Study on the Credit Risk in Societies with Agricultural Profile

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Abstract: *The credit risk is one of the most important risks the banks face in their daily work and it has a direct impact on bank performance. In the current context, a bank has available a variety of options to determine capital requirements, to decrease the credit risk. This study aims to analyze the correlation of the main indicators of creditworthiness of firms and the credit risk, that a bank will take giving credit to these firms.*

Keywords: default risk, creditworthiness indicators, correlation analysis, bank performance

JEL Classification: G23, G32

1. Introduction

In the current global financial crisis the banks must adopt measures to adopt the new conditions and prepare for this change immediately. One of the most important areas requiring attention and priority action is the link between the capital of bank and the risks they are subjected during his activity.

The credit risk in one of the most important risk the banks facing in their daily work and their manager has a great influence on their performance.

The credit risk can express the possibility that the debtors not to fulfill their obligations on due date, which generates its appearance. For reduce losses arising from non-collection of loans and interest at maturity, requires a careful monitoring of credit risk, which is done with a good management of priorities before and after the grant of credit.

The first stage is the management priority especially before granting credit. This includes:

- ✓ Division and limit on risks;
- ✓ Indicators of creditworthiness assessment firms, credit seekers;
- ✓ Constitution guarantees.

The second stage is the management priorities for granting credit. This includes:

- ✓ The credit portfolio and provisioning;
- ✓ Fund for general banking risks.

The banks must minimize the amount of credit risk and try by all means to charge the related receivable.

The evaluation indicators of creditworthiness of a company must bear in mind that debt service payment of the applicant company, respectively, interest and other costs arising for credit agreements can be repaid within and without any delay, which could lead to losses for banks that provide credit.

We propose further that through an econometric study, to assess the credit risk, namely to assess the collectability of loans or defaulted ones.

To measures this probability, we will use as a methodological approach, a set of econometric tools. In this approach econometric steps covered are:

- Delimitation hypotheses to be tested;
- Mathematical formulation of economic assumptions;
- Econometric model specification;
- Data collection;
- Parameter estimation;
- The model results;
- Conclusions and recommendations.
- Delimitation hypotheses to be tested

The analysis purpose that we perform is caught in the first stage of our approach, assumption delimitation.

To study the probability of repayment or default of loans, we test these two hypotheses:

- between the first credit risk and value indicators of creditworthiness of companies there is a powerful correlation.
- Indicator assessment of creditworthiness of a company helps in determining the amount of credit risk/likelihood of repayment or default on the loan.

2. Methodology

This hypothesis comes from the assumption that indicators of creditworthiness of the companies have a major influence on the value of credit risk. To test the two hypotheses mentioned will use one of the most used empirical tools: the linear regression. Social-economic processes and phenomena aren't generally, independent phenomena, but they manifest as a result of the action of influencing factors and condition, in turn, the manifestation of others. Therefore, we say that between mass phenomena manifest links, dependents. Connections that exist between two statistical variables can be studied using regression technique.

Regressions will help in explaining and predicting a value based on another factor which will reduce uncertainty regarding major events, but random. One of the most commonly used mathematical functions is the linear function. Relation between effect variable (Y) and causal variable (X) can be studied through simple linear regression. The dependent variable (Y) is represented on the vertical axis, and the independent variable (X) is represented on the horizontal axis. By examining the chart we can determine if the relation between the two variables (if it exists) is linear or curve, parabolic etc.

Least squares method is the most simple mathematical method which can be used to determine a linear function of X and Y, to represent the relation between the two variables. No straight line can't be perfect every observation on the diagram. The general equation for the line is $Y = a + bX$ .The estimated equation for the regression analysis is:

$$\hat{\hat{Y}}(X) = \hat{a} + \hat{b}X + e$$

where:

Y = the dependent variable;

$\hat{a}$ = the constant;

$\hat{b}$ = the regression coefficient;

X = the independent variable;

e – the error, the difference between the actual value and the estimated value by regression line.

The estimated regression function describes the nature of the relation between X and Y. In addition, we are interested in the power relation between X and Y. The coefficient of determination, R^2, is the measure of the power relation between the two variables. The coefficient of determination measures the total variation percentage of Y that is explained by variation of X. This coefficient varies between 0 and 1. If there is a perfect linear relation between X and Y then all variations of Y is explained by variation of X and R^2 is 1. At the other extreme, if there is no relation between X and Y, then none of the variations of Y not explained by variation of X and the coefficient of determination is 0.

Through regression results will allow us to describe and understand the dependency relations, to predict a new value of the variable effect and adjust and control the effect variable by intervention on the cause variable. To test hypotheses H_1 and H_2, we will use as the dependent variable, the credit risk (effect) and as independent variable, indicators of creditworthiness of the companies (cause).

Credit risk data were established after the Convention to note PD credit record 0 and 1 the probability of repayment, and the data on indicators of creditworthiness of companies were collected on site www.doingbussines.ro, the annual financial statements, for a sample of 20 companies ((CETATEA DE BALTA S.R.L., SAMI PRODAGRO S.R.L., TUP & TUP S.R.L., AGRA OARDA S.R.L., AGRO MARGIN S.R.L., AGRO URSA S.R.L., VITICOLA S.A., CIUMBRUD PLANT S.R.L., ECO VERT S.R.L., KING ALEX S.R.L., MAGIC GRUP S.R.L., AGRAD PRODCOM S.R.L., AGRICOLA MOTTA 2007 S.R.L., AGRO ROMAR S.R.L., AGRO RALUCA S.R.L., AGRO LUCAS S.R.L., AGRO BALOGH S.R.L., AGRO TURDEAN IMPEX S.R.L., JIDVEI S.R.L. FILIALA ALBA, AGRI VITIS TRADITION S.R.L.) for a period of 5 years, ie 2009-2013.

In the next section of study, we present the results obtained by the mentioned tests. Note that all estimated were made using econometric software Eviews 4.1.

3. Data collection

In my opinion, a determining factor in accomplishing an analysis of a correlation is the data collection system. In this regard we need to consider the following factors: data access, data quality and process management.

Data availability. Credit risk assessment requires a large volume of data. To be effective, the system must allow the possibility of accessing data (reading, writing and modifying them) with minimal intervention of the human factor.

Data quality. Risk systems are made with high quality data. So a performance analysis should be able to determine the intensity of correlation between the two variables, and a variable influence on other variable.

The data used to build the model consist in financial statements of 20 companies with bank commitments. The companies were selected from a random sample of 100 companies. Of the 20 selected companies, 11 companies recorded a low probability risk, and the remaining 9 companies registered a high probability of risk.

Indicators of creditworthiness of the company (indebtedness, the current liquidity, coverage of debt, the net profit margin, return on equity after taxation, inventory turnover speed, solvency), and indicators that highlight the evolution of the economic and financial analysis companies are exogenous variable and endogenous variable is credit risk analysis.

4. The model results

To have a more accurate picture of the relation between credit risk and indicators of creditworthiness of companies, we estimate a regression for each

indicator of creditworthiness of companies, then we estimate a regression multifactorial credit risk and all indicators of creditworthiness of the companies to a place. Will these templates, we test even the validity of the assumptions H_1 and H_2.

- **Econometric regression model analysis unifactorial**

In phase on, we considered the selection of seven economic and financial indicators (indebtedness, the current liquidity, coverage of debt, the net profit margin, return on equity after taxation, inventory turnover speed, solvency), relevant to each of the 20 selected companies.

To determine the correlation of each exogenous variable (indebtedness, the current liquidity, coverage of debt, the net profit margin, return on equity after taxation, inventory turnover speed, solvency) with endogenous variables (credit risk) we conducted univariate analysis for the seven indicators. The unifactorial econometric model is defined by the following equation:

$$y=f(x) + \varepsilon$$

and:

- ✓ x exogeneous variable, independent or causal variable;
- ✓ yendogenous variable, dependent or effect variable;
- ✓ ε residual variable random;
- ✓ f(x)is the regression function with which be expected the value o variable y.

To determine the correlation between exogenous variable (indebtedness, the current liquidity, coverage of debt, the net profit margin, return on equity after taxation, inventory turnover speed, solvency) and endogenous variable (credit risk) we use single factor linear regression function. This is:

$$y = a + bx + \varepsilon$$

If regresion analysis model consists of parameter estimation of the unifactorial econometric model by determining estimators.These estimators must be calculated so that the difference between the real values of the dependent variable y and the estimated values of the parameters calculated to be as small enough.

As we see in the table 1, the estimated model, increasing the value of indebtedness contributed positively to increasing the value of credit risk. Influence coefficient value is an average of 0,0613654. This value indicates that an increase of one unit of indebtedness will lead to an increase in credit risk 0.0812173. The fact that the relationship between the two variables is high is highlighted and the coefficient of .613654.

Tabel 1 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.5278278	0.124640	4.234823	0.0005
GI	0.0812173	0.012438	2.499184	0.0042
R-squared	0.613654	Mean dependent var		0.550000
Adjusted R-squared	-0.041142	S.D. dependent var		0.510418
S.E. of regression	0.520812	Akaike info criterion		1.627784
Sum squared resid	4.882410	Schwarz criterion		1.727357
Log likelihood	-14.27784	F-statistic		3.249167
Durbin-Watson stat	3.519922	Prob(F-statistic)		0.003236

Own calculations

Note:,, RC" is credit risk, ,,GI" is indebtedness

Figure No. 1 is represented by the regression line for each selected firm. Also, how selected companies are placed in this figure gives us information on the performance of each of them. Thus, high values on OX, where is the leverage, should be accompanied by elevated credit risk represented on OY.

The first observation to be emphasized is the high heterogeneity of how selected companies are placed front line regresie. This, actually, indicates a different relation between the two variables, between the companies analyzed.

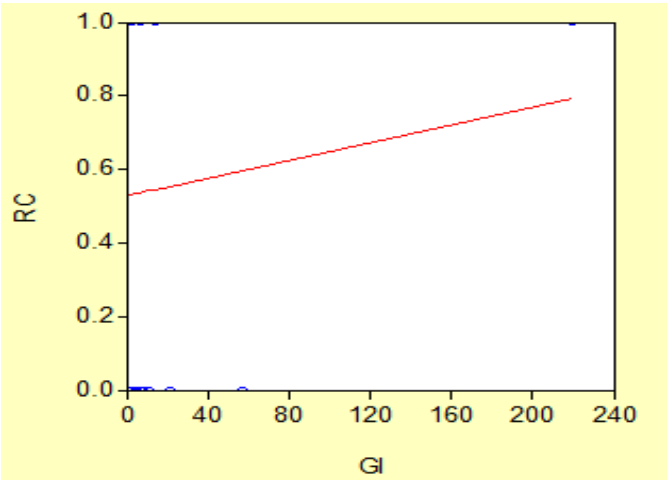

Figure 1 Graphical representation of indebtedness and credit risk
Source: own processing by the data derived from BSE
Note: on OX is the indebtedness; on OY is the credit risk.

We continue to present the results of linear regression analysis for current liquidity.

A value is an average coefficient of influence of 0.526466.This value indicates that an increase of one unit of indebtedness will lead to a drop in the value of credit risk by 0.191906. The relationship between the current liquidity and credit risk is inversely proportional. The fact that the relationship between the two variables is high is emphasized by R2 coefficient as well of 526,466. The relation between the current liquidity and credit risk is inversely proportional.

Table 2 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.321664	0.178936	3.797649	0.0008
LC	-0.191906	0.118881	-2.614296	0.0123
R-squared	0.526466	Mean dependent var		0.550000
Adjusted R-squared	0.077936	S.D. dependent var		0.510418
S.E. of regression	0.490124	Akaike info criterion		1.506324
Sum squared resid	4.323993	Schwarz criterion		1.605897
Log likelihood	-13.06324	F-statistic		2.685952
Durbin-Watson stat	2.645876	Prob(F-statistic)		0.018389

Source: Own calculations
Note:,,RC" is the credit risk, ,,LC" is the current liquidity

Figure No. 2 highlights the values of two variables analyzed for each company. The graphic reveals a high heterogeneity of how selected companies are placed against the regression line.

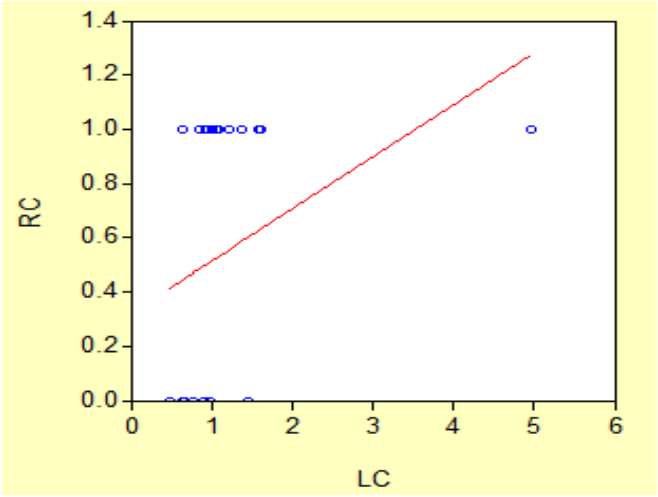

Figure 2 Graphical representation of current liquidity and credit risk
Source: own after data extracted from BSE.
Note: OX is represented on the current liquidity; on OY is the credit risk.

In Table 3 are presented the results of the estimated model for the coverage of debt. As we can see, this model indicates a negative influence on the coverage of debt on credit risk. Thus, one unit increase in the coverage ratio of debt will drive down the value of credit risk with 0.021406. The value of Coefficient R2, shows that variation of the independent variable - coverage of debt - 73.3% of the variation surprise than the dependent variable - the risk of credit.1406.

Table 3 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.484330	0.142481	3.399268	0.0032
GAD	-0.021406	0.027283	-2.784606	0.0442
R-squared	0.733069	Mean dependent var		0.550000
Adjusted R-squared	-0.020649	S.D. dependent var		0.510418
S.E. of regression	0.515661	Akaike info criterion		1.607904
Sum squared resid	4.786307	Schwarz criterion		1.707477
Log likelihood	-14.07904	F-statistic		4.615606
Durbin-Watson stat	3.483743	Prob(F-statistic)		0.041285

Source:Own calculations
Note:,, RC"is the credit risk, ,,GAD" is coverage of debt

Next figure represents regression and the way each analyzed firm stands against it. We take into account the fact that the positioning above it indicates an above average performance, and those that are positioned below the regression line indicates poor performance.

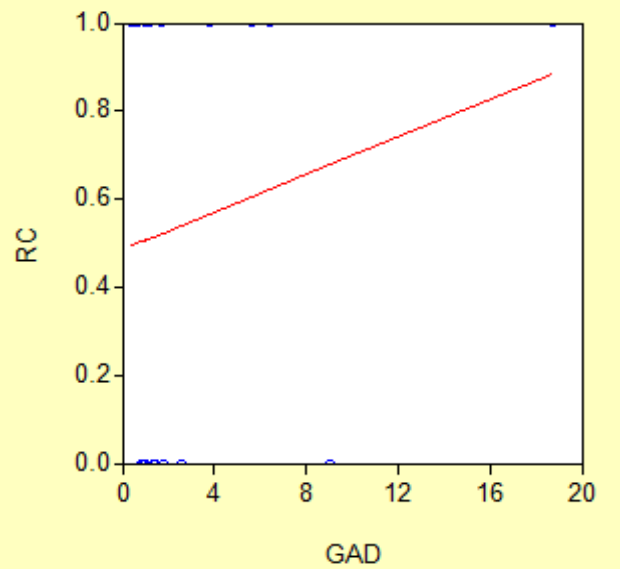

Figure 3 Graphical representation of coverage of debt and credit risk
Source: own after data extracted from BSE.
Note: on OX is the coverage of debt; on OY is the credit risk.

In Table 4, in the model, the influence of the independent variable on the dependent variable diminishes considerably, being close to 0. Moreover, the influence of the profit margin on the value of credit risk is not significant in statistical terms.

Table 4 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.548424	0.125797	4.359602	0.0004
MPN	0.000177	0.005119	0.034587	0.9728
R-squared	0.000066	Mean dependent var		0.550000
Adjusted R-squared	-0.055485	S.D. dependent var		0.510418
S.E. of regression	0.524387	Akaike info criterion		1.641466
Sum squared resid	4.949671	Schwarz criterion		1.741039
Log likelihood	-14.41466	F-statistic		0.001196
Durbin-Watson stat	1.403840	Prob(F-statistic)		0.972790

Source: Own calculations
Note:,,RC "is the credit risk, ,,MPN"-net profit margin

Figure No. 4 indicates a greater heterogeneity of how the companies analyzed are placed against the regression line, indicating a different degree of performance. We shall take into account that the positioning above it indicates an above average performance, and those that are positioned below the regression line indicates poor performance.

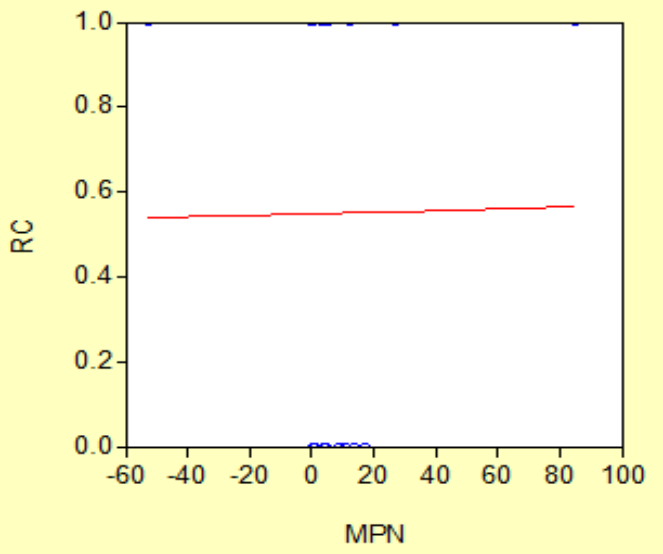

Figure 4 Graphical representation net profit margin and credit risk
Source: own after data extracted from BSE.
Note: on OX is the net profit margin; on OY is the credit risk.

Table No. 5 in the model, return on equity after tax impact of credit risk is negative, the coefficient is statistically half fictive and amounted to 0.012523. If return on equity after tax increases by one unit, then credit risk decreases with 0.012523. In these circumstances, the coefficient is high, ie 64.8% of the variation in credit risk is determined by the variation return on equity after tax.

Table 5 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.470032	0.141902	3.312369	0.0039
RCPI	-0.012523	0.002649	-3.952657	0.0353
R-squared	0.647999	Mean dependent var		0.550000
Adjusted R-squared	-0.004889	S.D. dependent var		0.510418
S.E. of regression	0.511664	Akaike info criterion		1.592342
Sum squared resid	4.712402	Schwarz criterion		1.691916
Log likelihood	-13.92342	F-statistic		5.907556
Durbin-Watson stat	3.498109	Prob(F-statistic)		0.045338

Source: Own calculations
Note:,,RC "is the credit risk, ,,RCPI "is return on equity after tax.

Figure No.5, we must have in mind that positioning above the regression line indicates an above average performance of the analyzed companies regarding return on equity after tax, and those that are positioned below the regression line indicates better the weak performance.

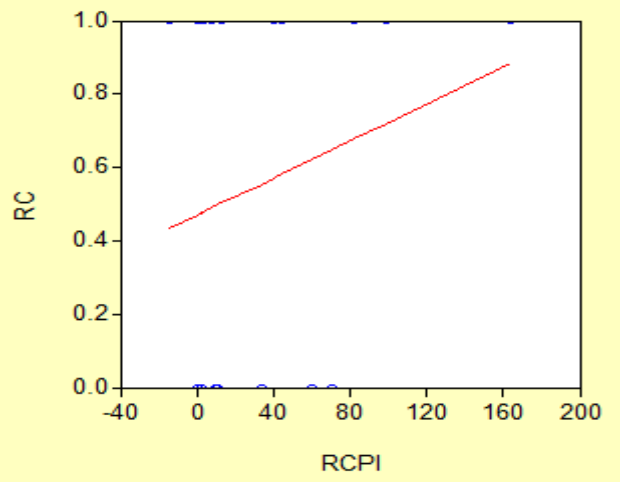

Figure 5 Graphical representation of return on equity after tax and credit risk
Source: own after data extracted from BSE.
Note: on OX is the return on equity after tax; on OY is the credit risk.

In Table No.6 shows the results of the model estimated speed of inventory turnover. As we can see, the model shows this time a negative rate of inventory turnover on credit risk. Thus, one unit increase in the rate of inventory turnover will decrease the value 0.000122 credit risk, this amount is insignificant because the coefficient value that approaches the value 0. Coefficient R2, shows that variation of the independent variable - rotational speed of the stocks - only captures 10.52% of the variance of the dependent variable - credit risk.

Table 6 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.618845	0.120589	5.131839	0.0001
VRS	-0.000122	8.37E-05	-1.455009	0.1629
R-squared	0.105237	Mean dependent var		0.550000
Adjusted R-squared	0.055528	S.D. dependent var		0.510418
S.E. of regression	0.496044	Akaike info criterion		1.530336
Sum squared resid	4.429079	Schwarz criterion		1.629910
Log likelihood	-13.30336	F-statistic		2.117051
Durbin-Watson stat	1.348082	Prob(F-statistic)		0.162885

Source: own calculations
Note:,,RC "is credit risk; ,,VRS "is speed of inventory turnover.

Figure No. 6 is the regression and the way each analyzed firm stands against this. We shall take into account that the positioning above it indicates an above average performance, and those that are positioned below the regression line indicates poor performance.

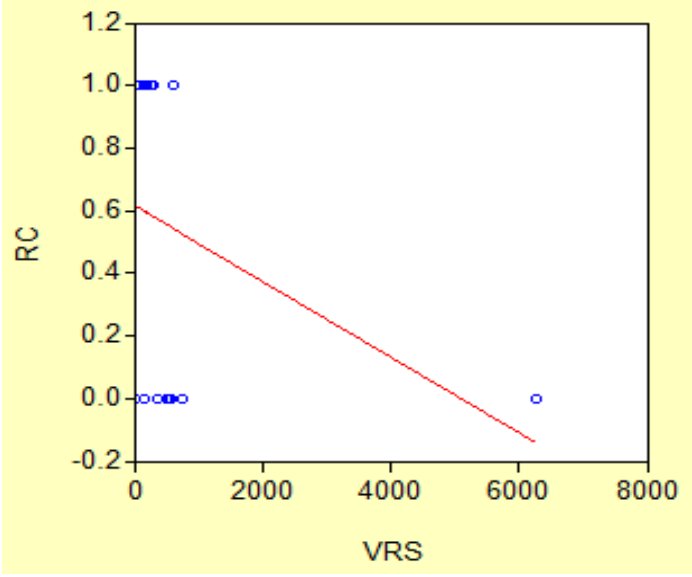

Figure 6 Graphical representation of inventory turnover rate and credit risk
Source: own after data extracted from BSE.
Note: OX is the axis of rotation of stocks; on OY is the credit risk.

Tables No. 7, in the model, the influence of the independent variable (solvency) on the dependent variable (credit risk) has a value over average coefficient R2 is about 70%. Moreover, if the solvency would increase by one unit of credit risk falls by 0.111948. Namely between solvency and credit risk exists an inverse relation.

Table 7 Results of Linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.323262	0.201879	4.601269	0.0012
S	-0.111948	0.083011	-3.348607	0.0194

R-squared	0.691768	Mean dependent var	0.550000
Adjusted R-squared	0.041311	S.D. dependent var	0.510418
S.E. of regression	0.499764	Akaike info criterion	1.545276
Sum squared resid	4.495746	Schwarz criterion	1.644850
Log likelihood	-13.45276	F-statistic	5.818734
Durbin-Watson stat	3.557189	Prob(F-statistic)	0.001341

Source: own calculations
Note:,,RC "is credit risk; ,,S "is solvency.

Figure No. 7 indicates a low heterogeneity of how the analyzed companies are placed against the regression line, showing a high performance proximity. Points to consider that a position above it indicates an above average performance, and those that are positioned below the regression line indicates poor performance.

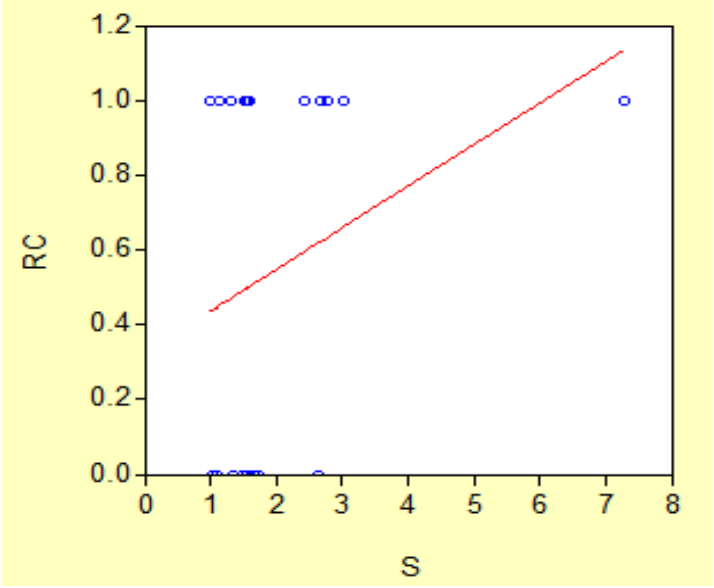

Figure 7 Graphical representation of solvency and credit risk
Source: own after data extracted from BSE.
Note: on OX is the solvency; on OY is the credit risk.

Following their analysis was noted in five exogenous variables strongly correlated with the endogenous variable: indebtedness, current liquidity, coverage of the debt, the rate of inventory turnover, solvency. We considered that the relation between selected variables and credit risk should be clear and viable economically, that the relation between each of the variables: current liquidity, coverage of debt, return on equity after tax, solvency and risk credit is inversely proportional, an increase of these indicators imply a fall in the value of credit risk, while the relation between leverage and credit risk is directly proportional to an increase in this indicator implying an increase in credit risk.

- **Econometric model analysis of multifactorial regression**

In stage II, we took into consideration the selection of five financial indicators (indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency) of the 7 indicators initially selected, relevant to each of the 20 selected companies and which have a strong correlation with credit risk.

Multifactor econometric model is defined by the following relation:

$$y = f(x1, x2, \ldots xn) + \varepsilon$$

where:

- ✓ xn = (x1, x2, ... xn) is exogenous variable, independent or causal variable;
- ✓ y is the endogenous variable, dependent or variable effect;
- ✓ $\varepsilon = (\varepsilon 1, \varepsilon 2; \ldots \varepsilon n)$ is the residual variable, random, disruptive or error;
- ✓ f (x1, x2, ... xn) is the regression function will be assessed by which the variable y values.

To determine the correlation between exogenous variables (indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency) and variable endegene (credit risk) will use linear instance, through regression multifactorial. This is:

$$y_t = b_0 + b_1 x_{1t} + b_2 x_{2t} + \ldots + b_k x_{kt} + \varepsilon_t$$

Regression analysis is multifactorial model for estimating econometric model parameters, determining estimators.

These estimators should be calculated so that the difference between the real values of the dependent variable (yi) and estimated values using the parameters calculated to be as small as possible.

Using the 5 indicators (indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency) econometric model to estimate multifactor regression, the result is as follows:

Table 8 Results of linear regression unifactorial

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.032889	0.347620	5.094610	0.0009
GI	0.061694	0.082736	4.019337	0.0003
LC	-0.160868	0.095273	-2.499836	0.0098
GAD	-0.016771	0.017893	-2.662419	0.0208
RCPI	-0.001568	0.001479	-3.686213	0.0219
S	-0.088379	0.069072	-3.018766	0.0096
R-squared	0.617519	Mean dependent var		0.055345
Adjusted R-squared	-0.061938	S.D. dependent var		0.510418
S.E. of regression	0.525987	Akaike info criterion		0.196246
Sum squared resid	3.873279	Schwarz criterion		2.094966
Log likelihood	-61.96246	F-statistic		68.77836
Durbin-Watson stat	1.815500	Prob(F-statistic)		0.000424

Source: own calculations

Note:,, RC" is credit risk; ,,GI" is indebtedness; ,,LC" is the current liquidity; ,,GAD "is coverage of debt; ,,RCPI" is the return on equity after tax; ,,S "is solvency.

The result is statistically relevant, demonstrated and probability values obtained in the five variables, less than 0.05%.

The results reveal that between each of the indicators: current liquidity, coverage of debt, return on equity after tax, solvency and credit risk exists an inverse relationship, so as the values of these indicators are higher as credit risk is reduced, while between indicators indebtedness and credit risk there is a linear relationship, an increase of this indicator with an increase in credit risk.

These results are correct in terms of economic interpretation as well. Analyzing influence on credit risk indicators is observed that the current liquidity has the greatest influence on him, while return on equity after tax has a less significant influence.

Exogenous variables (indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency) have a significant influence on the endogenous variable (credit risk), this influence is explained by the coefficient R2, which has a value of 61.75%.

4. Conclusions

In conclusion, we can state firmly that between the 5 indicators of creditworthiness of the companies selected, considered and exogenous variables (indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency) and endogenous variable (credit risk) there is a strong correlation. The results are confirmed by the estimated model both through linear multifactorial regression and unifactorial regression. Both assumptions made available in the initial stage of the study have been validated econometric models. The variables - indebtedness, current liquidity, coverage of debt, return on equity after tax, solvency have a strong influence on the credit risk factor associated with each variable is significant in statistical terms, this has led to acceptance H1 hypothesis, namely between credit and value indicators of creditworthiness of the companies there is a strong correlation. Another observation that can be drawn is related to the fact that over 60% of the change in the value of credit risk is determined by the 5 indicators. The validity of this observation is supported by the differences in outcomes outlined in the model for each indicator estimated by linear regression and the fact that between each of the indicators: current liquidity, coverage of debt, return on equity after tax, solvency and risk credit there is an inverse relation, so as the values of these indicators are higher as credit risk is reduced, while between indicators indebtedness and credit risk there is a linear relationship, an increase of this indicator causing a increase credit risk.

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