Empirical Study on the Relationship between Efficiency, Capital and Risk into the Banking System of Romania

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Abstract: *In this article, we study the relationship between the efficiency of the Romanian banks and the risk taken and also the banking capital. In our opinion, this analysis is important because it offers important findings regarding the influence of risk on banking profitability and on banking efficiency. Moreover, over the analyzed period the risks faced by banks increased significantly. Therefore, it is important to know exactly the relationship between efficiency, capital and risk in order to better understand the behavior of bank management.*

Keywords: banking profitability, banking risk, crisis

JEL Classification: G21, G32.

1. Introduction

In a previous research[1] we analysed the risk-performance correlation at two banks in Romania (BCR-ERSTE and Bancpost) by the quantification of the influence of the indicators of the banking risks on the banking performance indicator – financial profitability rate.

Within this article, we propose to expand the research and identify the possible correlations between the levels of the efficiency, capital and banking risk on a sample of 11 representative banks of Romania.

During the last two decades before the credit crisis which began at the end of 2007, the European banking markets became more and more integrated. The twin forces of the deregularisation and technological change contributed to the process of the financial integration and increased the competition in the field of the financial services. As a consequence of this process, one noticed a special interest in improving the efficiency from the banking system. That is, it forced the banks to operate closer to "the best practice" or the efficient production function. At the same time, this increase in the competition could – at least on short term – lead to greater (possibly excessive) exposure to risk. This happens because the competition reduces the market share of the banks.

In this context, a number of studies focused on the impact of the capital (Repullo, 2004; Gropp and Heider, 2010) and of the operational efficiency (Casu and Girardone, 2009) on the banking risk.

Surprisingly, there is a limited number of studies which evaluate the inter-temporal relations between the banking risk, capital and efficiency. The recent financial crisis underlined the need of a subsequent understanding of the determinants of the banking risk in an increased banking efficiency and decreased banking capital environment (Haldane and Alessandri, 2009).

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[1]Manta Alina (2009) – "The risk and the performance in the banking activity", Universitaria Publishing House, Craiova.

Thus we propose ourselves to evaluate the impact of the banking efficiency on the banking risk. In this regard the low levels of efficiency would determine the banks to increase their performance by lower standards and/or the intensive monitoring of the credit. In exchange, they have an influence on the efficiency levels. For instance, the increase of the banking risk can temporally precede a decline in the cost efficiency.

On the other hand, the relation between efficiency and risk can be affected by the level of the capital especially in the light of the decrease of the banking capital level on macroeconomic level. For example, the moral hazard problems can increase the incentives of the weakly capitalised banks in order for them to increase their risk level drawing upon them in the future nonperforming loans. Similarly, the much capitalised banks can be experiencing some moral hazard problems and can be both more efficient and safer than the weakly capitalised institutions. The other way around, as the capital is expensive the much capitalised banks can, in average, increase their risk level in order to maximize the incomes.

Before beginning our research, we will use the information provided by the specialty literature and we evaluate the inter-temporal relations between the banking risk, efficiency and capital levels. We will use 11 commercial banks from Romania during 2008 - 2011. Data stop in 2011 because since 2012 the banks from the sample recorded losses and the program does not accept negative inputs.

2. Literature review

Fiordelisi, Marques-Ibanez and Molyneux (2010) consider that the bankruptcies from the financial sector are expensive, not only for the capital of the banks but for the tax payers also. Therefore the study of the variables which influence the risks of the banks and, especially of the efficiency of the banks has a long history. A first American research on the risk exposure examined the effects of the capital regulations (for example Peltzman, 1970 or Mayne, 1972).

The literature offers contradictory results regarding the effects of the capital requirements on the risk exposure (see Berger et al., 1995; Freixas and Rochet, 1998; Santos, 1999). Thus totally, the problem whether a greater capital adequacy rate reduces or not the global banking risk remains mainly unsolved.

Hughes and Mester (1998, 2009) supported the necessity to take into consideration the banking efficiency within the analysis of the relation between capital and risk. According to Hughes and Mester (1998, 2009) both the capital and the risk can be determined by the banking efficiency level. For example, the supervision authorities can allow the efficient banks (with top management) a greater flexibility.

In this idea Berger and De Young (1997) and Kwan and Eisenbeis (1997) claim that the explicit recognition of the concept of the banking efficiency concept is very important in the empiric models by analysing the determinant factors of the banking risk on a sample of American banks. Both works prove that both the efficiency and also the capital are relevant determinant factors of the banking risk. Berger and De Young (1997) show that the decrease of the cost efficiency precedes the increase of the nonperforming credits rate (especially at the weakly capitalised banks). They also show that an increase of the nonperforming credits rate leads to a decrease of the cost efficiency. Kwan and Eisenbeis (1997) observed that the weakly performing banks are more vulnerable to the risk exposure.

Williams (2004) and Altunbas et al., (2007) reproduced both the works in a European banking setting. The sample includes European banks during 1990-1998 and discovers that the banks with weak management tend to grant credits of a weaker quality. Altunbas et al., (2007) follows an approach similar to Kwan and Eisenbeis

(1997) and uses a set of simultaneous equations for the investigation of the relation between capital, provisions for losses from credits and costs efficiency for a sample of European banks during 1992-2000. In total contrast to Williams (2004), Altunbas et al., (2007) doesn't discover a positive relation between inefficiency and the exposure to banking risk. The inefficient European banks seem to hold more capital and assume a smaller risk. As a whole, the European studies offer contradictory observations regarding the relations between the operational efficiency, the capital and the banking risk.

Our study points out the relations between the efficiency of the costs (calculated in a previous article - Manta Alina, Bădîrcea Roxana (2014)), capital and banking risk in Romania on a sample of 11 banks during 2008 – 2011. Unlike the previous studies our sample includes data regarding the Romanian banks, covering also the crisis period which led to the radical changes in the international financial-banking system.

3. Research hypotheses

Before the introduction of the empiric model we can state that the research hypotheses about the relations between the risk, the capital and the banking efficiency have as starting point the studies of Berger and DeYoung (1997) and Fiordelisi, Marques-Ibanez and Molyneux (2010).

In the future the efficiency levels of the banks can have an impact on the banking risk. According to the *"defective management" hypothesis*, Berger and DeYoung (1997), and Williams (2004) observed that the banks which operate with low efficiency levels have greater costs mainly because of the inadequate monitoring of the credit and because of the inefficient control of the operational expenses (which reflects almost immediately in the lower cost efficiency). The decrease of the cost efficiency will temporally precede the increase of the credit, operational, market and reputational risks.

The "cost economy" hypothesis supposes that there is an exchange between the short term cost efficiency and the future exposure to risk because of moral hazard considerations. In such cases, the banks seem to be more efficient from the cost point of view considering that they allot fewer resources to the risk monitoring. Therefore the volume of the nonperforming loans stays unaffected on short term. On medium term however, the banks reach higher risk levels as they buy the supplemental inputs necessary for the administration of future higher risks. This will normally lead to future higher risks. In other words, a bank can be tempted to increase its incomes by assuming some higher risks in order to compensate the lost profits.

The "bad luck" hypothesis is linked to the consequences of the increase of the banking risk on the efficiency levels. They argue that the external exogenous events (for example the unexpected shocks) can precipitate the increases of the loans nonperforming for the bank unrelated to the managers' skills or appetite for the risk exposure. These increases of the risk lead to supplemental costs and managerial effort. Thus, according to this hypothesis, we expect for an increase in the banking risk to precede a decrease in the cost and income efficiency.

The "moral hazard" hypothesis suggests a negative correlation between capital and risk which point out that the managers of the banks tend to expose themselves to more risks especially when the level of the bank's capital is low (or the banks are more inefficient). The moral hazard hypothesis could occur at the same time with the occurrence of the problems between the managers and shareholders of the bank (see Gorton and Rosen, 1995), a moral hazard traditional problem being when the managers expose themselves to risks which are entirely experienced by the

shareholders. On the other hand, the more capitalised banks have less incentives for the moral hazard (Jeitschko and Jeung, 2005) and they are more predisposed to adopt some safe practices of cost reduction (for example the shareholders can be more active in controlling the banking costs or allotting the capital).

4. Research methodology

In order to point out the correlations between the capital, the efficiency and the banking risk we estimate the following equations:

$$Risk_{i,t} = f_1\left(Risk_{i,lag}, cost\_eff_{i,lag}, E/TA_{i,lag}, Z_{i,t}\right) + \varepsilon_{i,t} \qquad (1)$$

$$cost\_eff_{i,t} = f_1\left(Risk_{i,lag}, cost\_eff_{i,lag}, E/TA_{i,lag}, Z_{i,t}\right) + \varepsilon_{i,t} \qquad (2)$$

$$E/TA_{i,t} = f_1\left(Risk_{i,lag}, cost\_eff_{i,lag}, E/TA_{i,lag}, Z_{i,t}\right) + \varepsilon_{i,t} \qquad (3)$$

where *i* is an index which identifies the analysed banks, *t* denotes the time dimension, *Risk* is the variable which represents the bank risk, *cost_EFF* are the scores of the cost efficiency (calculated in a previous article), *E/TA* is the ownership equity reported to the total assets while *Z (j=1,…,3)* are control variables including the factors which influence the efficiency – capital – risk relation and $\varepsilon_{i,t}$ is the term of random error. The definitions of the variables are represented in short in the following table.

Table no. 1.

Variable Definition	Used Symbol	Variable Measuring
Banking Activity Efficiency	**CE**	Cost efficiency measured through the DEA – VRS model
Credit risk	**NPL/L**	Nonperforming loans rate
Capital	**E/TA**	Report between ownership equity and total assets
Intervention interest	**IR**	BNR reference interest rate
Concentration degree in the banking system	**HH**	Herfindahl-Hirschman Index
Number of credit institutions	**NCI**	Number of credit institutions

Equation (1) analyses whether the changes occurred in the evolution of the cost efficiency temporally precede the variations of the banking risk. Equation (2) evaluates whether the changes of the banking risk precede cost efficiency variations and equation (3) reflects whether the capital levels of the bank temporally precede modifications in the evolution of the banking risk.

The measuring error can be one of the main problems encountered during the evaluation of risk and banking efficiency. As the banking risk is a crucial measure in our analysis we try to identify its dimension by using the traditional report nonperforming loans to total loans NPL\L. Previous studies (for example Berger and De Young, 1997, Williams 2004) focus on the report between the nonperforming loans and the total loans (NPL) as representative indicator of the credit risk and it is past oriented.

Regarding the banking efficiency, we estimate the cost efficiency by using the data envelopment method (Data Envelopment Analysis - DEA). The previous studies focus also mainly on the calculation of the cost efficiency (for example Kwan and Eisenbeis 1997, Berger and DeYoung 1997, Williams 2004, Altunbas et al., 2007).

The banking capitalisation degree is measured through the report between equity and total assets (E/TA – leverage).

We base ourselves on the previous literature in order to introduce other factors in the model which can influence the correlations between capital, risk and efficiency. Namely, we include a set of control factors such as: the banking concentration degree (by using the Herfindahl–Hirschman), the number of credit institutions (NCI) and the monetary policy interest rate (IR). For standardisation, the logarithms of all the data outside the cost efficiency are previously found.

Going back to our sample, we will use the quarterly data from 11 commercial banks in Romania during 2008 - 2011. The data specific to the banks is collected from their financial reports. The data regarding the macroeconomic variables is taken from the Statistics section from the National Bank of Romania site and from Eurostat data base. The final sample contains 176 observations and comprises representative commercial banks of Romania (see graphic no. 1. with the evolution of the average values of each variable).

The correlation among the variables is usually neglectable suggesting that there is less likely that our models suffer major multicollinearity problems.

For the study of the risk-efficiency-capital study we will estimate a panel model in Eviews. The panel data models (Codirlaşu Adrian, 2007) consist in the estimation of regression equations in which one uses time series for the evolution on a certain period of the shares of more companies and we wish to determine how certain macroeconomic variables influence the yield of those shares, a solution is the use of panel data models. Thus, thanks to this type of models one can determine a single coefficient which should express the impact of a macroeconomic variable on the yield of a group of companies. The panel data models allow:

✓ Resuming through a single coefficient of the impact of a variable on a group of dependent variable time series (group of companies, of countries, etc.).

✓ Estimating specific coefficients (constant or coefficients of the independent variables) for each time series considered dependent variable – fix effects.

✓ Grouping dependent variables in categories and estimating the impact of the category of which it is part of on its evolution.

5. The results of the research

According to scenario no. 1, when variable CE (cost efficiency) is dependant variable, one states there is a *positive correlation between cost efficiency and nonperforming loans rate (LNPL)*, in other words an increase of the cost efficiency leads to an increase of the nonperforming loans rate. This thing could suggest the fact that the more efficient banks become greater loan portfolios and therefore they assume greater risks which in the future become greater which confirms the "cost economy" (Berger 1997). In other words, the efficient banks are exposed to more risks, namely an increase of cost efficiency can lead to an increase of the nonperforming loans rate suggesting the fact that these banks intentionally performed short term cost reductions which will lead to the long term deterioration of the loans portfolios quality. On the other hand, a decrease of cost efficiency caused by greater expenses with loans monitoring, will generate, similarly a smaller volume of nonperforming loans ("risk aversion management" hypothesis) or on the contrary, an increase of cost efficiency due to

minimizing the expenses with the loans monitoring, can lead to an increase of the nonperforming loans ("cost economy" hypothesis). In the second case, a less efficient management could increase the nonperforming loans rate given that inefficiency can be measured not only through very large operational expenses but also through an inadequate monitoring of loan portfolios ("the defective management" hypothesis).

On the other hand, we observe there is a *strong negative correlation between cost efficiency (CE) and capital level (LETA)* which means that on a one percent increase of the capital/assets (LETA), cost efficiency decreases by 0.46%. In the case of efficient banks, when the efficiency will decrease, they will hold less capital. On the other hand, the less efficient banks tend to hold more capital.

One notices from scenario no. 2 and 3 *a statistically significant positive connection (p-value is 0,000) between the nonperforming loans rate (risk measure) and the banking capital level* which denotes the fact that the banks with greater nonperforming loans portfolios tend to hold a greater capital level (Altunbas 2007). The more capital the bank holds, the greater the assumed risks will be. In this context, we consider that the Romanian banks are safe and conservatory as far as the risk exposure is concerned and the positive correlation between capital and risk can be perceived as a protection measure against the unfavourable macroeconomic phenomena. Therefore, we consider that it is better for the banks to hold a high capitalisation degree in the economic boost in order to avoid an increase in the risk degree and a decrease of the performance induced by a capital deficit in times of economic recession. Thus a capital buffer can be seen as a protection measure against the deterioration of performances in times of economic recession. From the perspective of the regulation authorities, this significant positive connection between capital and risk can indicate the preference for capital of the surveillance organs as a measure of restriction of risky activities (Suhartano 2012). The banks which are more risky and more inefficient will orient themselves to holding a greater capital volume.

At the same time, a positive shock of the interest rate has such a negative impact on the quality of the loan portfolio because this way the rates to pay for debtors and thus the non-reimbursement risk increases.

Scenario no. 1 points out *a statistically significant positive connection between the cost efficiency and the number of credit institutions (NCI)* which suggests that the cost efficiency levels are positively related to market competitors (justifying the opinion according to which competition makes banks more efficient from the cost point of view).

We also observe a *statistically significant positive connection between the report between the capital and credit institutions (NCI)* suggesting that the high capital levels are positively related to a number of market competitors (arguing thus that the opinion according to which competition can encourage higher levels of ownership equity).

On the other hand, we notice that in all the three scenarios (Scenario no. 1, 2 and 3) *BNR reference interest rate exercises a negative influence on the three variables* which denotes the fact that at an increase by one percent of the interest rate, the cost efficiency, the capital and the banking risk level register a decrease by 0.10%, 0.38% and 2.94% respectively.

And not last of all, we identify *a statistically significant negative connection between the banking risk (LNPL) and the degree of banking concentration (LHH)* which suggests that the banking risks are smaller on the more concentrated banking markets. In other words, a reduced concentration degree can point out a more competitive banking market and long term less stable banking systems, as Boyd and Nicolo (2003) claim.

Scenario no. 1.

Dependent Variable: CE?
Method: Pooled Least Squares
Date: 03/22/15   Time: 01:13
Sample: 2008Q1 2011Q4
Included observations: 16
Cross-sections included: 11
Total pool (balanced) observations: 176

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.55316	1.398792	-9.689187	0.0000
LNPL?	0.024164	0.005480	4.409219	0.0000
LETA?	-0.461384	0.025175	-18.32691	0.0000
LNCI	2.362616	0.303376	7.787754	0.0000
LHH	0.951612	0.121738	7.816870	0.0000
LIR	-0.102065	0.034653	-2.945350	0.0033

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.825169	Mean dependent var	0.522114
Adjusted R-squared	0.823803	S.D. dependent var	0.352452
S.E. of regression	0.147945	Akaike info criterion	-0.975725
Sum squared resid	42.02431	Schwarz criterion	-0.929705
Log likelihood	960.5017	F-statistic	604.1340
Durbin-Watson stat	1.528097	Prob(F-statistic)	0.000000

Sursa: calcule proprii în Eviews.

Scenario no. 2.

Dependent Variable: LNPL?
Method: Pooled Least Squares
Date: 03/22/15 Time: 01:22
Sample: 2008Q1 2011Q4
Included observations: 16
Cross-sections included: 11
Total pool (balanced) observations: 176

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	63.78828	5.754540	11.08486	0.0000
CE?	0.414844	0.094086	4.409219	0.0000
LETA?	0.636965	0.112130	5.680590	0.0000

LNCI	-8.409318	1.262213	-6.662359	0.0000
LHH	-3.858809	0.504754	-7.644927	0.0000
LIR	-2.945909	0.127236	-23.15303	0.0000

Effects Specification				

Cross-section fixed (dummy variables)

R-squared	0.777515	Mean dependent var	1.894978
Adjusted R-squared	0.775777	S.D. dependent var	1.294556
S.E. of regression	0.613001	Akaike info criterion	1.867330
Sum squared resid	721.4789	Schwarz criterion	1.913350
Log likelihood	-1791.575	F-statistic	447.3196
Durbin-Watson stat	1.604878	Prob(F-statistic)	0.000000

Sursa: calcule proprii în Eviews.

Scenario no. 3.

Dependent Variable: LETA?
Method: Pooled Least Squares
Date: 03/22/15 Time: 01:24
Sample: 2008Q1 2011Q4
Included observations: 16
Cross-sections included: 11
Total pool (balanced) observations: 176

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.194142	1.179571	-7.794478	0.0000
CE?	-0.322702	0.017608	-18.32691	0.0000
LNPL?	0.025950	0.004568	5.680590	0.0000
LNCI	1.578637	0.255163	6.186784	0.0000
LHH	0.954947	0.101096	9.445905	0.0000
LIR	-0.388884	0.027657	-14.06095	0.0000

Effects Specification				

Cross-section fixed (dummy variables)

R-squared	0.680761	Mean dependent var	2.283116
Adjusted R-squared	0.678267	S.D. dependent var	0.218133
S.E. of regression	0.123728	Akaike info criterion	-1.333227
Sum squared resid	29.39271	Schwarz criterion	-1.287207
Log likelihood	1306.563	F-statistic	272.9536
Durbin-Watson stat	1.661305	Prob(F-statistic)	0.000000

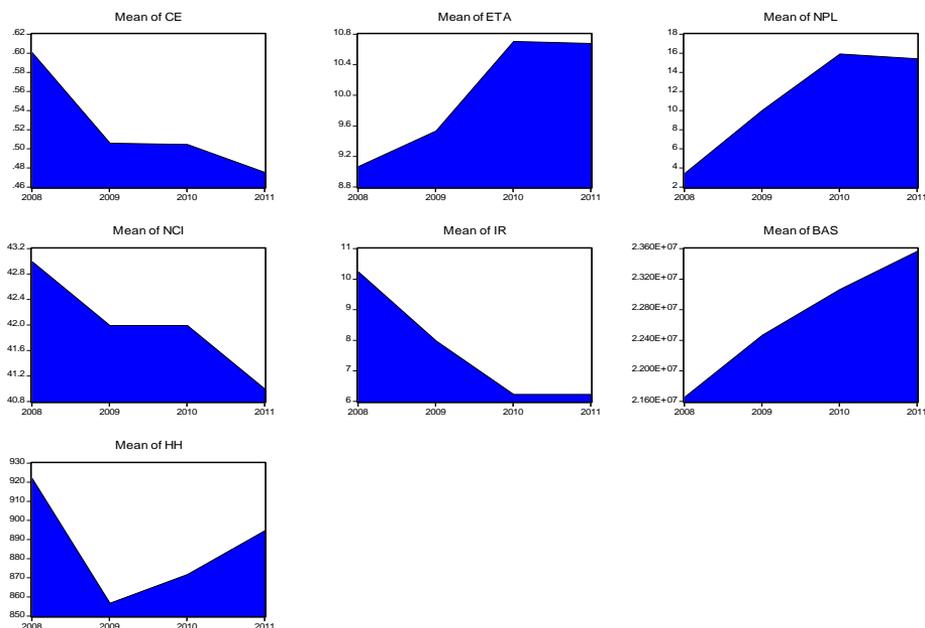*Sursa: calcule proprii în Eviews.*

The evolution of the average values of variables included in the model

Source: own calculations in Eviews.

In conclusion, from the performed analysis result two relevant aspects from prudential supervision aspects.

First of all, from the experience of the Romanian banks, one observes that the strict and rigorous implementation of the capital adequacy requirements can contribute to the decrease of the prociclicity associated to the implementation of the present Basel requirements.

Second of all, the study confirms that an increase of the capital requirements should be produced during the stagnation or economic boost periods because the increase of the capital in the recession periods can lead to the deterioration of the banking performances.

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