Factor Analysis of Credit Risk in Romania

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Abstract

All lending institution is confronted with credit risk and therefore assumes it. So it is necessary to analyze the dynamics of credit risk, the effects on profitability, capital adequacy and, very important, but also difficult to quantify, the general trust in the institution (Berríos M.R., 2013).

In order to assess the correlations between credit risk and other financial variables, a database was created in SPSS program packages and the factor analysis was performed. The analysed variables are: Credit Risk Rate, Economic Profitability, Non-performing Loans, Rate of Return, Leverage Effect, Solvency Ratio and Return on Equity (Pinches, 1973).

It was established that for Romania for the analysed period are strong correlations between all variables analyzed.

Key words: credit risk, solvency, equity, leverage, principal component analysis
J.E.L. classification: C58, E51

1. Introduction

All lending institution is confronted with credit risk and therefore assumes it. So it is necessary to analyze the dynamics of credit risk, the effects on profitability, capital adequacy and, very important, but also difficult to quantify, the general trust in the institution (Berríos, 2013).

The credit risk is quantified as the credit risk rate. A credit risk analysis starts with a description of the existing lending situation, of the main financial phenomena, based on available information, in a statistical form. This description is one of the premises of the statistical analysis carried out in the present paper through factor analysis, so that the aspects of the use of credit risk in Romania can be highlighted.

The analysis is aimed to outline a picture of the current credit risk situation in Romania, from the perspective of the most comprehensive indicator that characterizes them: the credit risk rate.

For credit risk analysis, it is important to know the effect and the influence of other financial variables. This problem can be addressed by factor analysis, i.e., principal component analysis.

2. Data and method

In the analysis were used the variables: Credit Risk Rate, Non-performing Loans Rate, Rate of Return, Leverage Effect, Solvency Ratio and Return on Equity.

As method was used the factor analysis. Principal Component Analysis is a descriptive multidimensional analysis method used to the study of centered and reduced numeric variables.

Principal Component Analysis is a method of factorial analysis that reduces a complex system of variables correlated to a small number of latent variables (Pintilescu, 2007)

The objectives pursued by an analysis of the principal components are (Baccini, 2005):

- the "optimal" graphical representation of individuals, minimizing the deformation of the cloud of points, in a sub-space Eq of dimensions q (q <p);
- graphical representation of variables in a sub-space Fq, best explaining the initial links between these variables;
- reduction of size, i.e. approximation of table X through a table q (q <p).

3. Results

The principal component analysis highlights the correlations between the registered statistical variables.

After processing the data in SPSS, is obtained the correlation matrix (Table no. 1). This is a symmetric matrix to the principal diagonal and presents the values of the correlation coefficients between variables, considered two by two.

The values of the coefficients resulting from the correlation table between variables show that there are statistically significant relationships between the variables considered, so the analysis of the principal components can be applied (Pintilescu, 2007).

Table no. 1 Matrix of correlations between variables

Correlation Matrix [a]

		rata riscului de creditare	rata creditelor neperformante	rata rentabilitatii activitatii de baza	efectul de parghie	indicatorul de solvabilitate	rentabilitatea economica	rentabilitatea capitalului propriu
Correlation	rata riscului de creditare	1.000	.995	.592	.465	.427	.152	.106
	rata creditelor neperformante	.995	1.000	.593	.460	.419	.175	.126
	rata rentabilitatii activitatii de baza	.592	.593	1.000	.502	.458	.378	.357
	efectul de parghie	.465	.460	.502	1.000	.695	.031	.012
	indicatorul de solvabilitate	.427	.419	.458	.695	1.000	.238	.237
	rentabilitatea economica	.152	.175	.378	.031	.238	1.000	.996
	rentabilitatea capitalului propriu	.106	.126	.357	.012	.237	.996	1.000
Sig. (1-tailed)	rata riscului de creditare		.000	.004	.022	.034	.267	.333
	rata creditelor neperformante	.000		.004	.024	.037	.237	.303
	rata rentabilitatii activitatii de baza	.004	.004		.014	.024	.055	.067
	efectul de parghie	.022	.024	.014		.000	.449	.480
	indicatorul de solvabilitate	.034	.037	.024	.000		.163	.164
	rentabilitatea economica	.267	.237	.055	.449	.163		.000
	rentabilitatea capitalului propriu	.333	.303	.067	.480	.164	.000	

a. Determinant = 6.29E-006

Source: Own Projection, using SPSS

Table 1 shows the χ^2 statistic, which tests whether there is a statistical link between the statistical variables. The value of KMO statistics is 0.598, which means that exists a significant statistically link between the analyzed variables. This result is also confirmed by the value of sig, which is smaller than 0.05. The matrix of correlations is not a unit matrix, so there are significant links between the considered variables, in this case the analysis of the principal components can be applied (Timraz, 2012).

Table no. 2 Values of KMO test statistic and χ^2 statistics

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.598
Bartlett's Test of Sphericity	Approx. Chi-Square	177.654
	df	21
	Sig.	.000

Source: Own Projection, using SPSS

After standardize the variables, are obtained new variables with the mean 0 and variance 1. Variance of the variables considered in the analysis of the principal components are found in Table no. 3.

Table no. 3 Variance of statistical variables

Communalities

	Initial	Extraction
rata riscului de creditare	1.000	.795
rata creditelor neperformante	1.000	.787
rata rentabilitatii activitatii de baza	1.000	.657
efectul de parghie	1.000	.603
indicatorul de solvabilitate	1.000	.526
rentabilitatea economica	1.000	.987
rentabilitatea capitalului propriu	1.000	.991

Extraction Method: Principal Component Analysis.

Source: Own Projection, using SPSS

If the values of the variance after extracting the factors are reduced, the respective variables are not correlated with the factorial axes, so can be removed from the analysis.

In this case for the considered variables (credit risk ratio, non-performing loans rate, rate of return, leverage effect, solvency ratio, economic profitability and return on equity), the values of the variance after factor extraction are bigger than 0.5, so the variable are correlated with the factorial axes.

Table no. 4 The values of the matrix of correlations and the variance explained by the factorial axes

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.481	49.732	49.732	3.481	49.732	49.732
2	1.866	26.663	76.395	1.866	26.663	76.395
3	.948	13.549	89.944			
4	.442	6.308	96.252			
5	.256	3.651	99.903			
6	.005	.070	99.974			
7	.002	.026	100.000			

Extraction Method: Principal Component Analysis.

Source: Own Projection, using SPSS

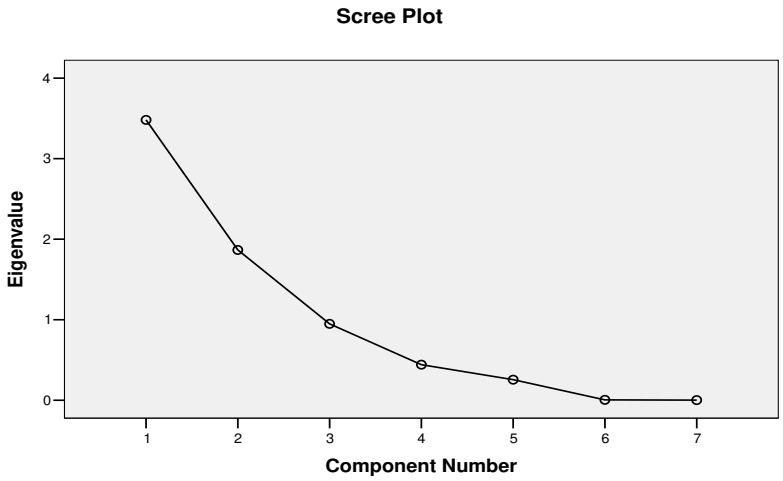
The values of the correlation matrix correspond to the inertia explained by the factorial axes. For the variables considered, the values are: $\lambda_1 = 3.481$, $\lambda_2 = 1.866$, $\lambda_3 = 0.948$, $\lambda_4 = 0.442$, $\lambda_5 = 0.256$, $\lambda_6 = 0.05$ and $\lambda_7 = 0.02$. The first factorial axis explains 49.73% of the total cloud variance. The second factorial axis explains 26.66%, and together with the first axis explains 76.39% of the total variance.

According to Kaiser's criterion, for principal component analysis it is chosen to interpret the first two factorial axes, since the two values are greater than 1.

According to Benzécri's criterion, the number of axes which explains over 70% of the total variance of the cloud point is chosen, so the first two factorial axes are chosen because together explain the largest differences between the statistical units, respectively 76.39% of the variance total.

According to Cattel criterion, we conclude the same (Figure no. 1). This involves pursuing the "sudden" fall of the inertia explained by the eigenvalues. After the first two axes, there is a sudden change in the slope of the graph of eigenvalues, there are significant differences between the first two values and the last five values, so it is chosen to interpret the first two factorial axes (Pintilescu, 2007).

Figure no. 1 Graphic representation of the correlation matrix own values



Source: Own Projection, using SPSS

The coordinates of the variables on the factorial axes show the value of the correlation coefficients between the variables x_j and the respective factorial axis (Table no. 5). For example, the credit risk rate variable has a high positive coordinate (0.829) on the first factorial axis and a negative coordinate on the second factorial axis (-0.328). The credit risk rate variable will be graphically represented in the positive quadrant of the first factorial axis and in the quadrant of the negative values of the second factorial axis (Pintilescu, 2007).

The variable rate of return has positive coordinates on both factorial axes, 0.81 on the first factorial axis and 0.029 on the second factorial axis. Since the value is greater for the first component, we conclude that this variable is better explained on the first axis

The credit risk rate variables, the non-performing loans rate and rate of return on core have high values close to 1, indicating that are strongly correlated with the first factorial axis and there are significant differences between the statistical units in terms of the values recorded for these variables.

Between these variables there are direct links because they are coordinated by the same sign, i.e. the statistical units that record high values for the credit risk rate variable, record high values for non-performing loans rate and rate of return on the core.

The second factorial axes is formed only by variables return on equity and economic profitability, as they only have higher values for the second axis.

Table no. 5 Coordinates of the variables on the first two factorial axis

Component Matrix[a]

	Component	
	1	2
rata riscului de creditare	.829	-.328
rata creditelor neperformante	.833	-.306
rata rentabilitatii activitatii de baza	.810	.029
efectul de parghie	.683	-.370
indicatorul de solvabilitate	.716	-.114
rentabilitatea economica	.497	.860
rentabilitatea capitalului propriu	.466	.880

Extraction Method: Principal Component Analysis.
a. 2 components extracted.

Source: Own Projection, using SPSS

Table no. 6 Contributions of the variables to the inertia of the first two factorial axis

Component Score Coefficient Matrix

	Component	
	1	2
rata riscului de creditare	.238	-.176
rata creditelor neperformante	.239	-.164
rata rentabilitatii activitatii de baza	.233	.016
efectul de parghie	.196	-.198
indicatorul de solvabilitate	.206	-.061
rentabilitatea economica	.143	.461
rentabilitatea capitalului propriu	.134	.471

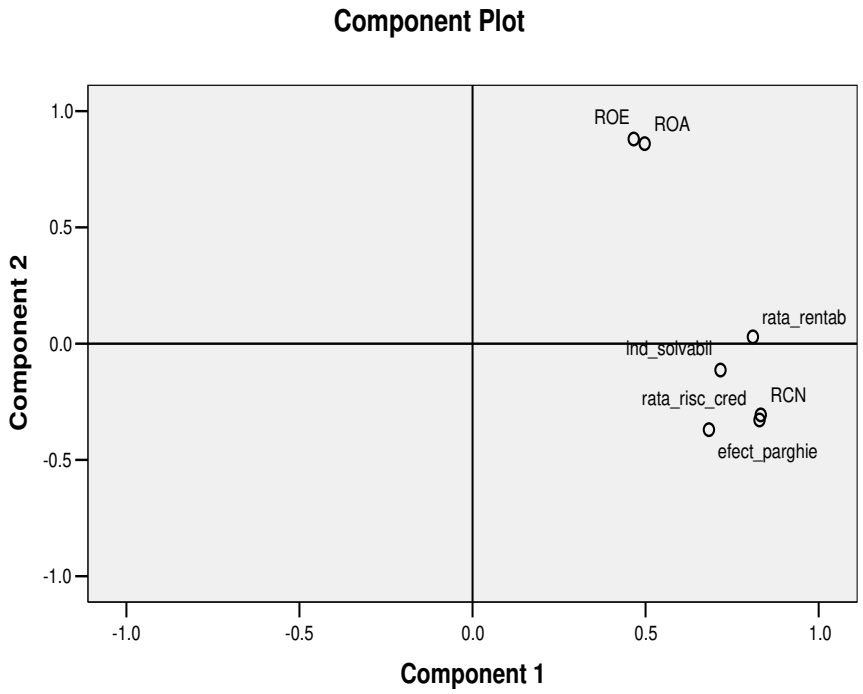
Extraction Method: Principal Component Analysis.
Component Scores.

Source: Own Projection, using SPSS

The values of the contributions of the variables to the inertia of the factorial axes show the importance of the respective variable in the differentiation of the considered statistical units. A high value shows a significant importance of the respective variable in differentiate the analyzed statistical units, so all variables contribute to the formation of the first factorial axis, instead only the returns on equity and the economic profitability contribute to the formation of the second axis (Pintilescu, 2007).

The graphical representation of the position of the credit risk rate variables, the non-performing loans ratio, the rate of return, the leverage effect, the solvency ratio, the economic profitability and return on equity in the first two axes (Figure no. 2) show a direct link, because are on both sides of the first factorial axis.

Figure no. 2 Representation of variables in the system of the first two factorial axis



Source: Own Projection, using SPSS

4. Conclusions

Using the principal component analysis, it was established that for Romanian there are strong correlations between all variables analyzed: credit risk rate, return on equity, non-performing loans rate, rate of return, rate on profitability, leverage effect and solvency ratio.

Subsequent developments in the study should enlarge the sample, and should also include other economic factors. Moreover, depending on the possibilities of accessing the necessary specific data, the study can also be applied for EU's regions.

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