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# DIAGNOSIS OF A COMPANY'S RISKS

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***Abstract*** *All companies present risks: some can be controlled, others not. The main risks that a company is confronted with are related to the investments, liquidity, solvency, decrease in the demand for products, insolvency, depreciation of the national currency. It is important to identify, quantify and try to prevent or minimize the negative effects. The factors which generate the risks can be internal (one can act upon them) or external (they cannot be influenced). The investment projects cannot be done without a risk analysis. At medium and large companies there are specialized people who handle the risk analysis.*

**Key words:**
Risk, risk evaluation, sensitivity analysis, scenario analysis, decision tree
**JEL Codes:**
G32, D81

## 1. Introduction and context of the study

This article aims to provide new insights into the diagnosis of company risks. Knowing the risks, controlling and diagnosing them are vital activities, especially during crisis conditions. Risks cannot be totally eliminated, but some of them can be influenced positively. The objective of the research is to know, control, measure and diagnose the risks that a company is confronted with.

This work is a result of scientific research, based on the analysis of literature and legal regulations regarding the company risks.

## 2. Companies' risks

Generally, risk is defined as the possibility of being in danger, of being confronted with a difficulty, or having to incur a loss. From an economic point of view, risk encompasses a large variety of uncertainties regarding a company's future activities (company risk) or a country's (country risk).

*In a company* there are several risk categories:

a. Liquidity risk represents the incapability to sell products and to cash in their counter value;
b. Price risk, due to the decrease of the selling price;
c. Non-payment risk, due to the insolvency of other companies that are going bankrupt;
d. Investment risk represents the company's possibility to make investments that will not be recuperated;
e. Currency risk, caused by the possible fluctuations of the exchange rate;
f. Interest rate risk, due to a possible change of the financial instruments on the monetary market.

*Political risk* can also be of a great importance at this stage. According to some authors (Watson D. and Head A., 2007, p. 483), political risk represents the risk that comes from the political actions of some countries that can negatively affect the value of the company's operations.

*System risk (systematic)* expresses the possibility that the companies' reactions to the risks implied by the business environment in which it operates might lead to an increase in the economic system as a whole. System risk can be amplified by the globalization phenomenon which, although leads to a better allocation of resources, it can also lead to a propagation of individual disturbances, due to a tight connection between the national and international. System risk is a result of the interaction between the entities that form the economic system. One cannot take measure to reduce to system risks because they are exogenous to the system (risks due to changes in the legal system,

risks related to the economic crisis, interest rate risk, fraud risk).

*Non-systematic risks* are those risks that are unique to a company (loss of contracts, trials, strikes, faulty projections in the business plans). The company can take measures against these non-systematic risks, to diminish their negative effects.

There are no investments without risks. However, it is thought that the investments guaranteed by the government have a low risk, close to zero. The profitability of investments in treasury bills or bonds issued by the government is considered without risk. But, in this situation, one must take into account the country. A bond issued in Germany will have a different risk that one issued in Greece. The risk premium related to the bonds in these two counties can be of few percents.

*Risk analysis* for a company has two stages:

a. identifying the risk factors and measuring the impact, which can be done through a sensitivity analysis, through the scenario method, through the decision tree;
b. quantifying the risk which can be done through dispersion, mean square deviation, variation coefficient.

**3. Risk factors**

*Risk factors* are those internal or external factors which can influence the achievement of the company's objectives. Risk must be methodically identified, meaning risk must be established related to every activity.

*Risk management* as part of the strategic management, consists of assigning responsibilities to the company's employees and implies identifying the risks and making adjustment strategies to increase the success possibilities and reduce the loss probabilities.

The factors that influence a company's activity can be the following: financing system, available capital, economic and political environment, tax system, financing cost, inflation rate, exchange rate, demand and offer, characteristics of the outlets.

Risks can be classified according to their probability of appearance and their influence on the company's results (level of impact).

*Risk evaluation* is part of the operational process and it must identify and analyze internal and external factors which could affect the organization's objectives. Internal factors are, for example, the nature of the entity's activities, the personnel's qualifications, major changes in organization or the employees' efficiency, and external factor can be the variation of the economic, legal conditions or changes in technology.

Risk evaluation is a permanent problem, because the conditions keep changing, there are new regulations, new people, new objectives and all these changes permanently modify the "geography" of risks, which cannot be ever finalized (Morariu A., Suciu G, and Stoian F., 2008, p. 186). Risk analysis is not an exact science. Through establishing control activities, high risks are meant to become medium or low, until a possible subsequent disappearance.

The risk evaluation activity is an essential component of management and must be done constantly, at least once a year, in order to identify all risks.

The *phases of risk analysis* are the following:

- Identifying the company's objectives;
- Analyzing and evaluating the inherent risks, with consequences on the financial operations;
- Verifying the existence of internal checks, of procedures of internal check, and also their evaluation;
- Evaluating the weaknesses, quantifying and dividing them into risk classes.

In the financial diagnosis analysis, *several techniques are used to identify risks:* sensibility analysis, scenario technique, decision tree, Monte Carlo simulation (Dragotă V., Obreja L., and Dragotă I.M., 2012, p. 210).

*A. Sensibility analysis (sensitivity analysis)* establishes the influence of each risk factor on the result of a process, economic activity.

Sensitivity analysis can measure risk because it takes into account the factors with the highest influence on the value of a result (net updated value, profit, turnover).

The sensitivity analysis only determines the effect on the whole project in case one of the variables is modified. This is important because it frequently highlights the way in which the effect of a single change in the risk variables can produce a significant difference in the project's results. A sensitivity analysis is done in order to establish the variables with a major impact on the project's result and which will be included in the quantitative analysis of risks as entry variables.

There are two main methodological approaches of the sensitivity analysis: deterministic method and stochastic method.

*The deterministic sensitivity analysis* is based on the assumption that the set ordered by the basic parameters is an element of a given subset of all the possible options of parameters. It tries to determine the upper and lower limits of the subset corresponding to the economical results of the project.

*The stochastic sensitivity analysis* treats the parameter's vector as a stochastic variable with given distribution, transposing the economic balance of the model in stochastic variables. It aims to calculate the first moments of these variables, variation indicating the robustness of results. A good sensitivity analysis must analyze the entire range of plausible values of the key parameters and their interactions, to evaluate the way in which impacts change, as a result of changes in the key parameters.

*The flexibility of parameters* which influences the sensibility analysis can be divided in 3 categories: high, intermediate and low. For example, if we analyze the sensibility analysis of the turnover, there are 3 parameters that influence it: the number of employees, hourly productivity and the yield of the manufactured products.

*The critical variables* are the ones that influence significantly a process, work, investment. For example, in an investment, the critical variables are the NPV, IRR and the term to recover the investment.

*B) The scenario technique* is similar to the sensitivity analysis but it is used mostly for analyzing projects with longer implementation periods. This technique implies the construction of a set of unfavourable circumstances, called the *pessimistic scenario,* where all the parameters taken into account have a negative evolution (low income and high expenses), of an *optimistic scenario* (all parameters have a positive evolution), meaning high income and low expenses and a *neutral scenario* (most probable). For each scenario a probability of achievement is established, the sum of all three being 1 or 100%. Starting from the three scenarios, one tries to estimate the most probable size that the analyzed indicator can have. If we analyze with the scenario technique the size of the net profit, we will have the formula:

$$E(NP) = \sum_{s=1}^{n} P_s \times NP_s , \qquad (1)$$

where: $E(NP)$ = average of the net profit;

$P_s$ = probability associated with the "*s*" scenario;

$NP_s$ = net profit calculated for the "*s*" scenario;

*n* = number of scenarios.

According to the deviation from this average value, the variance (dispersion) is determined and also the variation coefficient, according to the formula:

$$\sigma^2(NP) = \sum_{s=1}^{n} P_s \left[NP_s - E(NP)\right]^2 , \qquad (2)$$

$$VC(NP) = \frac{\sigma(NP)}{E(NP)} , \qquad (3)$$

where: $\sigma^2(NP)$ = variance of the net profit;

$\sigma(NP)$ = standard deviation of the net profit;

$VC(NP)$ = variation coefficient of the net profit.

The indicators for the favourable and unfavourable situation are calculated and then compared with the indicators from the basic situation. Big differences between the pessimistic scenario and the basic variant signify a high risk.

*C) The decision tree* allows for the evaluation of all evolution variants for the enterprise which start from decision points. In a decision tree there are two types of nodes: decision nodes and result nodes.

*Decision nodes* are the point where a choice has to be made of a decisional alternative, based on estimates or calculations. *Result nodes* are the points where it is estimated that results are likely to appear. The average values of performances obtained in each node of the decision tree will be estimated based on the probabilities associated to each evolution variant of the company.

*Action directions* which allow the study of risks that the investment projects are confronted with are:

a. Identifying of risk sources, respectively emphasizing the domains that interact with the project while the investment objective is ongoing and which can be affected in the future by an unpredicted evolution.
b. Establishing the risk types that can have a major impact on the project. A risk classification is made, the most important ones being those which are the likeliest to appear, observed in the case of similar projects or estimated by the experts.

c. Evaluating the risk by using several different techniques of risk evaluation, such as: critical point, position indicator, variation coefficient, sensitivity analysis.
d. Analyzing different future potential situations, evaluating the consequences of risk appearance and measuring the way in which they affect the project's economic and financial viability.

*D) The Monte Carlo simulation* was elaborated in the 1940's and it represents a computerized method which uses statistical sampling techniques to obtain a probabilistic approximation for the solution of a model. In this context, simulation consists of the process approximation of a model's result by applying randomly and repeatedly the algorithm of a model. The Monte Carlo simulation combines the probability distributions according to the relations existing in the models, by trying different combinations of entry variables and storing the results to be displayed.

According to some authors (Ross S.A., Westerfield R.W., and Jaffe J., 2008, p. 237) the Monte Carlo simulation is a new attempt to shape the uncertainties from the real world. The name of this approach is inspired from the famous European casino because it analyses projects just as someone would analyze strategies in gambling.

The Monte Carlo method can be successfully applied in case of big projects or investments. The stages of the Monte Carlo analysis are the following:

- Establishing the problem which must be solved;
- Elaborating a model;
- Defining the model's risk variables;
- Making simulations according to the identified variables;
- Analyzing the simulations' results in statistical terms.

The Monte Carlo analysis can offer useful details about risk exposures, including the series of possible results, the probability to attain the objectives, risks with the highest impact, the main risk factors and the most efficient actions. Each simulation round represents the probability that a risky event might appear.

A distribution of cumulative probabilities of all the simulation rounds can be drafted and then used to interpret the probability of the project's results as being inferior or superior to a specified value. This distribution of cumulative probability can be used to evaluate the project's overall risks.

**4. Risk measurement indicators**

*Quantifying the risk* of a company means measuring the variability of the forecasted profit, taking into account multiple scenarios, depending on the changes that can interfere in the future economic activities. The statistical indicators used in the risk evaluation are the variance, mean square deviation and variation coefficient.

*The variance (dispersion)* is a synthetic measure of data dispersal in a statistical series, vis-à-vis the average value. It is calculated as the simple or weighted arithmetic mean of the square of deviations of the individual values from the central tendency (arithmetic mean) and it is marked usually with the letter $\sigma^2$.

For example, the profit's variance is estimated by taking into account the punctual values of profit obtained in each situation and the probabilities associated with each scenario, according to the formula:

$$\sigma^2 = \sum P_i \times \left(Pn_i - \overline{P}_n\right)^2, \quad (4)$$

where: $\sigma^2$ = profit's variance;

$P_i$ = probability of fulfilment of the "*i*" scenario;

$Pn_i$ = profit hoped to be obtained in the "*i*" scenario;

$\overline{P}_n$ = average achievable profit:

$$\overline{P}_n = \sum P_i \times Pn_i . \quad (5)$$

Because variance as a synthetic indicator of the dispersion of the individual values around the mean, does not always have an economic content, as it is expressed in squared units (for example squared lei), it does not have a sense from an economic point of view. In order to eliminate these shortcomings, the mean square deviation is used.

The *mean square deviation or standard deviation* ($\sigma$) is calculated as a square root of the variance and thus it is expressed in the unit of measurement of the studied characteristic. The value of this indicator is useful to determine the probable variation interval for future profits. Thus, if one presumes that the distribution is normal, the expected level of the indicator will be included, with a probability of 68%, in the interval

$\left(\overline{P}_n - \sigma; \overline{P}_n + \sigma\right)$ or with a probability of 95% in the interval $\left(\overline{P}_n - 2\sigma; \overline{P}_n + 2\sigma\right)$.

Variance (dispersion) and mean square deviation are expressed in the same units of measurement as the values that they represent. If for a statistical population multiple characteristics are studied, having different units of measurement, and the aforementioned indicators cannot be compared for different characteristics. In order to avoid this shortcoming, there is a need for calculating a dimensionless indicator, called variation coefficient.

*The variation coefficient* ($C_{\text{var}}$) is calculated as the ratio between the mean square deviation and the arithmetic average of that element:

$$C_{\text{var}} = \frac{\sigma}{\overline{X}} \cdot \qquad (6)$$

where: $\sigma$ = mean square deviation;

$\overline{X}$ = arithmetic average of the *X* element.

The variation coefficient is the most synthetic indicator of data dispersion in relation to the average tendency. It permits to compare the variability for characteristics of different nature and it has values between 0 and 100 (if is expressed as a percentage). The closer the values are to 0, the more homogeneous the statistical series and the more representative the $\overline{X}$ mean. The closer the values are to 100, the higher the dispersal of the observed individual values and the least representative the $\overline{X}$ mean.

**5. An application**

In addition to the theoretical part, we present an application related to the evaluation of some investment projects. We consider having two investment projects, A and B, which are characterized by the data presented in the following table:

| Evolution scenario | Probability ($P_i$) | $NPV_{(A)}$ | $NPV_{(B)}$ |
|---|---|---|---|
| Recession | 0.3 | - 5,000 | - 3,500 |
| Average situation | 0.5 | 6,000 | 5,500 |
| Growth | 0.2 | 8,000 | 7,000 |

Establish the following:

a. Mean Net Present Value ($\overline{NPV}$) for the two investment projects;
b. Standard deviation for the two investment projects;
c. Variation coefficient for the two investment projects;
d. Which project is the riskiest?

Solution:

a. The mean $\overline{NPV}$ s of the two projects are:

$\overline{NPV}_{(A)} = 0.3 \times (-5{,}000) + 0.5 \times 6{,}000 + 0.2 \times 8{,}000 = 3{,}100$ lei;

$\overline{NPV}_{(B)} = 0.3 \times (-3{,}500) + 0.5 \times 5{,}500 + 0.2 \times 7{,}000 = 3{,}100$ lei.

b. The standard deviation is given by the formula:

$$\sigma = \sqrt{\sigma^2} = \sqrt{\sum_{i=1}^{n} P_i \times \left(NPV_i - \overline{NPV}\right)^2} .$$

The standard deviations of the two projects are:

$$\sigma(A) = \sqrt{0.3 \times (-5{,}000 - 3{,}100)^2 + 0.5 \times (6{,}000 - 3{,}100)^2 + 0.2 \times (8{,}000 - 3{,}100)^2} =$$
$$= \sqrt{28{,}690{,}000} = 5{,}356 \text{ lei};$$
$$\sigma(B) = \sqrt{0.3 \times (-3{,}500 - 3{,}100)^2 + 0.5 \times (5{,}500 - 3{,}100)^2 + 0.2 \times (7{,}000 - 3{,}100)^2} =$$
$$= \sqrt{18{,}990{,}000} = 4{,}358 \text{ lei}.$$

c. The variation coefficient is given by the formula:

$$C_{\text{var}} = \frac{\sigma}{\overline{NPV}} .$$

The variation coefficients of the two projects are:

$$C_{\text{var}(A)} = \frac{\sigma_{(A)}}{\overline{NPV}_{(A)}} = \frac{5{,}356}{3{,}100} = 1{,}73;$$

$$C_{\text{var}(B)} = \frac{\sigma_{(B)}}{\overline{NPV}_{(B)}} = \frac{4{,}358}{3{,}100} = 1{,}41.$$

d) The investment project B reflects a lower associated risk than project A, because the values of the standard deviation indicators and the variation coefficient are lower in project B than in project A.

## 5. Conclusions

To know, evaluate and act to reduce the risk in a company must be one of the management's permanent priorities. It must continuously act upon unsystematic risks. All aspects related to risks must be found in a "risk manual" where the responsibilities, terms, people who are involved, actions that must be done should be clearly established. This manual will be updated permanently, taking into account the internal and external context.

In an open, globalized world, the risks are multiple and hard to anticipate. One must always take into consideration a variant that is considered normal, an optimistic one and also a pessimistic one. One can evaluate the past much more easily, but the future can present a lot of uncertainties, and the problem related to risks will play a bigger and bigger role.

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