AN EMPIRICAL MODEL FOR ASSESING RISK AND PERFORMANCE IN THE ROMANIAN BANKING SYSTEM

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1. Introduction

In order to maximize their profitability, banks should obtain the largest benefits for a given level of the portfolio risk level. In terms of profitability of a bank, the ideal situation is constituted by attracting short-term resources and placing them on long-term. From a traditional commercial banking system perspective, the interest rates for placements would be higher than those of short-term resources, which would generate a substantial interest rate margin. This approach, however, ignores the risks inherent in banking activities, particularly the liquidity risk. Even if the performance of the borrowers would be excellent and the bank would not face outstanding loans, it is not always possible to provide the necessary liquidity at the final maturity of the instruments as a result of various exogenous and endogenous factors that influence the banking system. The bank management must decide the proportion placed in different assets and liabilities in order to achieve the desired profitability level and to respect the liquidity, solvency and prudential requirements. Reserve requirements imposed by the central bank must be met first. Then, the excess funds remaining will be placed in various other types of assets to ensure both liquidity and an appropriate level of profitability. Regarding these proportions, there could be estimated different risk-profitability optimization models.

A series of empirical studies regarding this subject have appeared in the recent years, especially after the implementation of Basel principles by banks when the relationship between efficiency and risk has became a major concern of the banks in the given context of capital adequacy requirements. The literature is divided between studies that focus on profit efficiency and the ones focused on cost efficiency. The first approach stress the maximizing of the bank's profit function, given a fixed level of costs (see Berger and Bonaccorsi di Patti, 1996; Pires Goncalves and Ricardo, 2006), while the second assess the risk generated by the banks' portfolios (see Kaparikas et al, 1994; Berger and De Young, 1997; Williams 2004; Falkena et al, 2004). Other studies have highlighted the effects of banking competition in reducing monopoly rents and cost inefficiencies of banks, by encouraging them to lower the prices and the operating costs (Hasan and Marton, 2001; Fries and Taci, 2005). On the other side, some studies found potential negative effects of the growing banking competition regarding the excessive risk-taking by banks, with negative impacts on financial stability (Berger, 1995; Goldberg and Rai, 1996; Allen and Gale, 2004; Carletti and Hartmann, 2002; Weill, 2004).

In order to control these possible negative impacts, regulators imposed some capital adequancy rules in accordance with the Basel priciples. In addition, a number of studies have highlighted the impact of capital requirements on the efficiency and risk relationship (Casu and Girardone, 2009; Scott and Dunkelberg, 2010; Berger et al., 2010). Also, the recent financial crisis

highlighted the need for further understanding of the determinants of banking efficiency and risk taking. Using Granger-causality techniques William (2004) assessed the inter-temporal relationships between loans, cost efficiency and the level of capital for a sample of European savings banks over the period 1990–1998 finding that poorly managed banks tend to make more poor quality loans. In contrast, using a static simultaneous equation framework to investigate the relationship between capital, loan provisions and cost efficiency for a sample of European banks over the 1992–2000 period Altunbas et al (2007) found a positive connnection between inefficiency and bank risk-taking. A recent study is that of Fiordelisi et al (2010) who analyzed the inter-temporal relationship between bank efficiency, capital and risk for a sample of 26-EU banks from 1995 to 2007. They discovered that lower bank efficiency Granger-causes higher bank risk, increases in capital produce cost efficiency improvements and higher capital levels tend to have a positive effect on efficiency levels.

There are several hypotheses in the existing literature that explain the relationship between efficiency, risk and capital reserves. One of them is the bad management hypothesis studied by Berger and De Young (1997) and Williams (2004), which states that banks operating at low efficiency levels have higher costs due to the inadequate credit monitoring and operating expenses. If the cost efficiency will decline than the bank's risk will increase because of the credit, operational, market and reputational problems. Another hypothesis suggested is the moral hazard one, which claims that the banks take on more risk when the capital level is low, due to the presence of informational frictions and to the existence of agency problems (Jeitschko and Jeung, 2005). But, if the bank is sufficently capitalized would be more likely to reduce costs, having less moral hazard incentives. Berger and De Young (1997) developed the bad luck hypothesis which counts for the unexpected shocks that could cause problems with the loan portfolio for the banks, that are unrelated to the management risk-taking appetite. They state that the increases in risk cause additional costs and the reduction of efficiency. Another hypothesis is the cost skimping one according to Berger and De Young (1997), which highlights that there is a trade-off between short-term cost efficiency and future risk-taking due to moral hazard considerations. Under this hypothesis banks appear to be more cost efficient as long as they devote fewer resources to credit screening and monitoring. As a consequence, non-performing loans remains unaffected in the short run, but in the long run banks would reach higher risk levels as they have to purchase the additional inputs necessary to manage future higher risks.

Focusing on the Romanian banking system, the behavior of banks within the risk-efficiency framework has important implications for prudential supervision and the achievement of long-term efficiency is crucial for the financial stability in this country. Our aim is to present a framework for modelling the risk-efficiency relationship for the Romanian banking system. Section 2 presents the methodology used for analyzing the causality and the relationship between variables. Section 3 presents the data and variables used for the risk-efficiency framework. Section 4 describes the main results and section 5 concludes.

2. The methodology used for analyzing the causality and relationship between banking risk and performance

For modeling the relationship between performance and risk in the Romanian banking sector we have used

a Vector Autoregressive representation of risk, profitability, rentability and a control ratio. VAR model was popularized in econometrics by Sims (1980) and is a system regression model that captures the evolution and the interdependencies between multiple time series. In the general form, the model is written below:

$$Y_t = B + A_1 Y_{t-1} + A_2 Y_{t-2} + ... + A_p Y_{t-p} + \varepsilon_t$$

where is the dependent variables' vector (kx1) vector, is a (kxk) matrix of coefficients, and is the innovations (k x 1) vector.

Transposing this to our research the following simultaneous equations would result:

$$Risk_t = c_1 + \alpha_1 Risk_{t-1} + \beta_1 ROA_{t-1} + \lambda_1 \mathrm{Rentab}_{t-1} + \gamma_1 LTD_{t-1} + \varepsilon_{1,t}$$
$$ROA_t = c_2 + \alpha_2 Risk_{t-1} + \beta_2 ROA_{t-1} + \lambda_2 \mathrm{Rentab}_{t-1} + \gamma_2 LTD_{t-1} + \varepsilon_{2,t}$$
$$\mathrm{Rentab}_t = c_3 + \alpha_3 Risk_{t-1} + \beta_3 ROA_{t-1} + \lambda_3 \mathrm{Rentab}_{t-1} + \gamma_3 LTD_{t-1} + \varepsilon_{3,t}$$
$$LTD_t = c_4 + \alpha_4 Risk_{t-1} + \beta_4 ROA_{t-1} + \lambda_4 \mathrm{Rentab}_{t-1} + \gamma_4 LTD_{t-1} + \varepsilon_{4,t}$$

where t denotes the time dimension, lag denotes the number of lags used, Risk is the variable showing the bank's risk, ROA and Rentab are variables used for performance, LTD is the Loans to Deposits ratio and is the disturbance error term. The definitions of the variables used are presented in the next section. The number of lags included in the model were chosen by analyzing the AIC and BIC information criteria, Final Prediction Error and Sequencial Modified LR test statistic. All these tests indecate one lag for all the variables

In order to show the causality between banking risk and performance in the Romanian banking sector we have performed a Granger causality analysis as the joint test that the first lag of each determinant is distributed as a F distribution. The null hypothesis of the Granger causality states that the coefficints are equal to zero. We have used a 90% confidence level, which states that if the probability is less than 10% the null hypothesis that one variable Granger-causes the other variable is rejected at the 10% significance level.

Taking as an example two variables X and Y, in order to test if X cause Y in the Granger sense, the following regression should be estimated:

$$Y_t = \mu + \sum_{i=1}^{k} \beta_i Y_{t-i} + \sum_{j=0}^{k} \alpha_j X_{t-j} + \varepsilon_t$$

where k is the lag order and is the disturbance error term. The null and the alternative hypothesis are: $H_0 : \alpha_1 = \alpha_2 = ... = \alpha_l = 0$ (X doesn't cause Y) and $H_1 : \exists\, \alpha_i \neq 0$ (X cause Y).

A similar test is performed for testing if Y cause X in the Granger sense, for the following regression:

$$X_t = \mu + \sum_{i=1}^{k} \varphi_i X_{t-i} + \sum_{j=0}^{k} \delta_j Y_{t-j} + \varepsilon_t$$

The null hypothesis is $H_0 : \delta_1 = \delta_2 = ... = \delta_l = 0$ (Y doesn't cause X) and the alternative one is $H_1 : \exists\, \delta_i \neq 0$ (Y cause X).

The above hypothesys are verified with the Fisher-Snedecor test for the restricted and unrestrected equations.

3. Data and variables

We have used quarterly data starting from Q4 2007 until Q4 2010 from FINREP and COREP reports of the National Bank of Romania that include all credit institutions which do business in Romania. A short description of the variables used in the models is given below:

Table 1: Variables' description

Code	Description
ROA	ROA - Return on assets (Annualized net profit / Total average assets)
ROE	ROE - Return on equity (Annualized net profit / Average own capital)
Rentab	Total operating income / Total operating expenses
$Risk_1$	Past due and doubtful claims (net value) / Total assets (net value)
$Risk_2$	Credit Risk Ratio (Gross exposure of non-bank loans and interest classified as doubtful and loss / Total classified non-bank loans and related interest, excluding off-balance sheet items)
NPL	Non-performing Loans Ratio (Gross exposure of non-bank loans and interest classified as loss 2 that is overdue more than 90 days and /or for which legal proceedings were initiated against the debtor or against the operation / Total classified non-bank loans and related interest, excluding off-balance sheet items)
LVG	Efectul de pârghie (Fonduri proprii de nivel 1 / Total active la valoare medie)
LTD	Loans granted to clients (gross value) / Deposits from clients
Solvab	Capital Adequacy Ratio ($\geq$ 8%)

Source: National Bank of Romania (www.bnr.ro)

During the analyzed period, the Romanian banking system faced some structural changes. Banks' dependence on external financing has decreased starting from 2009, simulataneously with the deeper involvement of the foreign subsidiaries in collecting resources from the local market. The loans to total deposits ratio has encountered a reduction, while the non-performing loan ratio has increased in the last two years, but it is maintained under control through the provisioning plan. Also, the banks' capitalization incresed starting from 2009, facilitating the absorbtion of shocks. At the end of June 2010 the solvency ratio was 14.3% and the Tier 1 capital ratio was 13.4%. The stabilization of capital adequancy indicators was favored by the contraction in lending starting from Q4 2008, by the downword trend in the volume of high-risk assets and also by the purchase of government securities, according to the NBR. The laverage ratio also encountered an improvement in the last years. The main vulnerability of the banking system is the exposure to credit risk, which has altered in 2009 due to the economic downturn, intensified by the loans deniminated in foreign curency. On the other side, the profitability decresed in 2010, mainly due to higher expenses retaled to provisions for the credit risk. The operating profit decresed in 2010 with 20.6% above the one registered in 2009 when it faced the highest value. The level of profit was heterogenous, the largest values being recorded by the largest banks. Also ROA faced a reduction in the last years. The descriptive statistics for the indicators are given below:

Table 2: The evolution of the main banking indicators

Indicators	Risk1	Risk2	NPL	ROA	ROE	Rentab	LVG	LTD	Solvab
2007Q4	0,17	4,00	-	1,49	16,05	175,50	7,32	108,72	13,78
2008Q4	0,29	6,52	-	1,56	17,04	179,56	8,13	122,03	13,76
2009Q4	1,01	15,29	7,89	0,25	2,89	156,53	7,55	112,80	14,67
2010Q4	1,49	20,81	11,85	-0,09	-1,02	155,92	7,87	113,46	14,66
Average	1,35	17,58	9,53	0,10	1,22	163,63	7,72	115,12	14,49
St. dev.	0,33	2,62	2,13	0,29	3,26	9,75	0,37	2,20	0,42

Source: National Bank of Romania (www.bnr.ro) & authors' calculations

4. Results

In order to test the Granger causality between risk and performance we have used two models. In the first one the risk is expressed through the ratio between Past Due and Doubtful Claims (net value) / Total Assets (net value) and in the second model we have used a proxy for the credit risk, due to the main exposures of banks to this type of risk. The causality is analyzed between the risk proxies, the ROA ratio, the profitability ratio and the Loan do Deposits ratio, described earlier. The results of Granger causality for the first model shows unidirectional relationships from ROA and LTD ratios to the Risk ratio and from ROA and the Rentability variable to the Loan to Deposit Ratio at a 10% confidence level. No bidirectional causality is found. In the second model where the risk is approximated through a credit risk ratio ROA also causes the risk in the Granger sense, but differently from the first model the Rentability variable is caused by the credit risk ratio.

Tabelul 3: Granger results

Model 1				Model 2			
Dependent var.	Excluse	Chi-square	p value	Dependent var.	Excluded	Chi-square	p value
RISK1	Excluded	5.035561*	0.0958	RISK2	ROA	9.517299*	0.0683
	ROA	0.149424	0.9280		RENTAB	0.203787	0.9031
	RENTAB	10.562957**	0.0547		LTD	4.032696	0.1331
	LTD	1.317649	0.9707		All	7.243362	0.2989
ROA	All	0.172771	0.9172	ROA	RISK2	0.955227	0.6203
	RISK1	0.230700	0.8911		RENTAB	0.731483	0.6937
	RENTAB	2.077698	0.3539		LTD	0.372835	0.8299
	LTD	3.720613	0.7144		All	5.780713	0.4482
RENTAB	All	2.641349	0.2670	RENTAB	RISK2	13.37699**	0.0012
	RISK1	2.282609	0.3194		ROA	0.631796	0.7291
	ROA	0.162388	0.9220		LTD	2.240048	0.3263
	LTD	7.229295	0.3002		All	28.57705**	0.0001
LTD	All	2.958734	0.2278	LTD	RISK2	0.044798	0.9778
	RISK1	7.098198**	0.0288		ROA	0.581760	0.7476
	ROA	4.979899*	0.0829		RENTAB	1.724425	0.4222
	RENTAB	25.70480*	0.0003		All	9.424433	0.1511

* significat at 5%; ** significant at 10%;
Source: authors' calculations

In the above table are displayed the coefficients of the two VAR models for the two different risk proxies, estimated with one lead-lag interraction between the series:

Table 4: VAR models

	Model 1					Model 2			
	RISK1	ROA	RTB	LTD		RISK2	ROA	RTB	LTD
$RISK_1(-1)$	-0.043089	-1.417140	0.339564	18.65740	$RISK_2(-1)$	0.095029	-0.566856	-10.52083	0.590297
	(1.80945)	(4.20030)	(64.0344)	(10.9548)		(0.99844)	(0.67211)	(6.56516)	(3.18353)
	[-0.0238]	[-0.3373]	[0.0053]	[1.70313]		[0.09518]	[-0.8434]	[-1.6025]	[0.18542]
ROA(-1)	-0.267156	0.410902	16.25313	5.228362	ROA(-1)	-1.453380	-0.351507	4.756479	4.058315
	(0.32707)	(0.75923)	(11.5747)	(1.98015)		(1.67060)	(1.12458)	(10.9849)	(5.32672)
	[-0.8168]	[0.54121]	[1.40420]	[2.64039]		[-0.08699]	[-0.3125]	[0.43300]	[0.76188]
RTB(-1)	0.006020	-0.025949	-0.602798	-0.162181	RTB(-1)	0.033322	0.005012	-0.010634	-0.048592
	(0.02420)	(0.05618)	(0.85647)	(0.14652)		(0.08610)	(0.05796)	(0.56615)	(0.27453)

	[0.24874]	[-0.4619]	[-0.7038]	[-1.10687]		[0.38702]	[0.08647]	[-0.0187]	[-0.1770]
LTD(-1)	-0.042611 (1.05732) [-0.0743]	0.109664 (0.13306) [0.82418]	-0.529909 (2.02851) [-0.2612]	0.254628 (0.34703) [0.73374]	LTD(-1)	-0.107621 (0.18773) [-0.57326]	0.061791 (0.12638) [0.48895]	-0.529150 (1.23444) [-0.4286]	0.096159 (0.59859) [0.16064]
C	2.605112 (4.64984) [0.56026]	6.651493 (10.7937) [0.61624]	259.3490 (164.553) [1.57608]	79.98778 (28.1511) [2.84138]	C	-16.76309 (15.1076) [-1.10958]	6.172205 (10.1698) [0.60692]	132.4922 (99.3391) [1.33374]	72.67077 (48.1708) [1.50861]
R-squared	0.937091	0.808646	0.807779	0.959231	R-squared	0.994842	0.859311	0.941981	0.901133
Adj. R-squared	0.685453	0.043229	0.038897	0.796156	Adj. R-squared	0.974209	0.296554	0.709903	0.505667
F-statistic	3.723968	1.056478	1.050589	5.882126	F-statistic	48.21719	1.526965	4.058906	2.278662

Standard errors in ( ) & t-statistics in [ ]
Source: authors' calculations

5. Concluding remarks

To test the causality between risk and performance, this study follows the existing empirical literature in terms of choosing the performance indicators, using the Granger causality test and the Vector Autoregressive representation for several risk and profitability variables. The results of the Granger causality shows some important relationships. ROA and LTD ratios cause in the Granger sense the Risk ratio expressed as the Past Due and Doubtful Claims (net value) / Total Assets (net value) and the Rentability variable is a cause for the Loan to Deposit Ratio. In the second model where the risk is approximated through a credit risk ratio ROA also causes the risk in the Granger sense and the Rentability variable is caused by the credit risk ratio.

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