APPLICATION REGRESSION METHOD IN THE CALCULATION OF INDICATORS ECONOMIC RISK

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Abstract

The objective of this Article is to show that economic risk is influenced by multiple factors, and by regression method can establish the extent of influence of each factor. For this purpose have been carried out calculations and tests for a different number of commercial companies, and therefore for series smaller or bigger, using a number is less than or greater than independent variables that can influence economic risk, as a variable dependent on these analyzes, as well as regression method, may facilitate the process management from the point of view of both correctness decisions taken, as well as how many of those decisions.

Key words: risk economic, regression method, estimator, independent variable, dependent variable, sample.

Analysing processes in the economy, in a large number of cases, makes it necessary to observation processes for all cases or items population, which is very expensive, either for a sample of cases, which implies the risk deviation from the real values of the parameters studied. To minimize this risk and to obtain effective results using a low number of cases, results that can be generalized to the whole in cases in which the economic analysis, the theory estimatiei proposes determining a size "a" for a parameter some "a" noting a sample, based on a function of the observation(s), which describes a specific behavior of the indicator, so as to be an approximation of the project as precise parameter a.

The function(s) is considered estimator , and the value taken by this, estimatie.

If estimatorul is defined as a formula or a method by which it is considered a parameter unknown, estimatia will be numeric value that result from applying the formula on the sample of data that characterise the process being analyzed.

For determination of those parameters which express to what extent one or several factors influence economic process, statistical methodology focuses on the regression function. As a result, the estimation function parameters describing incremental dependence of effect (y) and factors (x) shall be made using regression method.

In this respect, statistically, economic risk stands for a variable rezultativa dependent on one, two or more independent variables factor incomes shall be described.

If to determine the risk economically dependent variable Y, regression method is used, it will build a regression function f(x1, x2, ----) on the basis of which will establish the link between rezultativa variable Y and independent variables x1, x2, ---, giving the regression equation:

Y=f(x1, x2, ---) .

Number independent variables x1, x2, 59,0 it may be more or less, depending on the factors influence considered .

The regression model unifactoriala is used when the variable Y operates a single X , the other factors having an action constant and negligible. In this case, the regression equation is:

Y=f(x)+ε .

Unifactorial regression model used is:

Y=a+bxi+ε ,
Where: a,b=parameters, the coefficients to be calculated.

The parameters a,b it is estimated using the method of least squares (MCMMP), according to which, amount of the squares discrepancies between points observed (actual values) and the values of y to be minimal, i.e. :

$$\sum (y_i - y)^2 = \text{minimum}$$

$$\sum (y - a - bx)^2 = \text{minimum}$$

If we consider economic risk (RE) the variable dependence for a number of five economic unit as being influenced by a single independent variable, namely the degree of risk debt burden (GR), we will calculate the parameters a,b as follows from Table 1:

Economic Risk Situation Debt Burden and the Degree Of Risk to a Number Of 15 Companies

Table 1

S.C.	GR=x	RE=y
1.	1,2	5,5
2.	0,9	5
3.	1,15	6
4.	1,18	6,3
5.	1,12	5,2
6.	0,3	4,2
7.	0,8	5,7
8.	0,6	4,9
9.	1,2	6,3
10.	1,37	6,42
11.	1,55	6,75
12.	1,8	7,02
13.	1,95	7,12
14.	2,3	7,46
15.	2,49	7,63

$y_i = 4{,}016+1{,}57x_i \;;\; i=\overline{1;15}$

$\hat{b} = 1{,}57$

The coefficient $\hat{a} = 4$, 016 shall be the level of risk, which is not determined by the degree of risk debt burden, but also by other factors, and the coefficient $\hat{b} = 1{,}57$ indicates that between the two variables there is a direct connection; on average, to increase by one unit of the degree debt burden of risk, economic risk increases by 1.57 credits.

ANOVA[b] and coefficients

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.658	1	12.658	101.342	.000[a]
	Residual	1.624	13	.125		
	Total	14.282	14			

a. Predictors: (Constant), GR

b. Dependent Variable: RE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	4.016	.226		17.749	.000	3.527	4.505
	GR	1.570	.156	.941	10.067	.000	1.233	1.907

a. Dependent Variable: RE

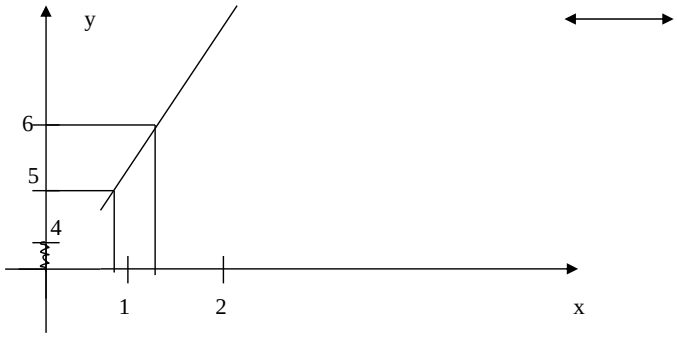
In the system of normal equations:

$$\begin{cases} na+b\sum x=\sum y \\ a\sum x+b\sum x^2=\sum xy \end{cases}$$

n=15 number of units observed $\Rightarrow \bar{y}=a+b\bar{x}$

or $a=\bar{y}-b\bar{x}$

This means that the regression right-hand passes through the point environment $(\bar{x};\bar{y})$.



$$b=\frac{n\sum xy-\sum x\sum y}{n\sum x^2-(\sum x)^2}$$

$$a=\frac{\sum y-b\sum x}{n}\ ;$$

If the variable dependence on y is influenced by many variables x, they will be using a regression model disorder with multiple etiologies, linear model whose expression is given by the relation :

$$Y=a_0+a_1x_1+a_2x_2+-----+a_px_p\ ,$$

Where :

a_0 =coefficient expressing influence of factors which are not included in the model, it can be considered with constant action.

$a_i, i=\overline{1;p}$ multiple regression coefficients, which shows the share with that influence each attribute factoriala rezultative feature on y .

Parameters $a_0, a_1, - - -, a_p$ are calculated on the basis of the method of least squares.

Considering rate indicators financial autonomy (Raf), and the rate of funding of the stocks (Rfs) as two independent variables the size which depends on the size economic risk, can be determined economic risk by means of a linear regression function of two variables, using SPSS. misalliance So, for 8 commercial companies having as its object of activity construction materials we have calculated the two indicators, after I have processed. Relations for the determination of the two rates shall be:

$$R_{af} = \frac{EquityCapital}{EquityCapital + BorrowedCapital}$$

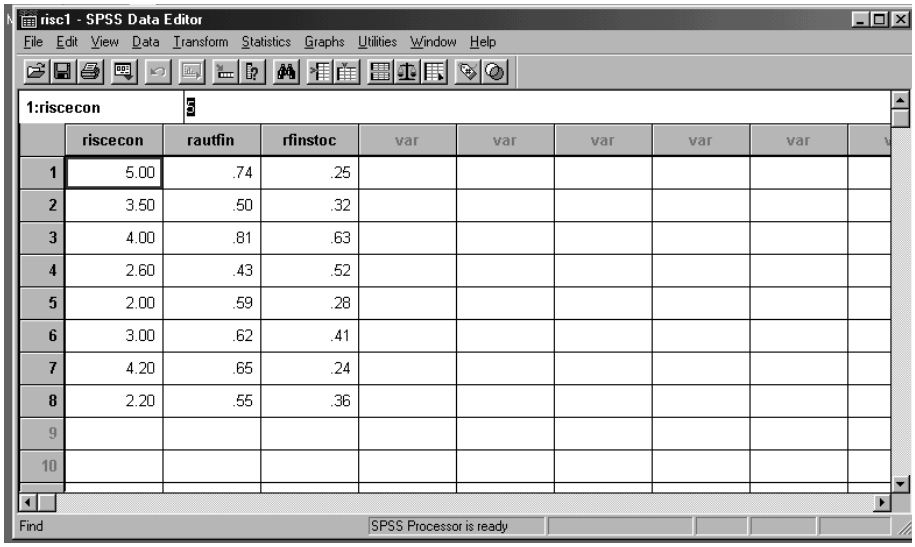
R_{af} express the share own financing sources in total capital available.

$$R_{fs} = \frac{WorkingCapital}{Stocks}$$

R_{fs} express possibility of financing stocks of working capital.

The results obtained can be seen in following layouts:

Databasefor the purpose of applying linear regression



The processing of the data by linear regression method

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.574	2	1.787	2.161	.211[a]
	Residual	4.134	5	.827		
	Total	7.709	7			

a. Predictors: (Constant), RFINSTOC, RAUTFIN

b. Dependent Variable: RISCECON

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.425	1.890		.225	.831
	RAUTFIN	5.691	2.794	.671	2.037	.097
	RFINSTOC	-1.570	2.503	-.207	-.627	.558

a. Dependent Variable: RISCECON

The linear regression function resulting is:
Y=0.425+5.691x1-1.57x2

Function of the regression obtained it is observed that 0,425 represents the economic risk which is not determined by the self-financing rate or the rate of funding of the stocks, but also other factors.

Between rate economic risk and financial autonomy there is a direct connection. So, to increase by one unit of the rate financial autonomy, economic risk increases by an average of 5,691 credits. Between economic risk and rate of funding of the stocks there is a connection reverse order; the increasing rate of funding of the stocks with a drive, economic risk decreases by an average of 1.57 credits.

It is found that the results obtained are characteristic of an economy in transition, which are specific and actions of other factors necontrolabili which may cause a disturbance in the operation's business.

Considering the indicators :

$$\text{Raf}=\frac{Kpr}{Kimpr+Kpr}$$

$$\text{Rfs}=\frac{FR}{St}$$

Where :
Raf=rate financial autonomy
Rfs=rate of funding of
St=stocks stocks,

It can be calculated economic risk by means of a linear function of two variables. This function will be written as follows:

$$z-\bar{z}=a(x-\bar{x})+b(y-\bar{y})$$

Where :

$$\bar{z}=\frac{\sum_{i=1}^{N} z_i}{N}\ ;\ \bar{x}=\frac{\sum_{i=1}^{N} x_i}{N}\ ;\ \bar{y}=\frac{\sum_{i=1}^{N} y_i}{N}$$

The parameters a, b may be determined in the following system of two equations with two unknowns :

$$\begin{cases} a\sum_{i=1}^{N}(x_i-\bar{x})^2+b\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})=\sum_{i=1}^{N}(x_i-\bar{x})(z_i-\bar{z}) \\ a\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})+b\sum_{i=1}^{N}(y_i-\bar{y})^2=\sum_{i=1}^{N}(y_i-\bar{y})(z_i-\bar{z}) \end{cases}$$

The two indicators, the rate financial autonomy (Raf), and the rate of funding of the stocks (Rfs), independent variables considered for eight companies, have led to determine the parameters a and b as a result of successive approximations, as is clear from the calculations made above.
When three independent variables influence economic risk, linear function of three variables will be written as follows :

$$z-\bar{z}=a(x-\bar{x})+b(y-\bar{y})+c(t-\bar{t}).$$

Estimatiile parameters a,b,c by the method of least squares shall be carried out in the system of three linear equations:

$$\begin{cases} a\sum_{i=1}^{N}(x_i-\bar{x})^2+b\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})+c\sum_{i=1}^{N}(x_i-\bar{x})(t_i-\bar{t})=\sum_{i=1}^{N}(x_i-\bar{x})(z_i-\bar{z}) \\ a\sum_{i=1}^{N}(x_i-\bar{x})(y_i-\bar{y})+b\sum_{i=1}^{N}(y_i-\bar{y})^2+c\sum_{i=1}^{N}(y_i-\bar{y})(t_i-\bar{t})=\sum_{i=1}^{N}(y_i-\bar{y})(z_i-\bar{z}) \\ a\sum_{i=1}^{N}(x_i-\bar{x})(t_i-\bar{t})+b\sum_{i=1}^{N}(y_i-\bar{y})(t_i-\bar{t})+c\sum_{i=1}^{N}(t_i-\bar{t})^2=\sum_{i=1}^{N}(t_i-\bar{t})(z_i-\bar{z}) \end{cases}$$

In determining the values maximum minimum variable rezultative y , using the method linear programming. General form of a linear programming problem is given by far (maximum or minimum) of a linear function of n variables, of the form:

$$f=c_1x_1+c_2x_2+-----+c_nx_n,$$

Provided that the n variables to satisfy a system of m linear equations inecuatii or the form:

$$\begin{cases} a_{11}x_1+a_{12}x_2+------+a_{1n}x_n \overset{\leq}{\geq} b_1 \\ a_{21}x_1+a_{22}x_2+------+a_{2n}x_n \overset{\leq}{\geq} b_2 \\ ----------\\ a_{m1}x_1+a_{m2}x_2+------+a_{mn}x_n \overset{\leq}{\geq} b_n \end{cases}$$

$$x_j \geq 0;\quad j=1;2;---n$$

$$\max(\min)[f]=\max(\min)\left[\sum_{j=1}^{n} c_jx_j\right]$$

$$(S):\begin{cases} \sum_{j=1}^{n} a_{ij}x_j \overset{\leq}{\geq} b_i \\ x_j \geq 0;\quad i=1;2;---m \end{cases}$$

General procedure for the resolution, specific method is linear programming simplex, but may be applied and other methods such as:

-The method graphics (geometric), if the variable rezultativa is influenced by a maximum of two independent variables;

-algebraic method, where two independent variables can be written as a function of the third.

As an application of a regression model, I did it for the construction of a regression model, for the purpose of illustrating dependence on y - economic risk and different rates economic, independent variables.

These independent variables are:

$$A=\frac{Total\quad financial\quad liabilities}{Current\ gross\ profit},$$

$$B=\frac{Total\quad financial\quad liabilities}{Total\ gross\ profit}$$

$$C=\frac{Interest\quad \exp ense}{Current\ gross\ profit},$$

$$D=\frac{Interest\quad \exp ense}{Total\ gross\ profit},$$

$$E=\frac{Financial\quad \exp enses+\ Financialliabilitiesmaturity<1year}{Total\ gross\ profit},$$

$$F=\frac{Interest\quad \exp ense}{Turnover},$$

$$G=\frac{Interest\quad \exp ense}{Financial\ liabilities}.$$

After selecting variables we did the construction of the regression function.

The regression function becomes:

$f(x)=\alpha_1 x_1+\alpha_2 x_2+\alpha_3 x_3+\alpha_4 x_4+---\alpha_7 x_7$,

where:

$x_1=A,\quad x_2=B,\quad x_3=C\quad ,x_4=D,\quad x_5=E,\quad x_6=F,\quad x_7=G$

This function expresses how the variable y rezultativa evolves under the influence variable x .

The values of indicators considered characterised the situation of 16 companies from the point of view of interlinkages between credit scoring and indicators economic risk; do not reflect situations ideal, but a situation frequency in current economy conditions. Thus, the financing costs and financial liabilities with maturity of less than one year may not be covered always from total gross profit.

Conclusion to be drawn is that it should be carried out a regression analysis for three versions: a variant in which the values of indicators financial exposure are ideal and significant to a group of companies effective, a variant in which they are grouped companies having regard situations economic-financial weak from the point of view of financial risk indicators and the other a variant in which they are represented companies with situations in the case of some favorable to unfavourable indicators and other indicators of credit scoring.

Values for the variable dependent on economic risk (mil. Lei) and independent variables coefficients to the 16 companies are in table no. 2.

The Independent And Dependent Variables To A Number Of 16 Companies, Necessary For The Determination Of The Regression Function

Table 2

Nr. crt.	A	B	C	D	E	F	G	RISCEC
1	1.57	1.91	0.12	0.15	1.50	0.01	0.08	15.35
2	1.31	1.56	0.22	0.23	0.20	0.01	0.08	14.55
3	1.66	1.52	0.29	0.19	0.34	0.01	0.06	14.38
4	1.22	1.10	0.10	0.09	0.10	0.02	0.05	13.59
5	1.74	1.82	.24	0.25	1.89	0.02	0.62	18.48
6	1.26	1.01	0.01	0.01	1.99	0.01	0.09	12.85
7	1.36	1.21	0.25	0.21	1.19	0.01	0.06	11.95
8	1.76	1.64	0.30	0.29	1.45	0.03	0.10	18.35
9	1.23	1.20	0.08	0.07	1.23	0.04	0.16	19.24
10	1.19	1.18	0.09	0.08	1.23	0.02	0.17	17.42
11	1.46	1.36	0.14	0.13	1.40	0.00	0.12	10.51
12	1.03	1.05	0.15	0.16	1.09	0.04	0.09	18.97
13	1.52	1.47	0.13	0.12	1.53	0.02	0.07	13.62
14	1.17	1.16	0.09	0.09	1.24	0.04	0.02	18.33
15	1.62	1.54	0.13	0.13	1.62	0.07	0.08	20.18
16	1.12	1.11	0.16	0.16	1.13	0.05	0.12	19.20

Using the program SPSS has been obtained from the following situation coefficients and of the function shown in the regression layout no. 4 :

The Regression Coefficients Function

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	13.919	2.701		5.154	.001	7.691	20.147
	A	-10.094	4.716	-.767	-2.140	.065	-20.969	.781
	B	7.430	3.749	.681	1.982	.083	-1.216	16.076
	C	34.986	23.375	.931	1.497	.173	-18.917	88.890
	D	-32.990	25.713	-.797	-1.283	.235	-92.285	26.305
	E	.753	1.129	.126	.667	.523	-1.849	3.356
	F	141.285	23.044	.867	6.131	.000	88.146	194.423
	G	6.214	3.390	.282	1.833	.104	-1.604	14.031

a. Dependent Variable: RISCEC

This means that the regression function is:

$$\hat{y} = 13.919 - 10.094A + 7.43B + 34.985C - 32.99D + 0.753E + 141.285F + 6.214G$$

By passing over this stage of the estimate model parameters, will follow significance test parameters estimate.

In that way, the regression function data shows that :

- the coefficient $\hat{a} = 13{,}919$ represents the economic risk which is not determined by the 7 independent variables considered, but by other factors;

- the coefficient $\hat{b} = -10{,}094$ specifies that between economic risk and the variable part of reverse there is a connection: the higher the coefficient variable A, the economic risk is less;

- the coefficient $\hat{c} = 7{,}43$, which indicates that between economic risk and variable B there is a direct connection, i.e. the higher the coefficient variable B with greater economic risk;

- a reverse connection also exists between economic risk and variable D, and between risk and other variables C, E, F and G there is a direct connection.

The confidence interval is determined for a probability of 95 %, resulting in the table and the time limits within which fall within the values

of the coefficients, but also their values when account is taken of spread (the coefficients standardize).

Model validation is carried out using test F, respectively with analysis dispersionale.

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121.143	7	17.306	7.651	.005[a]
	Residual	18.095	8	2.262		
	Total	139.238	15			

a. Predictors: (Constant), G, F, C, E, B, A, D

b. Dependent Variable: RISCEC

F_{calc} =7,651

$F_{0,05;1;14}$ =4,6

$F_{calc} > F_{0,05;1;14} \Longrightarrow$ THE MODEL IS VALIDATED AS BEING ACCEPTABLE.

In the following table shows that properties are met the linear regression coefficient, which confirms the validity linear regression model.

Coefficient Correlations[a]

Model			G	F	C	E	B	A	D
1	Correlations		1.000	.123	.171	-.256	.035	-.078	-.219
		F	.123	1.000	.097	-.300	.116	.014	-.117
			.171	.097	1.000	.493	.661	-.725	-.963
			-.256	-.300	.493	1.000	.277	-.482	-.422
			.035	.116	.661	.277	1.000	-.856	-.698
		A	-.078	.014	-.725	-.482	-.856	1.000	.677
			-.219	-.117	-.963	-.422	-.698	.677	1.000
	Covariances		11.493	9.579	13.518	-.981	.448	-1.246	-19.089
		F	9.579	531.007	52.014	-7.813	9.984	1.535	-69.441
			13.518	52.014	546.410	13.017	57.937	-79.901	-579.087
			-.981	-7.813	13.017	1.274	1.171	-2.568	-12.236
			.448	9.984	57.937	1.171	14.058	-15.129	-67.326
		A	-1.246	1.535	-79.901	-2.568	-15.129	22.240	82.071
			-19.089	-69.441	-579.087	-12.236	-67.326	82.071	661.178

a. Dependent Variable: RISCEC

Conclusions

Basic ideas stemming from dealing with this topic on the use linear regression method in the identification of the factors influence economic risk and of the extent to which manifest themselves influence each factor are:

-an analysis relevance requires a sample consisting of as many commercial companies;

-factors of influence of economic risk can vary by area of activity of the company;

-there is no perfect models of risk analysis;

-these models are estates taking into account economic context national and international.

-by using this information center computing, processing, interpretation, it may be possible to make estimatii of the parameters considered and can be performed for predictions. Downstream from upstream, from the results to the factors of influence, predictions would have an applicability more than stock records.

It is necessary to improve the data base for the purposes of use of indicators that relate to units of time less than one year (quarters, months) to capture in a more refined, delayed effects. Must be enlarged the reference framework by introducing to a greater extent indicators in the field financial and banking.

But, as well as his Nobel, Feynman, "it is important for the upturn to recognize partial ignorance and leave room doubt ... not to say it's never been that we've come to know everything."

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