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Sumy State University  
Oleg Balatskyi Academic and Research Institute  
of Finance, Economics and Management

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## FRONTIER ANALYSIS OF THE BANKS' FINANCIAL MONITORING EFFICIENCY CONCERNING ASSESSING THE RISKS OF MONEY LAUNDERING

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Over the last ten years, there has been a significant acceleration in the evolution of new methods for money laundering, which are becoming more diverse and specific, and the mechanisms for presenting criminal proceeds in the form of fairly legal proceeds are becoming more complex and diversified. Therefore, the issue of assessing the risks of money laundering requires in-depth study, analysis and development.

Risk is a rather complex and multifaceted phenomenon not only in the economy but also in other spheres of society [4, p.91; 6, p.53; 7, p.39]. This is confirmed by the variety of views on the essence of the concept of risk [2, p.111; 11, p.5; 12, p.109; 14, p.123; 15, p.5]. Also, considerable attention of scientists is paid to the issues of combating money laundering, solving the problem of terrorism in its various aspects [3, p.39; 5, p.99; 13, p.37]. Therefore, researchers have considered the features of regulation and counteraction to money laundering through the use of various tools [1, p.52; 8, p.83; 9, p.32; 10, p.57].

To calculate the efficiency of banking institutions in Ukraine, it is proposed to use Banxia Frontier Analyst 4 software. It is noted that Frontier Analyst is a tool for Windows performance analysis, which uses a technology called Data Envelopment Analysis (DEA). The study involves a series of successive stages.

1 stage. Clustering of Ukrainian banks based on the k-means method.

Stage 2. Entering basic data. One output variable was selected: RLKD - quantitative assessment of the risk of money laundering, as well as input variables: K1 - the share of financial transactions registered on the basis of internal financial monitoring; K2 - violation the resolution of the NBUs' Board; K3 - violation of the Law "On legalization"; K4 - violation of the Law "On Banks"; K5 - the share of cash receipts from the total amount of receipts; K6 - the share of cash expenditures of the total expenditures. The expediency of its inclusion in the model by the method of PCM at the program Statistica 6.0 was checked. According to the results of factor loads and the schedule of talus, it was identified that to assess the technical efficiency of Ukrainian banks it is necessary to include all the above variables.

Stage 3. Structuring the project of DEA-analysis for the operating environment by constructing an input-oriented BCC-model of the fractional-linear

programming problem of minimization of conditional inputs and an output-oriented CCR-model of the fractional-linear programming problem of maximizing the ratio of conditional outputs with constant scale. The minimum and maximum values of the indicators' priority are selected on the basis of the Fishburne formula. Mathematical formalization of model construction (formula 1) is carried out:

$$\max \theta = \frac{\sum_i u_i w_i y_i}{\sum_i v_i w_i x_i} \quad (1)$$

$$\left\{ \begin{array}{l} \frac{\sum_i u_i w_i y_i}{\sum_i v_i w_i x_i} \leq 1, \\ \min w_i \leq w_i \leq 100\% \\ x_i \geq 0, y_i \geq 0 \end{array} \right.$$

where -  $\theta$  the level of technical efficiency of the financial monitoring for the selected banking institution;  $u_i(v_i)$  - characteristics of the econometric model concerning the dependence of the technical efficiency and the financial monitoring for the selected banking institution on the category of conditional outputs (inputs);  $y_i(x_i)$  - characteristic of conditional outputs (inputs).

Stage 4. Analysis of the obtained results concerning application of input-oriented BCC-model of fractional-linear programming problem for conditional inputs minimization and output-oriented CCR-model of fractional-linear programming problem for maximization of conditional outputs ratio with constant return of scale for efficiency of Ukrainian banks' financial monitoring. A comprehensive analysis of the results is shown on the example of 34 banks of six groups of banking institutions in Ukraine for 2019.

Stage 5. Systematization the obtained results and creation the practical recommendations for improving certain areas of strategic management of banking institutions in terms of financial monitoring. Initially, groups of efficient and inefficient banking institutions are formed. Thus, the work of financial monitoring on both models at 10 banks is effective. Next, the model let us identify the available reserve and the potential for increasing the effectiveness of financial monitoring for the group as a whole, and for each individual bank. Based on the data at Table 1, a clear interpretation the feasibility of intensifying certain areas for strategic management for banks' financial monitoring is presented.

Table 1 - The potential for increasing the effectiveness of financial monitoring on the example of three groups of Ukrainian banks in 2019.

Indicator	1 group of banks		2 group of banks		3 group of banks	
	BCC-model	CCR-model	BCC-model	CCR-model	BCC-model	CCR-model
K1	-25,87%	10,52%	16,46%	22,19%	-1,99%	-21,48%
K2	-11,13%	-5,52%	-14,05%	-9,78%	2,46%	-17,07%
K3	-16,5%	-8,29%	-8,8%	5,99%	-1,44%	-13,96%
K4	-24,6%	15,27%	-45,46%	-29,25%	-0,84%	-13,96%
K5	-8,04%	2,43%	-1,36%	12,1%	-5,89%	-15,86%
K6	-13,87%	40,68%	-13,87%	10,29%	0,11%	-17,65%
RLKD	0%	-17,29%	0%	-10,4%	87,28%	0%

Thus, the proposed model can be used in the introduction of supervision based on the assessment of the banking institutions' effectiveness of Ukraine in terms of compliance with the requirements on financial monitoring regulations. The Frontier Analyst approach provides an opportunity to conduct a comparative analysis of performance; to build a visualization of information important for further activities; to carry out more efficient distribution of available resources; find the information needed to develop a planning strategy; identify the worst and best units of research; to study more deeply indicators, characteristics and units of research.

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