OPEN ACCESS

The 4th World Sustainability Forum
1 - 30 November 2014

http://www.sciforum.net/conference/wsf-4

World Sustainability Forum 2014 – Conference Proceedings Paper

Aspects of Absolute Evaluation of Financial Stability State of Commercial Banks

Askoldas Podviezko [1]

[1] Vilnius Gediminas Technical University / Saulėtekio al. 11, LT–10223 Vilnius, Lithuania
Mykolas Romeris University / Ateities g. 20, LT-08303 Vilnius, Lithuania

E-Mail: askoldas@gmail.com

Received: 11 September 2014 / Accepted: 6 November 2014 / Published: 6 November 2014

Abstract: Concern on financial stability of commercial banks is an ongoing issue, requiring permanent reviewing of regulatory frameworks and developing new approaches. Currently static regulatory methodologies are prevailing, which set pre-defined minimal requirements on limited financial parameters, such as capital or liquidity. The number of such indicative parameters cannot reflect overall performance of a bank due to the following reasons. First, the set of monitored parameters is usually insufficient. Second, each financial stability parameter is monitored separately. Moreover, such parameters are static. Dynamic setting of values of minimal or desired parameters of financial performance of commercial banks should be more effective, in case we decide that we ought to vary requirements on banks over changing macroeconomic environment. Evaluation based on multiple criteria decision-aid (MCDA) methods comprises simultaneously several multidimensional criteria and provides results of evaluation in a clear form for both financier and everyman-depositor. Such an evaluation of financial stability state of the banks is providing more holistic approach. Moreover, it can considerably reduce information asymmetry between depositors and commercial banks, which may have positive effect on financial stability. Proposed methodology of absolute MCDA evaluation provides an efficient tool of altering benchmark banks, hypothetical best and worst banks, comparing to which the evaluation is carried out, thus allowing to alter requirements for banks upon shifts of financial environment.

Keywords: financial stability, MCDA, CAMEL, absolute evaluation, hypothetical banks, sustainable development.

1. Introduction

Concern on financial stability of commercial banks is an ongoing important issue for ensuring sustainable development of a society. The issue financial stability of commercial banks requires permanent reviewing of regulatory frameworks and developing new approaches. Observations stated in the European Banking Authority (EBA) work programme emphasize that development of new early warning tools for crisis prevention is required [1].

Static current regulatory methodologies are prevailing, which set pre-defined minimal requirements on limited financial parameters, such as capital or liquidity. Financial stability of commercial banks is influenced by large set of parameters of their financial performance. Such parameters are usually categorized into CAMEL categories, where letters of this acronym stand for the following categories: C for capital, A for Assets, M for management, E for earnings, L for liquidity. Additional category S for market stability is used, if necessary, to represent sensitivity of a bank emanating large deposits. The unique widely accepted set of such parameters was not elaborated yet to reflect financial stability of any commercial bank in the world. Entirely accepted Basel I and II requirements [2] [3] initially were designed to put constraints and to monitor capital adequacy and are gradually developing. The current Basel III framework , which is effective from 1 January, 2013 (with transition period until 2019) [4] has been extended to monitor long-term and short-term liquidity together with the capital adequacy ratio. Liquidity Coverage Ratio (LCR), which is designed to monitor a capability to withstand a 30-day period of stress, and Net Stable Funding Ratio (NSFR), which is designed to assess if a commercial bank can maintain a sound funding structure over one year period, were augmented to the framework. Other liquidity monitoring metrics are being developed as well. The trend of development of regulatory metrics imposed by Bank for International Settlements towards expanding number of criteria is therefore observed.

The number of such indicative parameters cannot reflect overall performance of a bank due to the following reasons. First, the set of monitored regulatory parameters is usually insufficient. Consequently, in the scientific literature considerably larger sets of criteria are used, which greatly outnumber the set imposed by Basel framework. Second, each financial stability parameter in the latter framework is monitored separately. Moreover, benchmark parameters are static. Dynamic setting of values of minimal or desired parameters of financial performance of commercial banks should be more effective, in case it is decided that we ought to vary requirements on banks over changing macroeconomic environment. Evaluation based on multiple criteria decision-aid (MCDA) methods comprises simultaneously several multidimensional criteria and provides results of evaluation in a clear form for both financier and everyman-depositor. Such an evaluation of financial stability state of the banks is providing more holistic approach than observing just capital and liquidity.

Financial statements of commercial banks present large numbers of financial data of various dimensions. Consequently, popularity of data warehousing upon penetration of computerization as a tool for decision-making in banking continuously has substantially increased [5]. Data warehousing is defined as “a subject-oriented, integrated, non-volatile, and time-variant collection of data in support of management's decision” [6] and mainly represents data storage for the purpose of decision-making. Augmented with more decision-aid tools such is a technique is then called data mining. Various definitions of data mining in literature, e.g.: “the analysis of (often large) observational data sets to find

unsuspected relationships and to summarize the data in novel ways that are both understandable and useful to the data owner" [7]. More definitions can be found in [8].

Most of managers of commercial banks understand that good and reliable data mining tools increase competitive advantage of banks [8]. In Taiwan data warehousing technology in 2004 was adopted for the purposes of data mining in 13 commercial banks of 44, which makes 29.5%. High costs are named among most important hampering factors of implementation data mining in Taiwanese commercial banks [5]. The methodology of evaluation of financial stability of commercial banks outlined in the paper does not require high expenditures. In case bank managers ascertain themselves that such techniques are inexpensive, not risky to adopt and are effective, desire for implementing such techniques could be much higher. The methodology could also be used for evaluations based on other objectives.

As the desired set of criteria reflecting financial stability of commercial bank is multidimensional [9] [10], it is natural that multiple criteria decision aid (MCDA) methods can be beneficial to fulfil the data mining task, even if only statistical methods are mentioned as being used for data mining [11]. Large number of criteria is usually named as a limitation for using such methods for data mining as MCDA methods can be used only in such cases, when the number of criteria is sufficiently small to allow experts to correctly estimate their weights. Probably, this is the cause, why MCDA methods are scarcely used for data mining [12]. Nevertheless, methods of eliciting only the most essential criteria with ability to reduce their number are already available [13]. Alternatively, creation of hierarchy structures with smaller numbers of criteria within each category can be used. Description of such techniques are now in press.

Plethora of statistical methods for evaluation of bank performance is available and is extensively used. The most prominent statistical methods are univariate analysis, discriminant analysis, Zeta analysis, logistic regression, data envelopment analysis, etc. Nevertheless, such methods impose strong limitations on data, such as normality, linearity, and independence among predictable variables [14] [15] [16]. This limitation can be tackled by using MCDA techniques, which do not impose any requirements on multidimensional data. Investigation by the author of influence of types normalization, if it is required to be used in certain MCDA methodologies, is now in press.

MCDA classic methodology provides results of evaluation in the form of ranking of evaluated alternatives. Even though this form of presenting results of evaluation is perfectly comprehendible by decision-makers of any background, such a way of presentation is not sufficient for making better decisions on the situation in the market, where evaluated alternatives-firms are present, to make assessment of influence of factors on the result.

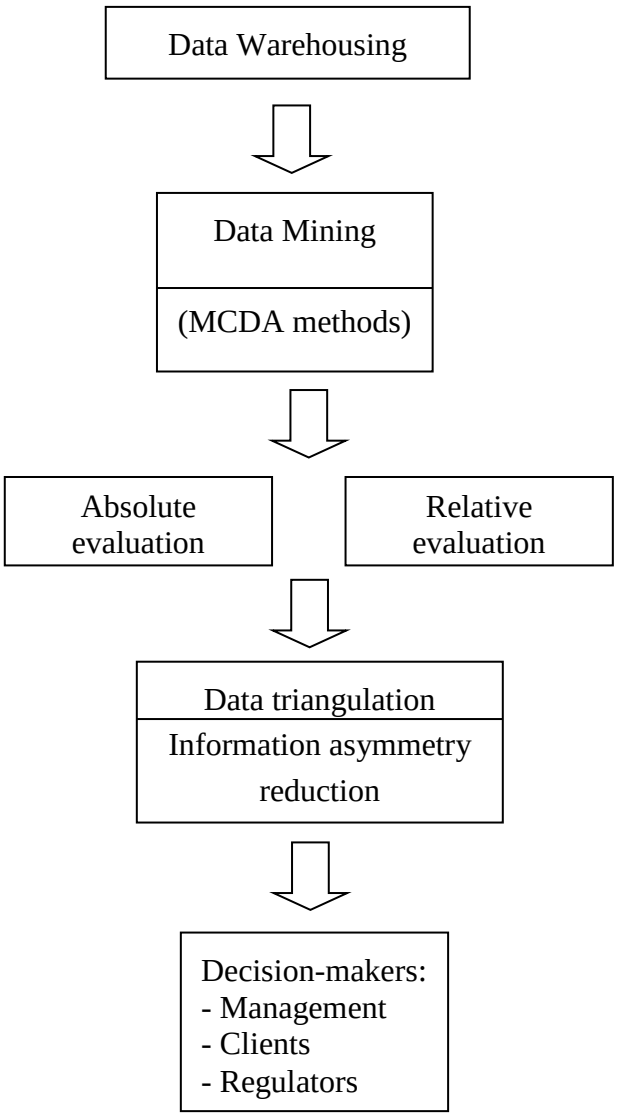
Data triangulation, with several ways of presenting results of evaluation enlarges the scope of comprehension of results of evaluation solves this problem. Several ways of presenting MCDA evaluation results can be incorporated into data mining framework (Figure 1). In [17] two additional methods of presentation results of MCDA evaluation, namely graphic and analytic, were proposed, for the purpose of creating data triangulation. Results of evaluation are presented graphically (Figure 2), where relative position of each commercial bank in terms of CAMEL categories is exposed by values calculated by the following formula:

$$C_j^t = \sum_{i \in K_t} \omega_i \tilde{r}_{ij} \tag{1}$$

where t represents a CAMEL category; j – index of an alternative; i – index of criterion, ω_i – weight of criterion i; $\tilde{r}_{ij}$ –transformed values of criteria in accordance with formula (2); K_t. – set of indices of criteria of the K-th CAMEL category.

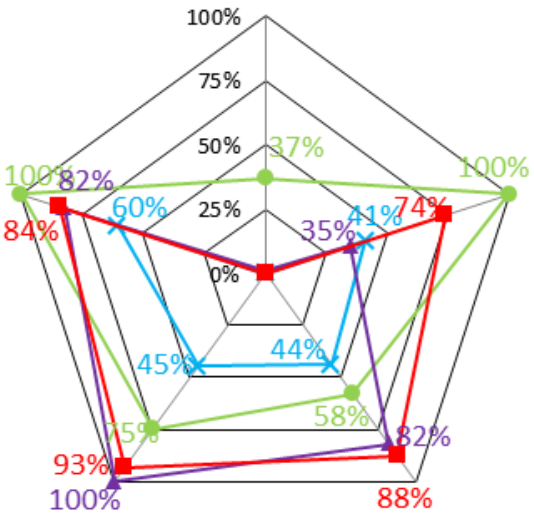
$$\tilde{r}_{ij} = \begin{cases} \dfrac{r_{ij} - \min\limits_j r_{ij}}{\max\limits_j r_{ij} - \min\limits_j r_{ij}}, & \text{when } i \text{ is a maximising criterion} \\ \dfrac{\max\limits_j r_{ij} - r_{ij}}{\max\limits_j r_{ij} - \min\limits_j r_{ij}}, & \text{when } i \text{ is a minimising criterion} \end{cases} \tag{2}$$

Figure 1. Adoption of MCDA techniques to data mining of commercial bank financial performance**.**



In addition to providing evaluation results in the form of ranking and graphical presentation of data it was proposed to use the analytical reporting tool, namely tables with normalized in accordance with formula (2) values of criteria. Such a tool provides detailed information about relative position of an alternative in the market by every criterion and is to be used after the analysis by graphical means.

Figure 2. Financial stability position of a bank in the market by CAMEL categories over three-year period (each year is represented by a different colour).



Finally, MCDA analysis is designed to perform relative evaluation of available alternatives. This kind of evaluation is relative to peer banks and does not allow to make absolute evaluation of the state of an alternative in the market. Dynamics of the state of a bank cannot be well-observed, as the context of evaluation is changing along with the state of all alternatives. In cases of macroeconomic fluctuations positions of banks may generally deteriorate, which will not be accounted by the relative MCDA evaluation. For the purpose of retaining and observing valuable information on the absolute state of alternatives [18] proposed to use absolute MCDA evaluation using specifically designed hypothetical benchmark worst and best alternatives, based on the TOPSIS method.

Multiple, but not overwhelming ways of presenting data increase comprehension of the current standing of a commercial bank by depositors-everymen, thus reducing the most dangerous market failure in the market of commercial banks related to unexpected withdrawals of deposits or bank panics. This factor is of prime importance in countries with high information asymmetry, where effects of financial liberalisation in the financial sector increase severity of financial crises [19].

4. Conclusions

Current regulatory frameworks usually incorporate small number of criteria, which influence financial stability of commercial banks. Financial stability requires holistic approach as many criteria effect the state of a bank. Such criteria are multidimensional; their values are not stable because of varying both micro- and macro-economic factors; distribution of such variables is almost impossible to grasp. In small countries panel data is not available due to small number of banks.

The paper shows how MCDA methods can be used for data mining techniques designed to monitor the financial stability state of commercial banks. First, MCDA methods unlike statistical methods do not impose stiff requirements on data. Second, costs of implementation data mining based on MCDA techniques is low. Third, in the paper several ways of presentation of evaluation results was proposed, which are well comprehendible not only by sophisticated specialists as in the case of statistical evaluation, but by the whole range of users, including depositor-everyman.

Further development of MCDA methods allow to make absolute evaluation of alternatives using hypothetical worst and best alternatives. Proposed methodology of absolute MCDA evaluation provides an efficient tool of altering benchmark banks, hypothetical best and worst banks, comparing to which the evaluation is carried out, thus allowing to alter requirements for banks upon shifts of financial environment. The newly developed methodology allows to monitor dynamics of the state of financial stability of a commercial bank.

The proposed methodology can considerably reduce information asymmetry between depositors and commercial banks, which may have positive effect on financial stability.

References and Notes

1. European Banking Authority *EBA Work Programme 2013*; European Banking Authority: London, UK, 2012.
2. Basle Committee on Banking Supervision *International convergence of capital measurement and capital standards*; Bank for International Settlements: Basel, Switzerland, 1988.
3. Basle Committee on Banking Supervision *International Convergence of Capital Measurement and Capital Standards*; Bank for International Settlements: Basel, Switzerland, 2004.
4. Basle Committee on Banking Supervision *Basel III: A global regulatory framework for more resilient banks and banking systems*; Bank for International Settlements: Basel, Switzerland 2011.
5. Hwang, H.-G.; Ku, C.-Y.; Yen, D. C.; Cheng, C.-C. Critical factors influencing the adoption of data warehouse technology: a study of the banking industry in Taiwan. *Decis. Support Syst*. **2004**, *37*, 1–21.
6. Ramamurthy, K. (Ram); Sen, A.; Sinha, A. P. An empirical investigation of the key determinants of data warehouse adoption. *Decis. Support Syst.* **2008**, *44*, 817–841.
7. Hand, D. J.; Mannila, H.; Smyth, P. Principles of data mining; Adaptive computation and machine learning; MIT Press: Cambridge, Mass, 2001.
8. Hormozi, A. M.; Giles, S. Data Mining: A Competitive Weapon for Banking and Retail Industries. *Inf. Syst. Manag.* **2004**, *21*, 62–71.
9. Öğüt, H.; Doğanay, M. M.; Ceylan, N. B.; Aktaş, R. Prediction of bank financial strength ratings: The case of Turkey. *Econ. Model.* **2012**, *29*, 632–640.
10. Fethi, M. D.; Pasiouras, F. Assessing bank efficiency and performance with operational research and artificial intelligence techniques: A survey. *Eur. J. Oper. Res.* **2010**, *204*, 189 – 198.
11. Breiman, L. Statistical Modeling: The Two Cultures (with comments and a rejoinder by the author). *Stat. Sci.* **2001**, *16*, 199–231.
12. Doumpos, M.; Grigoroudis, E. *Multicriteria decision aid and artificial intelligence: links, theory and applications*; Wiley-Blackwell: Hoboken, N.J, 2013.

13. Ginevicius, R.; Podvezko, V.; Podviezko, A.; Ginevicius, T. On Creating a System of Criteria for Multiple Criteria Evaluation Using Methods of Mathematical Statistics. In *The 14th German-Lithuanian-Polish colloquium on Innovative solutions in construction technology and management*; Technika: Vilnius, Lithuania, 2013; pp. 64–69.
14. Barniv, R.; McDonald, J. B. Review of Categorical Models for Classification Issues in Accounting and Finance. R*ev. Quant. Finance Account.* **1999**, *13*, 39–62.
15. Lin, S.-W.; Shiue, Y.-R.; Chen, S.-C.; Cheng, H.-M. Applying enhanced data mining approaches in predicting bank performance: A case of Taiwanese commercial banks. *Expert Syst. Appl.* **2009**, *36*, 11543–11551.
16. Ravikumar, P.; Ravi, V. Bankruptcy prediction in banks and firms via statistical and intelligent techniques – A review. *Eur. J. Oper. Res.* **2007**, *180*, 1 – 28.
17. Podviezko, A. Augmenting Multicriteria Decision Aid Methods by Graphical and Analytical Reporting Tools. In *Workshops on Business Informatics Research; Lecture Notes in Business Information Processing*; Springer Berlin Heidelberg, 2012; Vol. 106, pp. 236–251.
18. Podvezko, V.; Podviezko, A. Naujos absoliutaus daugiakriterio vertinimo galimybės. *LMD Darb.* **2013**, *54*, 54–59.
19. Mishkin, F. S. Global Financial Instability: Framework, Events, Issues. *J. Econ. Perspect*. **1999**, *13*, 3–20.