

VERIFICATION OF DECISIONS CORRECTNESS USING ECONOMETRIC METHODS

ALBICI MIHAELA, TESELIOS DELIA

CONSTANTIN BRANCOVEANU UNIVERSITY OF PITESTI, 2A BASCOVULUI Road
mturmacu@yahoo.com, delia_teselios@yahoo.com

Abstract:

Management existence cannot be thought without decision, and taking into consideration the role played by the management, some authors in the domain appreciate that the essence of management is represented by the process of decision-taking. The idea that assessing management starts from the analysis of the elaborated decisions, from the results of companies as a consequences of decisions taken, the decision being the base of the management process, contributing to performance of the management, effectiveness and opportunity of decisions thereby contributing to increased efficiency of management process. Econometric methods are an indispensable tool to systematize and interpret raw statistical data. Moreover, econometric methods are only possible methods to try to identify empirical relationships and interdependences between key variables.

Key words: economic models, uncertainty, decision, econometrics

JEL classification: C01, C12, D80

In a world of continuous change, both economically and socially, the decision making process represents the main factor of a successful business.

If decisions taken by managers are more or less important, they affect the organization day by day. Thus, using the decision support systems is very much needed. These systems can be either fully computerized, human or a combination of both. These “serve the management, operations and planning levels of an organization”[14] and “allow faster decision making, identification of negative trends, and better allocate on of business resources all to the benefit of the organization” [15].

Increasing degree of rigor required by the actions of the decision-maker imposes the use of scientific methods theoretically based, generally based on mathematical methods, while maintaining a practical and realistic guidelines.

Transition to a market economy of countries with central-planned economies, was a complex process that has brought significant changes to the conditions for conducting economic activities. These markets were forced to adapt their sizes, structures and in some cases, the efficiency of economic activity in a market economy.

The increasing of complexity of structured relationships, stimulating the entire economic and social system, in addition to the development of science and technology has created significant changes in the approach of the theoretical and practical concepts of risk and uncertainty. Economic, social, political and natural environment in which people live, work and develop, it is full of uncertainties. It is now commonly recognized that a system that works to get a future result, by definition operates, in a sphere of uncertainty, even if specific situations are characterized by varying degrees of risk, uncertainty or indeterminacy. Risk and uncertainty are not the subjects of choice; they are simply part of the human condition [1].

Although often used to express the same aspect, the terms risk and uncertainty have different meanings. Risk, in management represents the possibility of obtaining a

different result from the expected one. In economy, risk is expressed as an expected value that an event will be accompanied by undesirable consequences [13].

Uncertainty creates the risk of taking weak decisions. Therefore, we can talk about the existence of risk only in the presence of an uncertainty. Moreover, the risk of taking weak decisions increases with the growth of the uncertainty. Therefore, managing uncertainty becomes the main purpose in decision making process.

Essential is the fact that with the development of the economic system, with its increasing in complexity, uncertainties multiply and, therefore, become more vulnerable. Risk is part of the economic and social life, found in the form of commercial risk - the risk of maximizing products, competitive risk, price risk - social risk and production risk.

Following present studies on the subject, it has been emphasized that the concepts of risk and uncertainty is in the middle and at the base of companies' analysis and decisions. [8]

Triumph of statistical decision theory is precisely the possibility of measuring the degree of risk in terms of objective probabilities. Statistically processing the numerical results of measurements, statisticians can communicate a company manager the probability that the decision is wrong and is less than, 0.05. Taking into account all the factors involved, the manager may decide that the risk is acceptable. If the probability that the decision is wrong is too high, the manager may request additional tests, or take into account additional parameters. When we provide numerical results of some experiments, statistical decision theory allows us to measure the degree of risk associated with a decision of objective probabilities.

Taking as a basis a certain amount, a certain structure, and a way of presenting statistical information, decision management appears as a dynamic and rational process which requires manager's ability to master complex mechanism of the whole management system of the company. In this respect, computer subsystems, information - statistical and decisional can make a fundamental contribution.

For the economists, models represent essential instruments through which complex economic processes are illustrated, often being used mathematical techniques.

The model represents "a simple description of a system which is used for explaining how something works or calculating what might happen"[16] or according to Begg, Fischer, and Dornbusch, "a *model* or theory makes a series of simplification from which it deduces how people will behave" [4].

Economic models present two functions [17]:

- A simplification of an abstraction from observed data. The simplification aspect is extremely important, taking into account the complexity of economic processes, due to individual and cooperative decision processes, resource limitations or random fluctuations.

Therefore, the economists "must make a reasoned choice in which variables are relevant and which ways of analyzing and presenting this information are useful".

- "a means of selection of data based on a paradigm of econometric study", because the type of the chosen economic model determines the factors which will be taken into consideration in modeling and the way these will be compiled.

According to [12] "econometrics is the interaction of economic theory, observed data and statistical methods", in other words, "involves the application of statistical methods in an economics context."

"Although not diminishing the importance of other elements [...] Paul Samuelson pays more attention to technological innovation. The discovery of a new way to produce when everything is changing gives an opportunity in the economic environment"[9].

In the following study case there are used econometric methods, which support the decision making process at the company management level.

We take into consideration the case of a commercial society producing bakery, SC Panmir SRL, sourcing with flour from two suppliers S_1 and S_2 . At a moment of time t , the company acquired 2900 tons of flour, as follows: 1300 tons of flour from supplier S_1 and 1700 tons of flour from supplier S_2 .

On the receipt of flour it has been ascertained the fact that 440 tons of flour do not correspond in terms of quality. Also, there has been established that trashes from both suppliers are distributed as follows: 190 tons of flour from supplier S_1 and 250 tons of flour from supplier S_2 .

Given these conditions, the company's manager decided to stop working with supplier S_1 , the reason being the poor quality of the materials provided.

For the substantiation of the econometric decision adopted by the management company, we use more econometric tests. The first will be the difference test between two environments.

By structuring the previous data, we obtain:

Table 1. Systematization of data

Suppliers (x_i)	Material Quality (y_j)		Total (N_i)
	Unsatisfactory	Satisfactory	
S_1	190	1110	1300
S_2	250	1450	1700
Total (N_j)	440	2560 (n_{ij})	3000 (N)

Source: Created by the author

$X = \{x_i\}, i = \overline{1, k}$ independent variable;

x_1 - supplier S_1 ;

x_2 - supplier S_2 ;

$Y = \{y_j\}, j = \overline{1, m}$ dependent variable;

y_1 - unsatisfactory materials in terms of quality;

y_2 - satisfactory materials in terms of quality;

n_{ij} - conditional frequencies of variable Y ;

After systematization of data, there resulted a statistical two-dimensional series with two variables X and Y , resulting also two marginal distributions:

$$X: \begin{pmatrix} x_1 = 1 & x_2 = 0 \\ 1300 & 1700 \end{pmatrix}$$

$$Y: \begin{pmatrix} y_1 = 1 & y_2 = 0 \\ 440 & 2560 \end{pmatrix}$$

Conditional distributions of Y variable depending on the suppliers are:

$$Y_{S_1}: \begin{pmatrix} y_1 = 1 & y_2 = 0 \\ 190 & 1110 \end{pmatrix}$$

$$Y_{S_2}: \begin{pmatrix} y_1 = 1 & y_2 = 0 \\ 250 & 1450 \end{pmatrix}$$

Let N_i be the marginal frequencies of variable X and N_j the marginal frequencies of variable Y , then the number of observations will be $N = \sum_i \sum_j n_{ij}$.

Observing the way of distribution of the frequencies n_{ij} following observations can be made:

i) the two variables are totally independent if:

$$n_{ij} = \frac{N_i}{k} = \text{constant}$$

$$n_{ij} = \frac{N_j}{m} = \text{constant}$$

ii) the two variables are strict dependence if the conditional frequencies n_{ij} are distributed only on the main diagonal of the table, for the other elements of the table these frequencies are equal to zero;

iii) there is a statistical dependence if the conditional frequencies n_{ij} are distributed in a different way of the two cases mentioned above; in this case, statistical analysis will lead to one of the following conclusions:

- Acceptance of variant i);
- Acceptance of variant iii).

From the analysis of data presented in Table 1 we can observe that the distribution of conditional frequency n_{ij} fall into version iii).

In order to analyze the decision taken by the manager of SC Panmir SRL, we apply the difference test between two environments as follows:

We first calculate the average percentage of inappropriate materials in terms of quality on each supplier:

$$f_{s_1} = \frac{n_{11}}{N_1} = 0,146; f_{s_2} = \frac{n_{21}}{N_2} = 0,147$$

The variances for each of the two suppliers are:

$$\sigma_{s_1}^2 = f_{s_1}(1 - f_{s_1}) = 0,124684$$

$$\sigma_{s_2}^2 = f_{s_2}(1 - f_{s_2}) = 0,125391$$

Let α be the materiality or the risk with which we choose the right decision and we will select $\alpha = 0,05$, value which is usually used in economy. Here, the argument of the normal distribution is $t_\alpha = t_{0,05} = 1,96$.

Then we compare the empirical value of the variable t_c with its theoretical value $t_{0,05}$. If variables are independent then,

$$t_c = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{\sigma_{x_1}^2}{n_1 - 1} + \frac{\sigma_{x_2}^2}{n_2 - 1}}} < t_\alpha.$$

and if variables are dependent then,

$$t_c = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{\sigma_{x_1}^2}{n_1 - 1} + \frac{\sigma_{x_2}^2}{n_2 - 1}}} \geq t_\alpha,$$

Here,

$$t_c = \frac{|f_{S_1} - f_{S_2}|}{\sqrt{\frac{\sigma_{S_1}^2}{N_1 - 1} + \frac{\sigma_{S_2}^2}{N_2 - 1}}} \cong 0,0775$$

Therefore, $t_c = 0,0775 < t_{0,05} = 1,96$ and we can state, with a probability of 95%, that between the quality of delivered materials by the two suppliers S_1 and S_2 there is no important difference.

We can assert that the decision taken by the company management SC Panmir SRL to give up the collaboration with supplier S_1 due to poor quality of the flour supplied is not justified.

The second method to verify the correctness of the decision is the method of Yulle association coefficient, which can be applied by going through the following steps:

1. Determination of coefficient of association¹. Here,

$$\theta_c = \frac{n_{11}n_{22} - n_{12}n_{21}}{n_{11}n_{22} + n_{12}n_{21}} = -0,0036$$

The product $n_{11}n_{22}$ indicates the degree of achievement of the direct connection between X and Y . The product $n_{12}n_{21}$ shows the degree of reverse connection between these two features investigated.

Yulle's association coefficient is defined in the range $[-1;1]$ and has the following meaning:

$$\begin{cases} \theta = -1 & \text{then there is a strictly negative correlation between the variables;} \\ \theta = 0 & \text{then variables are independent;} \\ \theta = 1 & \text{then there is a strictly positive correlation between the variables.} \end{cases}$$

2. Determining the standard deviation:

$$\sigma_\theta = \frac{1 - \theta_c^2}{2} \sqrt{\frac{1}{n_{11}} + \frac{1}{n_{12}} + \frac{1}{n_{21}} + \frac{1}{n_{22}}}$$

Performing calculations we obtain $\sigma_\theta = 0,0516$.

3. Determination of the report $\frac{|\theta_c|}{\sigma_\theta} = 0,069$

4. Establishing the meaning of α and the theoretical values of t_α :

$$\alpha = 0,05 \Rightarrow t_\alpha = 1,96$$

5. Comparing empirical value $\frac{|\theta_c|}{\sigma_\theta}$ with theoretical values t_α :

$$\frac{|\theta_c|}{\sigma_\theta} = 0,069 < t_\alpha = 1,96$$

¹ It was introduced by the English statistician Yulle, in memory of Quetelet (1796-1874), Belgian scholar, who was among the first who began to apply the results of probability theory and mathematical statistics in the study of social phenomena.

Based on the above inequality we can state with a probability of 95% that the empirical value θ_c is not significantly different from zero, therefore the two variables X and Y are independent. To continue with, the decision taken by the company's management to renounce to the collaboration with supplier S_1 because of poor quality of the materials distributed can be considered as unfounded.

The relation existent between the two variables X and Y , and the correctness of the decision taken by the management of SC Panmir SRL to give up collaboration with supplier S_1 because of the poor quality of the flour provided, can be tested using χ^2 . This test is mainly used to check the connection between two nominal variables. The hypothesis of this test is to compare two distributions. There is a theoretical distribution (based on the state of independence) and an empirical distribution.

The first step in applying this test is the establishment the meaning of α and choosing the theoretical value $\chi^2_{\alpha;v}$ where $v = (k-1)(m-1)$ represents the number of freedom degrees, m the number of the groups according to variable Y , and k the number of groups according to variable X , taken from the distribution table χ^2 depending on meaning of α and number of freedom degrees v .

$$\alpha = 0,05; v = (2-1)(2-1) = 1$$

$$\text{In this case, the theoretical value } \chi^2_{\alpha;v} = \chi^2_{0,05;1} = 3,84$$

We will continue to determine the theoretical frequencies $n_{ij}^* = \frac{N_i \cdot N_j}{N}$ in case of total independence of variables:

$$n_{11}^* = \frac{N_1 \cdot N_1}{N} = \frac{1300 \cdot 440}{3000} = 190,66$$

$$n_{12}^* = \frac{N_1 \cdot N_2}{N} = \frac{1300 \cdot 2560}{3000} = 1109,33$$

$$n_{21}^* = \frac{N_2 \cdot N_1}{N} = \frac{1700 \cdot 440}{3000} = 249,33$$

$$n_{22}^* = \frac{N_2 \cdot N_2}{N} = \frac{1700 \cdot 2560}{3000} = 1450,66$$

The empirical values of random variable are

$$\begin{aligned} \chi_c^2 &= \sum_i \sum_j \frac{(n_{ij} - n_{ij}^*)^2}{n_{ij}^*} = \\ &= \frac{(190 - 190,66)^2}{190,66} + \frac{(1110 - 1109,33)^2}{1109,33} + \frac{(250 - 249,33)^2}{249,33} + \frac{(1450 - 1450,66)^2}{1450,66} \end{aligned}$$

$\Rightarrow \chi_c^2 \cong 0,0047 < \chi^2_{0,05;1} = 3,84$, from where results the variables X and Y are independent.

Based on previous calculations we can draw the following conclusion: the quality of materials supplied does not depend on suppliers' type.

To conclude, the three tests applied pinpoint that the company SC Panmir SRL decision to renounce collaboration with supplier S_1 due to poor quality of flour provided is not justified.

BIBLIOGRAPHY:

1. Achim, M.L., *Impactul globalizării asupra riscului și incertitudinii în economie*, mpr.ub.uni-muenchen.de/27202/1/Material_Achim.pdf

2. Albici, M., Belu, N., Tenovici, C., *Economic decisions in uncertainty conditions*, University Library of Munich, Germany, 2009, <http://mpira.ub.uni-muenchen.de/17954>.
3. Andronic, B., C., *Company Performance*, Polirom Publishing House, Iași, 2000, p. 157.
4. Begg, D., Fischer, S., Dornbusch, R., *Economics*, 6th ed., McGraw-Hill, 2000
5. Belu, N., Albici, M., *Economic decisions in risk conditions*, University Library of Munich, Germany, 2009, <http://mpira.ub.uni-muenchen.de/17611>
6. Cooke, S., Slack, N., *Making Management Decisions*, Prentice Hall International, U.K., 1991.
7. Coșea, M., Nastovici, L., *Risk Assessment. Analysis Methods and Techniques at Micro and Macro-Economic Level*, Lux Libris, Brașov, 1987.
8. Giarini, I.O., *Introduction a l'économie du risque et de la sécurité*, Association pour l'Étude Internationale de l'Économie de l'assurance, Geneva 1976.
9. Ioneci, M., *Innovation – The Positive Effect on the Crisis*, Annals of the University of Petrosani. Economics, vol. IX – part II, 2009, ISSN 1582 – 5949, pp. 39 - 43
10. Knight, F.H., *Risk, Uncertainty and Profit*, University of Chicago Press, Chicago, 1985
11. Tănăsioiu, O., Iacob, A.I., *Econometrie studii de caz*, www.bibliotecadigitalaase.ro
12. Verbeek, M., *A Guide to Modern Econometrics*, 3rd edition, John Wiley & Sons Ltd, England, 2008
13. <http://www.robustdecisions.com/decision-making-tools/risk-vs-uncertainty.php>
14. http://en.wikipedia.org/wiki/Decision_support_system
15. <http://www.targit.com/decision-support-system-dss>
16. http://www.gaoshan.de/university/tp/Importance_of_Models_in_Economics.pdf
17. http://en.wikipedia.org/wiki/Economic_model