. Although it is difficult to make a clear difference between the concepts of uncertainty and risk, they can be delimited as follows: uncertainty is the situation whom one cannot assign probabilities, and the risk is the situation whom one can assign probabilities in a certain distribution. Through their accomplishment manner and their content, investments imply a higher or a lower degree of risk.

The risk types associated to investment can be: (Costea, M., & Cătălin, V., 1995,p.119)

- The economic risk and the profit rate
- The firm-specific risk
- The general economic risk
- The international risk and diversification
- The international investments portfolio

The interrelation between the economic risk and the profit rate

Assuming the following two economic situations, their accomplishment probabilities, as well as the situation of company X, which will report different profit rates of the investments portfolio for the made investments as follows:

The economi situation in country A	Occurance probabilty (p)	Profit rate for company X (R_p)
Economic development	0,7	20%
Recession	0.3	-10%

If company X decides to invest in a receiving company operating in the economic system of country A, it will be exposed to a certain economic risk. The most frequently used formulas are the δ quadratic mean deviation and the ν′ coefficient of variation.

In this case:

$\delta = \sqrt{\Sigma(Rpi - Rp)^2 * pi} = \sqrt{(20 - 11)^2 * 0,7 + (-10 - 11)^2 * 0,3} = \sqrt{56,7 + 132,3} = \sqrt{189} =$ 13,75%

Rp = $\sum Rpi * pi$ = (20% * 0,7) + (-10% * 0,3) = 14% - 3% = 11%

$\nu' = \frac{\delta}{Rp} = \frac{13,75}{11} = 1,25$

Pr is calculated as a weighted average of the possible profits; its value is 11% and it represents the probable rate of the profit.

Thus, company X wants to invest in a company from country A, in an economic activity that offers a probable profit rate of 11% and a risk calculated with δ and ν′, with a value of 13.75%, respectively 1.25.

Any economic agent correlates the estimated profit rate to the afferent investment risk. In case that the investment implies a higher risk, the investor will request a higher gained profit rate, resulting that any profit rate can be seen as a compensation for a certain assumed economic risk. The profit rate, which, in the investor's acceptation, compensates the implied risk of an economic activity, is known as the "*acceptable profit rate"*. When the investors has to take an investment decision, he will try to estimate as strict as possible the estimated profit rate and the economic risk in order to make a comparison whit the acceptable profit rate, and if this rate is higher or equal to the estimate profit rate, the investor will take the risk.

The firm-specific risk

The analysis of the firm-specific risk emphasizes the direct or indirect influence of the specific factors in the investment-receiving company on the decision-making process in the investing company. This analysis includes risk factors that depend on the internal conditions of the receiving company, the financing conditions of the investment to be made, as well as risk factors depending on the implementation conditions on the host country of the investing company.

In this case, the international investor is exposed to a more various risk than the investor who operates on a single national market. Thus, one needs a rigorous classification of the different risk factors that arise at a microeconomic level in the foreign direct investment transactions, a classification that helps the correct identification of investment risk.

The general scheme of firm-specific risk classification in the foreign direct investment transactions is represented in Figure 2:

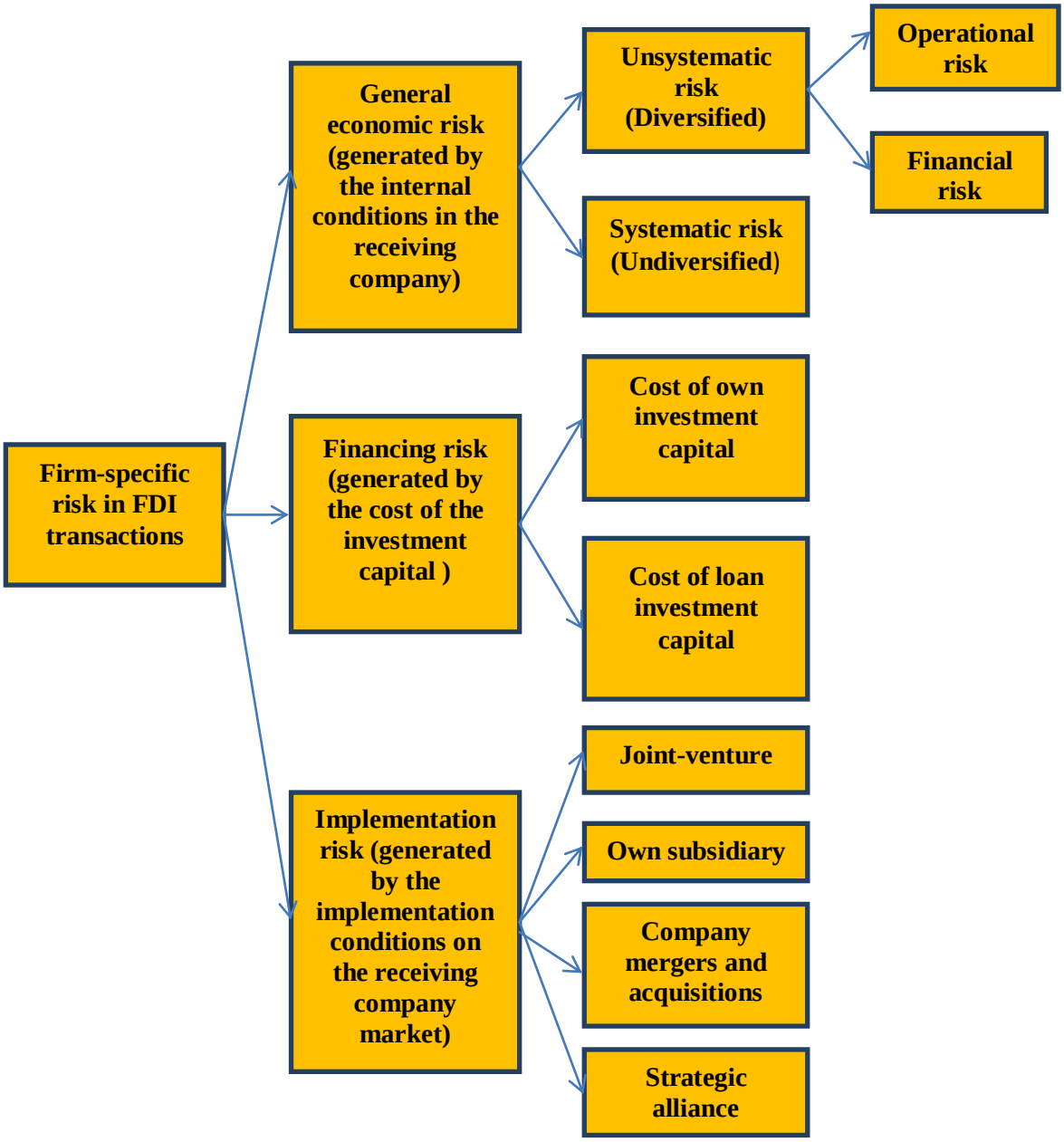

Fig. nr. 2 Firm-specific risk categories (Costea, M., & Cătălin, V., 1995, p. 136)

General economic risk – represented by the unsystematic and systematic risk.

Unsystematic risk – the result of the risk factors depending on the internal conditions in the company, it may be quantified by using statistical instruments and there are two types: operational and financial risk

Operational risk is influenced by various factors as follows:

- Elasticity of demand – the more stable the company's product demand is, the lower the risk is;
- The variation of supplying costs, directly reflected in the company costs. The more stable they are, the more stable the sales are and the lower the risk is;
- The marketing strategy – it reflects the company's ability to adapt to the dynamic market conditions and maintain its position on the market.
- The leaders' managerial competence – represents another basic aspect for the success or failure of one economic activity.

The financial risk – arises when the company uses lent capital and it is null when the company only uses its own capital.

The economic-financial risk occurs in the following situations – when there are errors regarding the estimation of the investment opportunities, regarding certain indicators, an incorrect evaluation of the socio-economic environment where the investment is made; the oversizing of the project; the dynamics of the economic activity (demand, competition, price evolution, etc); the evolution of the exchange rate, of the interest rate, of the taxation and other factors with significant influence on the financial activity. Due to the exogenous factors such as competition, regulations, inflation, etc, no matter what the positive effects gained within the company are, it cannot set a trend in the field it operates.

The systematic risk (undiversified) – depends on the general economic factors, which determine the frame of an national market, but also on the manner they interact with the company's internal factors.

Its determination is made by using the β coefficient, which expresses the linear correlation between the average profit evolution on a certain market (the cause) and the evolution of the company's profit (the effect).(Costea, M., & Cătălin, V., 1995, pp. 138-139).

$\beta = \frac{\frac{\Delta Y}{Y}}{\frac{\Delta X}{X}}$ where: - $\frac{\Delta Y}{Y}$ = the percentage alteration of the analyzed company's gained profit

- $\frac{\Delta X}{X}$ = the average percentage alteration of the profit for the companies operating on a certain national market

The β coefficient acts like an elasticity coefficient and measures the instability of one company's profit depending on the economic situation.

The use of β coefficient is possible just for the companies that own shares on the financial market. From its very own definition, this coefficient which is associated to the financial market is equal to 1. For one company's share stock, this coefficient can gain the following values and meanings:

β = 0.5 – the company profits are twice as less stable than the average, thus the risk associated to this investment will halve;

β = 1 – the company profits are as unstable as the average, the systematic associated risk of the investment is equal to the average;

β = 3 – company's profits are three times less stable than the average, which means that also the associated systematic risk of the investment is 3 times higher than the average.

There is one more method of influencing the firm-specific investment risk, namely the investment portfolio.

An investment portfolio – represents a package of several different placements. The concept of investments portfolio is different from the concept of portfolio investments. The portfolio investments are a certain type of international investment, while the investment portfolio is a pack of different placements that can include both direct investments and portfolio investments.

In most cases, one portfolio's risk is lower than the risk of each investment in the portfolio. The unsystematic risk (diversified) of the investment can be eliminate through diversification.

The project risk refers to the possible emergence of some errors regarding the solutions offered by the project; in most cases, the responsibility belongs to the projection entities. The effects of such a risk can emerge during the investments, by starting up the investment objectives or even during the exploitation period. The removal of the aspects of the project risk assumes calling the draftsman to account with converging or diverging actions, initiated by the investor.

The damage risk represents a physical nature effect risk, generated by natural disasters (fire, earthquake, landslides, floods, etc.). Protection against this risk can be made by ensuring the construction and mounting works at the ensuring societies that possess such an insurance form.

The politic risk concentrates on the abroad investments. The causes that generate such a risk can be: arrangements of that country that block the investments, blockage of the currency transfer, the interdiction to exploit the performing investments, war, strikes, embargo against the investment receiving

countries etc. the provenience of such risks is difficult but the investor can partially protect his investment, by using international assurances and reassurances.

3. Subjective and objective methods for risk determination in the investment decision

Investment risk has different causes and manifestations. In the specialty literature, various investment risk analysis methods have appeared, namely: subjective and objective methods.

Among the subjective risk analysis methods one may find: the informal method, the VAN-DRA report method, the flexibility method, the method of the efficiency threshold rate etc.

The informal method has an empiric feature and assumes the comparison of the various projects based on the net actualized value and choosing the project that has the highest net actualized value, considering that it is the less risky.

The method of the Net Actualized Value and the Actualized Recovery Period ration is based on the idea that the better a project is, the higher actualized revenues it generates, in a small period of time. This method has a limited feature because at the end of the investment recovery period it does not analyze any more the possible and probable evolution of the revenue flows.

The flexibility based method consists of adopting the projects that present a certain technical and financial flexibility that allows the investor to operate the changes that appear during the implementation process and transform an asset into money at the lowest possible cost in order to avoid certain risks.

The method of the recovery period criterion usage – supports the recovery of the invested amount of money in the shortest possible time but ignores the time revenues variation.

The "certainty equivalent" method also known as the ***method of the arbitrary or subjective increase and diminution*** (Pilverdier, L., 1993 p.342) – starts from the premise that most investors prefer lower but certain profits to the injury of high but uncertain revenues. The certainty equivalent (α) is the ratio between the investor-demanded (imposed) liquidities flow, being certain (Fc_h) and the expected liquidity flows, uncertain (Fa_h) at the moment, namely: (Lazăr C., 2002, p. 244).

$$\alpha_h = \frac{Fc_h}{Fa_h}$$

and

$$VAN = -I(\alpha_0) + \sum_{h=1}^{n} \frac{F_h(\alpha_h)}{(1+r_{fr}}$$

The investment projects are adjusted the specific risk. Uncertain liquidity flows are transposed in certain equivalences and then the "certain equivalent" net actual value is calculated. For the update, one may use the efficiency rate of the riskless financial assets (r_{fr}) and not the cost of the permanent capitals.

The actualization rate adjustment method - consists of the calculation of a risk premium as a difference between the cost of capital and the interest rate of the riskless financial assets and it applies in order to evaluate the risk associated to the low value investment projects.

The efficiency threshold rate method – helps the estimation of the project efficiency by using the internal capitalization rate adjusted with the risk premium.

The objective analysis methods of the investment projects risk are characterized by the objective quantification of the investment projects efficiencies. The main risk analysis objective methods are: (Cocriş V., Işan V., 1995, P.288) the standard deviation method and the coefficient of variation; the analysis of the investment projects sensitivity; the probabilistic simulation method; the decision tree method.

The standard deviation and the coefficient of variation method includes more assumptions:

- The values of the stochastic variables associated to the investment project are independent, they are distributed in time and are determined by hazard.
- The values of the typical project indicators (costs, revenues, residual value, etc.) are estimated at probable levels
- The actualization rate is associated to the riskless financial actives efficiency.

The risk diminution can be made with the help of the following hypotheses:

- If the analysis implies a single project, this will be accepted if the average net actualized value (NAV) is positive, and the coefficient of variation of NAV is lower than a subjectively imposed norm
- If the analysis implies much more projects, one has to consider all possible combinations, determine the standard deviation and the coefficient of variation for the global NAV of each combination.

The standard deviation measures the dispersion of the possible events around the average, expressing the square root of the standard deviations, respectively: (Lazăr C., 2002, p. 246).

$$\sigma = \sqrt{\sum_{i=1}^{n} P_i \cdot (X_i - \mu)^2}$$

Where the mean dispersion (μ) is determined as follows:

$$\mu = \sum_{i=1}^{n} X_i \cdot P_i$$

And the number of standard deviations from the average (z) is:

$$z = \frac{X - \mu}{\sigma}$$

where: X_i - the event for case i;

P_i – the occurrence probability of the event in case i;

n – the number of possible events

The coefficient of variation (v) relates the event dispersion to the mean through the ratio between the standard deviation and the mean dispersion, as follows:

$$v = \frac{\sigma}{\mu}$$

This method can be used for other appreciation indicators of the investment projects, amongst which one can find the internal capitalization rate (ICR), the profitability index (or the coefficient of actualized capitalization – K_{ac}).

The investment project sensitivity analysis method – assumes the determination of the project efficiency modification based on the modification of a certain variable. This results in the NAV of a project as a reaction to the cash flows modification. From the methodological point of view, the method assumes the gradual modification of each project parameter, while considering the other constants, and, based on this, determine the net actualized value. After finishing the calculation, results are set in growing order of every version's risk. The limit of this method consists of the fact that it does not separate the variables in acceptable and unacceptable, but sets them in order based only on their sensitivity against the modifications occurred in the variation of the project parameters and it does not take into account the possibility of achieving a negative NAV, which happens quite often in practice.

The method of probabilistic risk simulation - it is a general risk evaluation method. In any activity, the risk has the "chance" to occur or not, thus being associated to the probability concept. One may talk about two probability types and namely:

- objective probabilities – when we possess a great number of observations of a repeatable phenomenon (assurance cases);

- subjective probabilities – when the analyzed phenomenon is the subject of some situations that cannot be examined, observed, taking their repeatability view of things (the case of investment decisions).

The method of probabilistic simulation regards the simultaneous modification of more parameters and assumes that the possible parameter modifications are represented by a distribution of probabilities.

This method is intricate due to the large volume of used data, of the laborious processing and high costs, but it is also very efficient because it grasps the simultaneous influence of various indicators on the project efficiency taken by the NAV view of things.

The mean – variance analysis method – supposes the implementation of a yearly revenues flows value distribution and the analysis of the NAV values round the project, or the estimation of one revenue flow mean at *t* moment, the determination of their variances and their deviation.

The reasoning is relevant both for the outdated values and the updated values. (Levasseur M., Quintart A., 1992, p.489)

- For the outdated values:

- the mean of a revenue flow (F_t) at moment t is equal to:

$$\overline{F_t} = \sum_{x=1}^{mt} F_{xt} \cdot P_{xt}$$

- the variation of this revenue flow σ^2 (F_t) is:

$$\sigma^2(F_t) = \sum_{x=1}^{mt} [F_{xt} - \overline{F}_t]^2 \cdot P_{xt}$$

- the deviation of this flows (σ) is equal to the square root of their variances:

$$\sigma = \sqrt{\sum_{x=1}^{mt} [F_{xt} - \overline{F}_t]^2 \cdot P_{xt}}$$

where:

mt – the number of possible flows at moment t;

F_{xt} – possible x flow at moment t;

- For the updated values: ____

- the mean of the net actualized value results from the formula:

$$\overline{VAN} = \sum_{t=1}^{n} \frac{\overline{F_t}}{(1+r)^t}$$

- the variation of the net actualized value $\sigma^2(NAV)$ assigns the formulation of some assumptions regarding the relations between those flows in time and their determination according to the formula:

$$\sigma^2(NAV) = \sum_{t=1}^{n} \frac{\sigma^2(F_t)}{(1+r)^{2t}}$$

- the coefficient of variation (K_v) will be:

$$K_v = \frac{\sigma(NAV)}{\overline{NAV}}$$

The method of the decision tree – can be used only when the investment decision is made as gradual stages, each corresponding to a certain possible reaction (alternative).

There are various situations regarding the investment risk analysis through the decision tree method, such as: (Lazăr, C., 2002, p.248)

- the link between the revenue flows in time and the their accomplishment conditional probabilities;

- the accomplishment of the investment in stages in time, which links each hypothetical decision variant to the imposed events and the initial and conditional probabilities;

- the link between the riskless actualization rate and the risky rate taken by the certain equivalent coefficient view of things, within the efficiency (capitalization) evaluation of an investment project;

- the disclosure of the inflation phenomenon on the flows and the profitability of a project (by assuming each flow element with a specific inflation rate and make the economic efficiency calculation) .

The investment decision appears as a series of actions and reactions, where each possible action is to correspond to various probable reactions that cause their orientation towards other actions, so that the options would be made in stages in time. (Levasseur M., Quintart A., 1992, p.463)

According to its content and complexity, the investment decision implies a multidisciplinary approach in order to choose a convenient, competitive investment implementation alternative.

The theoretical studies on the investment decision emphasizes the uniqueness feature of the decision, due to the fact that the situation generated by its embracement can be subsequently correlated only by solving another decision problem, on total different terms compared to the initial state.

Conclusions

In the expert literature, there are various decision methods that which aim both at the certain or uncertain economic environment and the multicriterial decision context, the risk and uncertainty conditions.

From the importance of the investments for each economic system, they lie at the interference limit of various fields, such as: economy, finance, trade, social, political, technical environment. Involving important material or immaterial resources, investments assume some stages of transformation, aiming at the attainment of future advantages, especially profit.

The investment is exposed to a certain economic risk, a unsystematic and a systematic part. The investor will give heed to risk factors, which are independent of the company's internal conditions but which overlap these conditions in order to diminish possible losses.

In the market economy of the 21st century, uncertainty and risk represent two variables the investor cannot ignore. He must study and calculate the risk in order to determine it and choose the less risky investment option.

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