CONTEMPORARY ISSUES IN BUSINESS, MANAGEMENT AND EDUCATION'2015
eISSN 2029-7963/eISBN 978-609-457-867-0
doi:10.3846/cibme.2015.07

Bank Soundness in the Latvian Banking Market

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Received 19 October 2015; 01 December 2015

Abstract. Bank soundness is crucially important for the stability of the whole financial system. The goal of the paper is to reveal the contributing factors to bank soundness in the Latvian banking market. Multifactor regression analysis was applied as a core research method. Bank soundness was proxied by Risk index calculated for Latvian banks. Profitability, liquidity and asset quality ratios of individual banks extracted from BankScope data warehouse were used as explanatory variables. Research period covers 2007–2014. The regression model was created, based on financials of Latvian banks as for 2013. The reliability of the model was tested, using the financials from 2014 reports.

Keywords: bank soundness, Latvia, regression analysis.

JEL Classification: G21, G32, C2.

Conference topic: Financial Risk Management of Business Development.

Introduction

Maintaining the financial stability in a country is one of the greatest concerns of public authorities. In turn, soundness of commercial banks is a main determinant of an overall financial stability (Kulathunga, Rehman 2012). Citing Kaufman (2004), "Macroeconomic stability and banking soundness are inexorably linked. Both economic theory and empirical evidence strongly indicate that instability in the macroeconomy is associated with instability in these sectors is associated with instability in the macroeconomy". Based on Kumar *et al.* (2012), "Achieving stability in banking is only the beginning of a sound banking system. The main goal of banks today is to maintain stability and make sure they are impervious to external shocks while at the same time being internally sound and sensible".

Besides, bank soundness has an impact on economic development of a country (Vaithilingam *et al.* 2006; Igan, Tamirisa 2009), primarily through credit growth. According to Vaithilingam *et al.* (2006) "well developed and sound financial system can contribute significantly to economic growth by recognizing the important role financial intermediaries play in bridging the disequilibrium between savings and investment needs within an economy".

Stability of a banking system and soundness of individual banks is critically important in such countries, as Latvia. The role of other financial institutions, such as pension funds and insurance companies, is not so important (Haan *et al.* 2009). Banks remain to be main market players.

The goal of the current research is to explore factors affecting bank soundness in the Latvian banking market. To achieve the established goal the following tasks should be completed: 1) to select the appropriate measure for evaluation of bank soundness; 2) to define the set of factors and related measures affecting bank soundness; 3) to analyse the relationship between bank soundness and selected factors. The current research continues the series of studies on bank performance and related issues performed by the author in collaboration with other researchers (Titko *et al.* 2014; Titko, Jureviciene 2014; Titko *et al.* 2015). The object of the research is Latvian banking sector, specifically commercial banks operating in Latvia.

In the current paper the author makes an attept to predict bank soundness, using bank-specific indices. The research hypothesis is stated, as follows:

H1: It is possible to predict bank soundness with a linear regression model, using bank-specific measures as explanatory variables.

A multifactor linear regression analysis is performed to test the stated hypothesis. Risk index, measuring a probability of bank insolvency, is used as a dependent variable. Bank-specific financial performance measures are used as explanatory factors. These measures represent four groups of bank performance indices: profitability, liquidity, asset quality and bank size.

Research sample consists of 15 commercial banks operating in the Latvian banking sector. The research period covers 2007–2014. The main data source is statistics extracted from BankScope data warehouse. Testing the reliability of the received results is performed, using data provided by the Financial and Capital Market Commission (FCMC), the Association of Commercial Banks of Latvia (ACBL) and data from banks' financial reports.

In the result of the performed analysis the factors contributing the most to bank soundness in Latvian banking sector are revealed: cost-to-income ratio and deposits-to-loans ratio. The attempt to predict bank soundness with a regression model is failed. Despite the model statistical significance, its application does not yield reliable results consistent with real values.

Literature on bank soundness and related issues

The concept of bank soundness and the issues related to its evaluation and management are frequently debated topics in the literature. Researchers define bank soundness as "the ability of bank to meet its obligations to depositors and other creditors as viewed by specialized analysts" (Demirgüç-Kunt, Detragiache 2011) or "ability of the bank to meet the maximum possible paydown in its deposit liabilities from its assets, where the latter must be liquidated under distress conditions" (Dudley, Steib 1978).

The term "bank soundness" frequently is used together with the terms "safety" and "stability" (Dwight 2007; Schaeck, Cihak 2008). Financial soundness is also used as a synonym for "financial health" (Moorhouse 2004; Hilbers *et al.* 2000). Based on Kumar *et al.* (2012), "soundness of a banking sector is synonymous with efficiency, productivity, profitability, stability and a shock free environment". Due to the fact that capital adequacy ratio is frequently used as a measure of bank soundness, the term "soundness" is also often used together with the terms "capital adequacy" and "solvency" (Toby 2008).

A large amount of papers are focused on the macroeconomic determinants of the stability of the banking system (Babihuga 2007; Timmermans 2001; ECB 2006). Much attention is paid to the issues related to bank supervision in order to enhance bank soundness (Barth *et al.* 2002).

A plenty of works is dedicated to measuring techniques to evaluate bank safety and soundness (Ioannidis *et al.* 2010; Gaganis *et al.* 2006). International Monetary Fund prepared a compilation guide to assess financial soundness and listed financial soundness indicators (FSI) for depository and non-depository institutions (IMF 2006).

Many researches focus their attention on investigation of the efficiency-competition-stability relationship in the financial sector. Competition-stability relationship is studied from two perspectives: testing competition-stability or competition-fragility hypothesis.

The results confirm both negative (Beck *et al.* 2013) and positive (Schaeck *et al.* 2006; Amidu, Wolfe 2012; Akins *et al.* 2014) trade-off between competition and bank soundness. Amidu and Wolfe (2012) supported positive effect ofcompetition on bank soundness, because "diversification across and within both interest and non-interest income generating activities of banks increases". In turn, Beck *et al.* (2013) empirically confirmed competition-fragility hypothesis, analyzing data of 17055 banks in 79 countries. They state that competition "erodes banks' pricing power, increases banks' risk taking behavior and is hence detrimental for financial stability". OECD experts point to the controversy in results while studying competition-stability relationship in banking. In OECD report "Bank Competition and Financial Stability" (OECD 2011) it was stated that "structural and non-structural measures of competition are found to be both positively and negatively associated with financial stability, depending on the country analyzed and the measure of financial stability used".

Despite the huge number of studies related to bank soundness issues, the number of papers published by local researchers in the Baltic States is still limited. The current paper contributes to the literature in order to fill this gap.

Research methodology

Research sample consists of 15 commercial banks operated in the Latvian banking market in 2007–2014. The number of banks is limited by the data available in BankScope.

The core method to achieve the research objectives and to test the stated hypothesis is a multiple linear regression analysis. A functional relationship between bank soundness and bank-spesific measures takes the following form:

$$Z_i = f(Profit_i, Liquidity_i, AssetQual_i, Size_i), \quad (1)$$

where: Z_i is a soundness measure calculated for an individual bank; $Profit_i$ is a set of profitability indices of an individual bank; $Liquidity_i$ is a set of liquidity measures of an individual bank; $AssetQual_i$ is a set of asset quality measures of an individual bank; $Size_i$ is a set of measures used as proxies for bank size.

Measuring bank soundness the author follows the experience of other researchers (Beck *et al.* 2013; Schaeck *et al.* 2006; Amidu, Wolfe 2012) and use Z-score or Risk index (RI) as a stability indicator. Risk index measures the probability of insolvency is based on the likelihood of return to assets being negative and larger than the capital-asset ratio (Hannan, Hanweck 1988). It incorporates data on the bank's expected profits, the likelihood that these profits will be realized, and a bank's capital base (Sinha *et al.* 2009). RI is calculated from the formula (2):

$$RI_i = \frac{E(ROA) + CAP}{StDev(ROA)}, \quad (2)$$

where: RI_i is a risk index of a bank i at time t; $E(ROA)$ is the expected value of return on assets (usually the most recent value of ROA is used); CAP is a capital-to-asset ratio; StDev(ROA) is a standard deviation of ROA (σ).

The explanatory variables are expressed by the ratios summarized in the Table 1. Distribution of the ratios between groups is performed following the classification proposed by the Financial and Capital Market Commission (FCMC 2014).

Table 1. Explanatory variables (Source: author's compilation)

Variable	Measures	Label
$Profitability_i$	Net Interest Margin	NIM
	Cost to Income Ratio	CIR
$Liquidity_i$	Net Loans / Total Assets	NLTA
	Net Loans / Deposit & Short Term (ST) Funding	NLDSTF
	Liquid Assets / Deposits & ST Funding	LADSTF
$Asset\ quality_i$	Loan Loss Reserves / Gross Loans	LLRGL
$Size_i$	Total bank assets	TA
	Bank deposits and ST funding	DSTF
	Bank equity	E

To perform a regression analysis, financials as of 2013 are extracted from BankScope data warehouse. Risk index also is calculated as for 2013. Standard deviation of ROA is determined, using data of 2007–2013.

A regression analysis is based on the set of assumptions. One of them presumes no correlation between the explanatory variables. The results of the correlation analysis are presented in the Table 2.

Table 2. The results of the correlation analysis (Source: author's calculations)

	lnTA	lnDSTF	lnE	LLRGL	NIM	CIR	NLTA	NLDSTF	LADSTF
lnTA	1	0.997**	0.862**	–0.358	0.162	–0.497	0.610*	0.515*	–0.287
		0.000	0.000	0.190	0.565	0.060	0.016	0.050	0.299
lnDSTF	0.997**	1	0.826**	–0.358	0.147	–0.503	0.606*	0.502	–0.287
	0.000		0.000	0.190	0.602	0.056	0.017	0.056	0.300
lnE	0.862**	0.826**	1	–0.294	0.280	–0.398	0.628*	0.590*	–0.216
	0.000	0.000		0.287	0.313	0.141	0.012	0.021	0.438
LLRGL	–0.358	–0.358	–0.294	1	–0.212	0.412	0.012	0.116	–0.013
	0.190	0.190	0.287		0.448	0.127	0.965	0.681	0.964
NIM	0.162	0.147	0.280	–0.212	1	–0.204	0.286	0.265	–0.264
	0.565	0.602	0.313	0.448		0.467	0.302	0.341	0.342
CIR	–0.497	–0.503	–0.398	0.412	–0.204	1	0.122	0.265	–0.426
	0.060	0.056	0.141	0.127	0.467		0.666	0.341	0.113
NLTA	0.610*	0.606*	0.628*	0.012	0.286	0.122	1	0.973**	–0.691**
	0.016	0.017	0.012	0.965	0.302	0.666		0.000	0.004
NLDSTF	0.515*	0.502	0.590*	0.116	0.265	0.265	0.973**	1	–0.720**
	0.050	0.056	0.021	0.681	0.341	0.341	0.000		0.002
LADSTF	–0.287	–0.287	–0.216	–0.013	–0.264	–0.426	–0.691**	–0.720**	1
	0.299	0.300	0.438	0.964	0.342	0.113	0.004	0.002	

There are two values are determined for each variable: the value of a Pearson correlation coefficient and the statistical significance of the coefficient (Sig.). Values of the coefficient marked with "*" are statistically significant at the 0.05 level, and those which marked with "**" are statistically significant at the 0.01 level.

It is obvious from the Table 1 that, for instance, variables NLTA and NLDSTF cannot be used as predictors in one model. However, at the initial stage the regression analysis is performed without considering the results of the correlation analysis. Stepwise regression method is applied. It means that non-important variables are removed from the list and the variables left explain the distribution best.

The decision about the appropriatness of a model is made, based on the significance of the regression coefficients. The problem with collinearity (correlation between independent variables) is detected, based on VIF (variance of inflation) value. The critical value for VIF is determined equal to 5, following Jansons and Kozlovskis (2012). VIF > 5 indicates a collinearity problem.

To test the reliability of the results, gap analysis is performed, evaluating the difference between the values of Risk index predicted with the developed model and real values calculated, using statistics extracted from the financial reports and provided by the Association of Commercial Banks of Latvia (ACBL 2014).

Research results

To perform the regression analysis the values of Risk index should be calculated for Latvian banks as of 2013. The results of the calculations are summarized in the Table 3.

Table 3. Risk index (RI) of Latvian banks in 2013 (Source: author's calculations)

Bank Name	E(ROA)	CAP	σ	RI
Swedbank	2.27	20.20	3.06	7.34
SEB banka	0.63	10.21	2.19	4.94
ABLV Bank	1.60	5.71	1.66	4.41
Rietumu Bank	2.36	9.66	0.96	12.51
Citadele Banka	0.57	5.64	2.29	2.72
DNB Banka	0.45	9.68	2.32	4.36
PrivatBank	0.38	5.72	3.53	1.73
Norvik Banka	–2.52	4.94	3.14	0.77
Baltikums Bank	2.47	11.29	0.96	14.38
Regional Investment Bank	0.22	8.35	0.88	9.74
Trust Commercial Bank	0.38	13.39	2.73	5.04
Baltic International Bank	–0.10	9.82	0.34	28.59
Meridian Trade Bank	0.61	6.06	0.28	23.63
UniCredit Finance	–2.16	35.15	1.82	18.13
Latvijas Pasta banka	1.98	11.62	1.93	7.06

Without deep analyzing of the results, a positive moment can be mentioned: there are no negative values of risk index in 2013. It means that all the analyzed banks had a sufficient capital buffer to cover expected losses from operating activities.

Using the calculated values of Risk index and data extracted from BankScope data warehouse, a regression analysis is performed with Stepwise regression method. The analysis yields 6 models with a constant value included (Table 4).

Table 4. Models with a constant: summary and ANOVA (Source: author's compilation)

	Model	R^2	Adj. R^2	F Sig.
1	Predictors: (Constant), CIR	0.521	0.484	0.002
2	Predictors: (Constant), CIR, NLDSTF	0.735	0.691	0.000
3	Predictors: (Constant), CIR, NLDSTF, NLTA	0.912	0.888	0.000
4	Predictors: (Constant), CIR, NLDSTF, NLTA, E	0.965	0.950	0.000
5	Predictors: (Constant), NLDSTF, NLTA, E	0.964	0.954	0.000
6	Predictors: (Constant), NLDSTF, NLTA, E, DSTF	0.978	0.969	0.000

R-squared varies in the range from 0.521 to 0.978, increasing with the increase of the number of variables. All the created models are statistically significant (F Sig. < 0.05). The coefficients' statistics is presented in the Table 5.

Table 5. Models with a constant: coefficients' statistics (Source: author's compilation)

Model	Explanatory variables	Unstandartized coefficients B	Sig.	VIF
1	(Constant)	–13.648	0.020	
	CIR	0.287	0.002	1.000
2	(Constant)	–17.585	0.001	
	CIR	0.236	0.002	1.075
	NLDSTF	0.166	0.009	1.075
3	(Constant)	–6.715	0.075	
	CIR	0.102	0.051	1.722
	NLDSTF	0.980	0.000	32.156
	NLTA	–1.054	0.001	30.355
4	(Constant)	–0.699	0.805	
	CIR	–0.018	0.684	3.465
	NLDSTF	1.214	0.000	40.813
	NLTA	–1.216	0.000	32.765
	Equity	–1.109E-05	0.003	3.363
5	(Constant)	–1.745	0.146	
	NLDSTF	1.174	0.000	19.204
	NLTA	–1.176	0.000	20.642
	Equity	–1.024E-05	0.000	1.672
6	(Constant)	–2.089	0.047	
	NLDSTF	1.302	0.000	28.759
	NLTA	–1.360	0.000	32.173
	E	–1.501E-05	0.000	3.997
	DSTF	1.328E-06	0.029	4.915

The coefficients' statistics shows that only two models have all statistically significant coefficients (model 1 and model 2).

The Stepwise regression analysis is iterated, removing a constant value. The results are summarized in Tables 6 and 7.

Table 6. Models without a constant: summary and ANOVA (Source: author's compilation)

	Model	R^2	Adj. R^2	F Sig.
1	Predictors: NLDSTF	0.453	0.414	0.004
2	Predictors: NLDSTF, NLTA	0.898	0.882	0.000
3	Predictors: NLDSTF, NLTA, Equity	0.964	0.955	0.000

Table 7. Models without a constant: coefficients' statistics (Source: author's compilation)

Model	Explanatory variables	Unstandartized coefficients B	Sig.	VIF
1	NLDSTF	0.137	0.004	1.000
2	NLDSTF	1.230	0.000	66.159
	NLTA	–1.363	0.000	66.159
3	NLDSTF	1.202	0.000	66.450
	NLTA	–1.254	0.000	69.003
	E	–9.444E-06	0.000	2.330

Analyzing the results of stepwise regression analysis (Tables 4, 5, 6 and 7) it is obvious that the explanatory variables NLTA (net loans to total assets) and NDSTF (net loans to deposits and short-term funding) cannot be used simultaneously in one model. VIF value is much higher than the critical value equated to 5. The same conclusion can be done, analyzing the results of the correlation analysis (Table 2). Pearson correlation value is equal to 0.973 and it is statistically significant at 0.01 level for this pair of variables.

To avoid this problem, NDSTF variable is removed from the list and regression analysis is performed with Enter method, using two sets of predictors: 1) constant, DSTF, E, NLTA and 2) E, NLTA. The choice is substantiated with the fact that these models have all statistically significant coefficients, but the only problem is multicollinearity The results of the analysis are summarized in the Tables 8 and 9.

Table 8. Models created with Enter method: summary and ANOVA (Source: author's compilation)

	Model	R^2	Adj. R^2	F Sig.
1	Predictors: (Constant), DSTF, E, NLTA	0.489	0.349	0.053
2	Predictors: E, NLTA	0.437	0.351	0.024

Table 9. Models created with Enter method: coefficients' statistics (Source: author's compilation)

Model	Explanatory variables	Unstandartized coefficients B	Sig.	VIF
1	Const	–3.160	0.471	
	DSTF	–3.179E-06	0.135	3.282
	E	–1.041E-06	0.923	3.423
	NLTA	0.395	0.011	1.719
2	E	–1.120E-05	0.164	2.320
	NLTA	0.236	0.011	2.320

However, removing NDSTF variable from models diminishes the quality of the models. Thus, at the final stage of the analysis three models are left (Table 10).

Table 10. Best regression models (Source: author's compilation)

	Model	R^2	Adj. R^2	F Sig.	DW
1	Predictors: NLDSTF	0.453	0.414	0.004	1.930
2	Predictors: (Constant), CIR	0.521	0.484	0.002	1.864
3	Predictors: (Constant), CIR, NLDSTF	0.735	0.691	0.000	1.998

All three models are statistically significant (F Sig. < 0.05). The coefficients for regressors are also statistically significant at 0.05 level. For the selected models Durbin-Watson statistics is analyzed. Critical values for Durbin-Watson statistics are determined for $p = 1$ and $p = 2$ (number of regressors) and the appropriate number of observations ($n = 15$ banks for 2013). The results are summarized in the Table 11.

Table 11. Durbin-Watson statistics (Source: author's compilation)

Model	Test for positive autocorrelation in residuals	Test for negative autocorrelation in residuals	Conclusion
Model 1	$DW_1 = 1.930 > D_U = 1.36$	$4–DW_1 > D_U = 1.36$	No autocorrelation in residuals
Model 2	$DW_2 = 1.864 > D_U = 1.36$	$4–DW_2 > D_U = 1.36$	No autocorrelation in residuals
Model 3	$DW_3 = 1.998 > D_U = 1.54$	$4–DW_3 > D_U = 1.54$	No autocorrelation in residuals

Considering that the 3rd model combines variables from the 1st and 2nd models and its R-squared is higher (0.735), gap analysis is performed with application of only 3rd model. The model is expressed by the following equation (formula (3)):

$$RI_i = -17.585 + 0.236 \times CIR + 0.166 \times NLDSTF \, . \quad (3)$$

The application of the model to predict RI values in 2014 is performed, using data extracted from the financial reports of Latvian commercial banks. The model is applied for six largest banks: Swedbank, SEB banka, Rietumu bank, Citadele banka, DNB banka and PrivatBank. Real values of Risk index are calculated, using data provided by the Association of Latvian Commercial Banks. The results are visually presented in Figure 1.

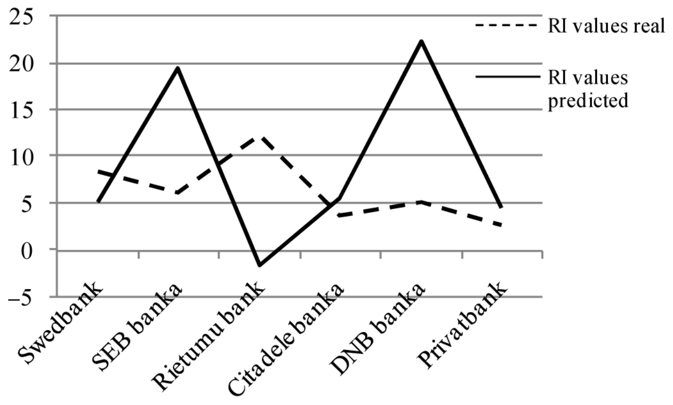

Fig. 1. Risk index: real and predicted values as for 2014
(Source: author's calculations)

It is obvious from the Figure 1 that there is a huge gap between the real values of risk index, calculated applying the formula (2), and predicted with application of the regression formula (3).

To improve the quality of the model, the set of predictors is extended. Two-period lagged explanatory variables are used to predict the value of Risk index.

Applying Stepwise regression analysis, three models with a constant included are constructed (Table 12).

Table 12. Regression models with lagged explanatory variables (Source: author's compilation)

	Model	R^2	Adj. R^2	F Sig.
1	Predictors: (Constant), CIR	0.722	0.484	0.002
2	Predictors: (Constant), CIR, CIR_{t-1}	0.858	0.692	0.000
3	Predictors: (Constant), CIR, CIR_{t-1}, $NLTA_{t-2}$	0.924	0.815	0.000

The selected model is the last one with three explanatory variables due to its highest adjusted R-squared value. The model is statistically significant at 0.01 level (F Sig. < 0.01). Durbin-Watson statistics (for p = 3 and n = 15) indicates no autocorrelation in residuals (DW = 2.017 > D_U = 1.465; 4–DW_1 > D_U = 1.465). The coefficients statistics is summarized in the Table 13.

Table 13. Model with lagged explanatory variables: coefficients' statistics (Source: author's compilation)

Model	Explanatory variables	Unstandartized coefficients B	Sig.	VIF
3	Const	–11.367	0.021	
	CIR	0.359	0.000	1.491
	CIR_{t-1}	–0.207	0.007	1.459
	$NLTA_{t-2}$	0.147	0.012	1.078

The coefficients for all the regressors are statistically significant at 0.05 level. There is no multicollinearity problem detected (VIF < 5). The new model is expressed by the following equation (formula (4)):

$$RI_{it} = -11.367 + 0.359 \times CIR_{it} - 0.207 \times CIR_{it-1} + 0.147 \times NLTA_{it-2} \,. \quad (4)$$

According to the model, the value of Risk index in the current period is affected by the value of cost-to-income ratio both in the current and the previous period, as well as by the value of loans-to-assets ratio two years ago.

Observed inertia in the model is a frequent situation in economic forecasting. However, the application of the created model to predict the values of Risk index in 2014 yields the significant gap between the real and predicted values, as well as in the previous case.

This, however, does not decrease the value of the received results. In both cases the factors affecting bank soundness proxied by Risk index are the same: cost-to-income ratio and the volume of bank loans. It points to the necessity to continue the research with an extended data set or larger research period.

Conclusions

The current paper contributes to the body of knowledge in regards to the investigation of bank performance and stability issues in the Baltic States.

The author made an attempt to predict bank soundness expressed by Risk index, using multifactor regression model. Despite the statistical significance of the created models and regressors'coefficients, gap analysis revealed a huge difference between real and predicted values of Risk index. Thus, the research hypothesis – *H1: It is possible to predict bank soundness with a linear regression model, using bank-specific measures as explanatory variables.* – in this case is rejected.

However, the author suggests continuing the research with extension of data set. It should be considered that the model is created, based on statistics extracted from BankScope. In turn, the application of the model is made, using data from the reports provided by Latvian banks. The reason of failure could be also the data inconsistence.

Considering the critical importance of bank soundness for overall financial stability and national economic development, the necessity of such kind of studies is obvious. The current research could be a starting point in the series of bank soundness-related studies, performed by the local analysts to reveal the factors contributing to bank stability.

Disclosure statement

The author does not have any competing financial, professional, or personal interests from other parties.

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