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COMPARATIVE ANALYSIS OF EXISTING METHODOLOGIES FOR ASSESSING THE EFFICIENCY OF LENDING PRACTICE

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Annotatsiya. Tijorat banklarining kreditlash faoliyati samaradorligini baholashning mavjud metodologiyalari, jumladan, koeffitsiyentli tahlil, CAMELS reyting tizimi, ma'lumotlarni qamrab olish tahlili (DEA), stoxastik chegara tahlili (SFA), riskni hisobga olgan holda kapital rentabelligi (RAROC), iqtisodiy qo'shilgan qiymat (EVA) va integral indeks usullari qiyosiy tahlil qilingan. Mazkur metodologiyalar ko'p mezonli baholash yondashuvi asosida oltita mezon bo'yicha baholangan. O'zbekistonning 19 ta tijorat banki ma'lumotlari asosida alohida ko'rsatkichlarga tayanuvchi va integral baholash yondashuvlari o'zaro taqqoslangan. Banklarning muammoli kreditlar (NPL) ulushi va kredit portfeli o'sishi bo'yicha reytinglari o'rtasidagi Spirmen rang korrelyatsiyasi koeffitsiyenti $-0,13$ ni, NPL ulushi va integral indeks bo'yicha reytinglari o'rtasidagi korrelyatsiya koeffitsiyenti esa $0,67$ ni tashkil etgan. Ushbu natijalar alohida ko'rsatkichlarga asoslangan baholash yondashuvlari bir-biridan farqlanuvchi xulosalarga olib kelishi mumkinligini ko'rsatadi. Tadqiqot natijalari asosida kreditlash faoliyati samaradorligini baholash metodologiyasini takomillashtirish yo'nalishlari taklif etilgan.

Kalit so'zlar: kreditlash samaradorligi, baholash metodologiyasi, CAMELS, DEA, SFA, RAROC, integral indeks, muammoli kreditlar, Spirmen rang korrelyatsiyasi.

Аннотация. Проведён сравнительный анализ существующих методологий оценки эффективности кредитной деятельности коммерческих банков, включая коэффициентный анализ, рейтинговую систему CAMELS, анализ среды функционирования (DEA), анализ стохастической границы эффективности (SFA), рентабельность капитала с учётом риска (RAROC), экономическую добавленную стоимость (EVA) и интегральный индекс. Рассматриваемые методологии оценены по шести критериям с применением многокритериального подхода. На основе данных 19 коммерческих банков Узбекистана проведено сопоставление подходов, основанных на отдельных показателях, и интегральной оценки. Коэффициент ранговой корреляции Спирмена между рейтингами банков по доле проблемных кредитов (NPL) и темпам роста кредитного портфеля составил $-0,13$, а между рейтингами по доле NPL и интегральному индексу — $0,67$. Полученные результаты свидетельствуют о том, что использование отдельных показателей при оценке эффективности кредитования может приводить к различающимся выводам. На основе результатов исследования предложены направления совершенствования методологии оценки эффективности кредитной деятельности коммерческих банков.

Ключевые слова: эффективность кредитования, методология оценки, CAMELS, DEA, SFA, RAROC, интегральный индекс, проблемные кредиты, ранговая корреляция Спирмена.

Abstract. A comparative analysis is conducted of existing methodologies for assessing the efficiency of commercial bank lending activities, including financial ratio analysis, the CAMELS rating system, data envelopment analysis (DEA), stochastic frontier analysis (SFA), risk-adjusted return on capital (RAROC), economic value added (EVA), and the integral index approach. These methodologies are evaluated against six criteria using a multi-criteria assessment framework. Based on data from 19 commercial banks in Uzbekistan, approaches relying on individual indicators are compared with an integrated assessment approach. Spearman's rank correlation coefficient between bank rankings based on the non-performing loan (NPL) ratio and loan portfolio growth is -0.13 , while the corresponding coefficient between rankings based on the NPL ratio and the integral index is 0.67 . These findings indicate that assessments based on individual indicators may produce divergent conclusions regarding lending efficiency. Based on the research findings, directions for improving the methodology for assessing the efficiency of commercial bank lending activities are proposed.

Keywords: lending efficiency, assessment methodology, CAMELS, DEA, SFA, RAROC, integral index, non-performing loans, Spearman's rank correlation.

INTRODUCTION

Lending represents one of the principal sources of income for commercial banks and constitutes the largest component of their assets. At the end of 2025, loans accounted for 63.5 percent of the total assets of Uzbekistan's banking system [13]. Therefore, the efficiency of lending activities is a key factor influencing a

bank's overall financial performance and stability.

However, the concept of "lending efficiency" encompasses several dimensions. From the perspective of bank shareholders, it reflects the profitability of lending operations; for regulators, it primarily concerns loan portfolio quality and the associated capital requirements; and from the state's perspective, it reflects the volume and economic impact of financing. Consequently, banking practice and academic literature employ various assessment methodologies that may produce differing results. Although Uzbekistan's loan portfolio increased by 13.3 percent in 2025, reaching UZS 604.0 trillion, growth rates and credit quality varied considerably across banks [11]. The Central Bank also monitors credit quality as one of the key indicators of banking system stability [12]. Under these conditions, identifying banks with efficient lending practices requires a comprehensive methodological approach.

The aim of the study is to conduct a comparative analysis of existing methodologies for assessing lending efficiency, evaluate their applicability to Uzbekistan's banking sector, and demonstrate the limitations of approaches based on individual indicators using empirical data.

LITERATURE REVIEW

One of the most established approaches to assessing lending efficiency is the use of financial ratios. P. Rose and S. Hudgins identify net interest margin, return on assets, return on equity, and loan portfolio quality indicators as key measures of bank performance [1]. In the Russian banking literature, lending efficiency is similarly assessed primarily through the profitability of lending operations and loan repayment rates [10]. This approach is relatively straightforward and relies on publicly available data. However, the relationships among individual indicators and their relative importance require further clarification.

The CAMELS rating system, widely applied in banking supervision, integrates capital adequacy, asset quality, management quality, earnings, liquidity, and sensitivity to market risk into a comprehensive rating framework. J. Lopez noted that CAMELS ratings are effective tools for monitoring banks' financial conditions, although their application depends on supervisory information and may involve delays in updating assessments [2].

Frontier-based methods assess bank efficiency by measuring the distance from the best-practice efficiency frontier. Data envelopment analysis (DEA), developed by A. Charnes, W. Cooper, and E. Rhodes, is a nonparametric linear programming method that enables comparisons among decision-making units using multiple inputs and outputs [3]. Stochastic frontier analysis (SFA), proposed by D. Aigner, K. Lovell, and P. Schmidt, distinguishes technical inefficiency from random statistical error [4]. Based on a review of more than 130 studies covering 21 countries, A. Berger and D. Humphrey demonstrated that different frontier-based methodologies may generate different efficiency estimates for the same banks [5]. In defining banking outputs, the intermediation approach proposed by C. Sealey and J. Lindley considers loans as outputs, while deposits and operating expenses are treated as inputs [6]. L. Mester demonstrated that incorporating risk into efficiency assessments is essential for obtaining more reliable estimates [7].

Among value-oriented approaches, risk-adjusted return on capital (RAROC) relates credit income after deducting expected losses to economic capital. E. Zaik and co-authors examined this approach using Bank of America as an example, presenting RAROC as a tool for loan pricing and capital allocation [8]. F. Fiordelisi, drawing on evidence from European banks, demonstrated that shareholder value efficiency measured through economic value added (EVA) may differ from traditional profit-based efficiency measures [9]. Selected domestic studies have examined lending efficiency through financial ratio analysis and the dynamics of non-performing loans [14, 15]. At the same time, opportunities remain to develop comparative assessments of existing methodologies using a unified set of criteria.

RESEARCH METHODOLOGY

The study was conducted in two stages. In the first stage, seven methodologies were evaluated using a multi-criteria assessment approach based on six criteria: risk coverage (weight of 0.25), data availability (0.20), objectivity (0.15), comparability (0.15), clarity (0.10), and applicability to management decision-making (0.15). Expert scores ranging from 1 to 5 were assigned to each criterion based on a review of the relevant literature [1–9] and the availability of publicly accessible banking data in Uzbekistan. The integral score for each methodology was calculated as follows:

$$U_m = \sum_{k=1}^K w_k \times b_{mk} \quad (1)$$

where bm_k represents the score assigned to methodology m under criterion k , and w_k denotes the weight of the corresponding criterion.

In the second stage, three indicators were calculated for 19 commercial banks with loan portfolios exceeding UZS 7 trillion, using Central Bank data as of 1 January 2025 and 1 January 2026 [11]. These indicators included the annual growth rate of the loan portfolio (g), the non-performing loan (NPL) ratio, and the change in the NPL ratio. The indicators were normalized using the min–max method, with direct normalization applied to loan portfolio growth and inverse normalization applied to the NPL ratio and its change. The normalized indicators were subsequently combined into an integral index:

$$I = 0.30 \times g_n + 0.45 \times NPL_n + 0.25 \times \Delta NPL_n \quad (2)$$

Banks were ranked according to each assessment approach, and the consistency of the resulting rankings was evaluated using Spearman's rank correlation coefficient:

$$\rho = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)} \quad (3)$$

where d_i denotes the difference between the ranks assigned to bank i in the two rankings, and n represents the total number of banks included in the analysis.

It should be noted that bank-level profitability indicators were not incorporated into the integral index because they are not included in the publicly available monthly banking statistics. This methodological limitation was taken into account when interpreting the research findings.

ANALYSIS AND RESULTS

The main characteristics of the methodologies used to assess lending efficiency are summarized in Table 1.

Table 1
Comparative Characteristics of Methodologies for Assessing Lending Efficiency¹

Methodology	Key indicators	Advantages	Limitations
Ratio analysis	Loan yield, NIM, NPL ratio, cost of risk	Straightforward application; publicly available data	Potential inconsistencies among indicators; absence of predefined weights
CAMELS	Capital adequacy, asset quality, management, earnings, liquidity, sensitivity to market risk	Comprehensive approach; established application in banking supervision	Limited access to confidential supervisory data; influence of subjective assessments
DEA	Input–output ratios; distance from the efficiency frontier	No predefined functional form required	Sensitivity to random errors; limited consideration of risk
SFA	Deviations from the estimated cost or profit frontier	Distinguishes inefficiency from statistical noise	Requires assumptions regarding functional form and error distributions
RAROC	(Income – costs – expected losses) / economic capital	Explicit incorporation of risk	Requires PD and LGD estimates and internal banking data
EVA / SVA	Economic profit exceeding the cost of capital	Focus on shareholder value creation	Complexity of estimating the cost of capital
Integral index	Weighted sum of normalized indicators	Flexible methodology; applicable to publicly available data	Dependence on the selection and justification of indicator weights

The evaluation scores assigned to the methodologies according to the selected criteria, together with their integral results, are presented in Table 2 and Figure 1.

¹ Source: Author's own work.

Table 2

Results of the Multi-Criteria Evaluation of Methodologies (1–5 Points) ²

Methodology	Risk coverage (0.25)	Data availability (0.20)	Objectivity (0.15)	Comparability (0.15)	Clarity (0.10)	Management applicability (0.15)	U _m
Ratio analysis	2	5	4	3	5	4	3.65
CAMELS rating	4	2	2	4	4	3	3.15
DEA	2	4	4	4	2	3	3.15
SFA	3	3	4	4	2	2	3.05
RAROC	5	2	3	4	3	5	3.75
EVA / SVA	4	2	3	3	3	4	3.20
Integral index	4	5	3	4	4	4	4.05

According to the evaluation results, the integral index (4.05) and RAROC (3.75) received the highest scores, while ratio analysis (3.65) ranked third. Although RAROC demonstrates the strongest performance in terms of risk coverage, it received a relatively low score for data availability because its application requires internal estimates of the probability of default (PD) and loss given default (LGD). Similarly, CAMELS and EVA demonstrate moderate overall results, whereas DEA and SFA received comparatively lower scores for clarity and applicability to management decision-making. Thus, under the conditions of Uzbekistan's banking sector, the integral index appears to be the most suitable assessment tool for external analysts, while RAROC is particularly appropriate for internal bank management.

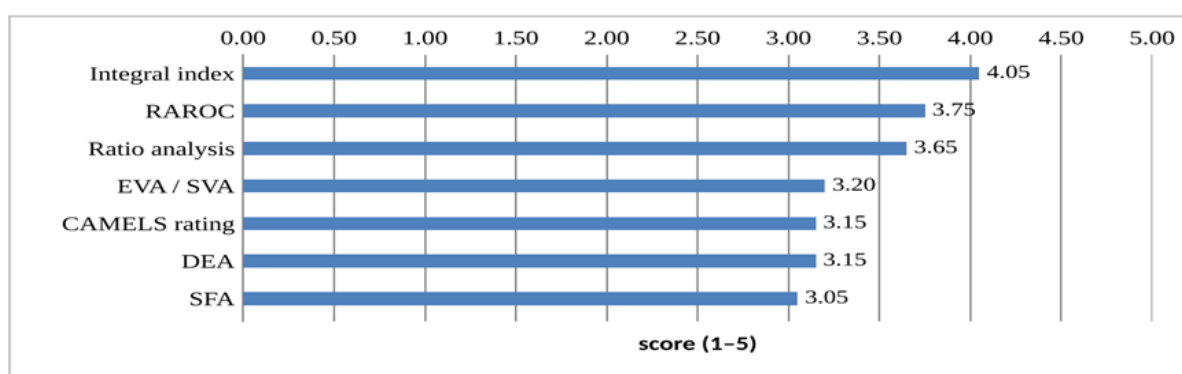
Figure 1. Integral Scores of Methodologies for Assessing Lending Efficiency³

Table 3

Lending Efficiency of Banks: Single-Indicator and Integral Assessment Approaches⁴

Bank	Portfolio growth, %	NPL, 01.01.2025, %	NPL, 01.01.2026, %	ΔNPL, p.p.	Index I	NPL rank	Growth rank	Index rank
Uzmilliybank	-2.4	3.0	2.8	-0.2	0.325	8	19	16
Agrobank	36.5	4.9	3.3	-1.6	0.542	11	5	5
Uzsanoatqurilishbank	-0.9	2.8	2.5	-0.3	0.361	5	18	13
Asakabank	7.1	4.5	3.6	-0.9	0.333	15	16	15
Kapitalbank	15.0	4.5	2.8	-1.7	0.465	7	10	7
Ipoteka-bank	1.0	10.2	3.5	-6.6	0.445	14	17	8
Xalq Banki	13.4	4.2	3.1	-1.2	0.420	9	11	11
Business Development Bank	9.0	8.5	4.5	-4.0	0.347	17	15	14

² Source: Author's own work.³ Source: Author's own work.⁴ Source: Author's own work.

Hamkorbank	25.0	1.7	0.8	-0.9	0.663	2	7	1
Mikrokreditbank	16.4	4.6	4.4	-0.2	0.306	16	9	18
Aloqabank	49.8	2.8	2.5	-0.3	0.651	6	1	2
Ipak Yuli Bank	13.0	1.5	1.1	-0.4	0.557	3	13	4
Turonbank	10.8	1.9	3.4	+1.5	0.312	12	14	17
Orient Finans Bank	13.1	0.2	0.1	-0.0	0.628	1	12	3
TBC Bank	38.5	2.1	5.7	+3.6	0.235	19	4	19
Anorbank	47.2	2.4	4.7	+2.3	0.394	18	2	12
InFinBank	19.6	1.4	2.5	+1.1	0.444	4	8	9
Davr Bank	26.7	1.9	3.2	+1.3	0.425	10	6	10
Trastbank	39.2	3.4	3.5	+0.1	0.502	13	3	6

The data presented in Table 3 demonstrate that assessments based on individual indicators may produce substantially different conclusions regarding lending efficiency. Aloqabank (49.8 percent), Anorbank (47.2 percent), and Trastbank (39.2 percent) occupy the leading positions in terms of loan portfolio growth, whereas Orient Finans Bank, Hamkorbank, and Ipak Yuli Bank achieve the highest rankings based on NPL ratios. Spearman's rank correlation coefficient between these two rankings is -0.13 , indicating a very weak negative association. For example, TBC Bank ranks fourth in loan portfolio growth but occupies the lowest position in the NPL ranking, as its NPL ratio increased from 2.1 percent to 5.7 percent over the year. In contrast, Uzmillybank ranks eighth according to its NPL ratio but occupies the lowest position in portfolio growth, reflecting a 2.4 percent contraction in its loan portfolio (Figure 2).

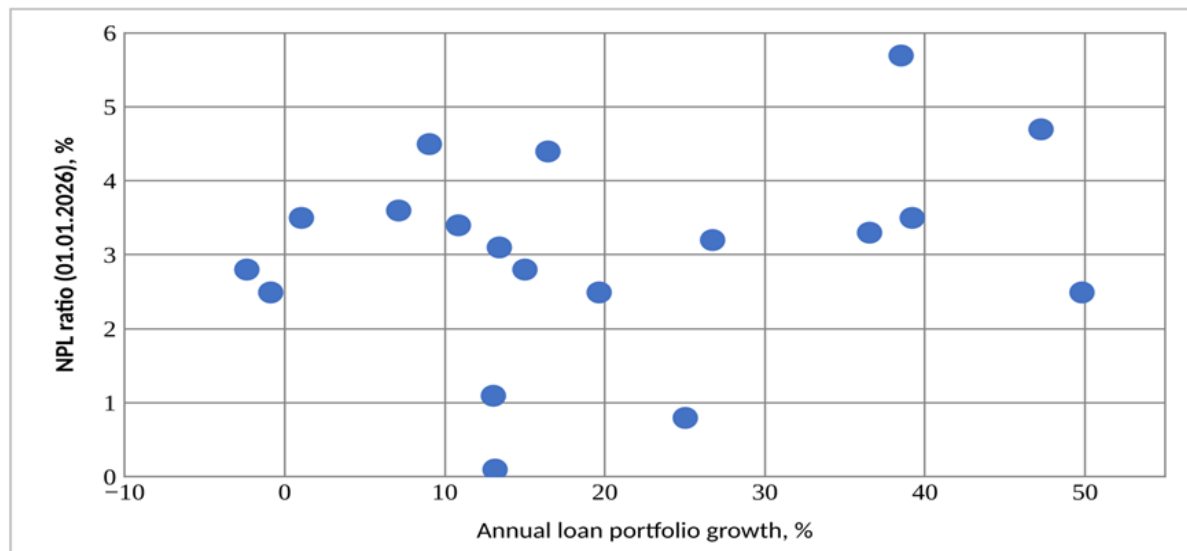


Figure 2. Loan Portfolio Growth and the Share of Non-Performing Loans in Banks⁵

The integral index provides a more balanced assessment by incorporating the selected indicators. Its correlation with the NPL-based ranking was 0.67, while the corresponding correlation with the portfolio growth ranking was 0.33. Hamkorbank, Aloqabank, and Orient Finans Bank achieved the highest integral index rankings, reflecting their combination of relatively strong portfolio growth and comparatively low or stable NPL ratios. Although Ipoteka-bank ranked fourteenth according to its NPL ratio, it advanced to eighth position in the integral ranking because its NPL ratio declined from 10.2 percent to 3.5 percent. This finding highlights the importance of assessing lending efficiency not only through indicators reflecting the current position but also by considering their dynamics over time. Nevertheless, because the proposed integral index does not incorporate profitability or risk-adjusted returns, it should be supplemented with value-oriented measures, particularly RAROC, to provide a more comprehensive assessment of lending efficiency.

⁵ Source: Author's own work.

CONCLUSIONS AND RECOMMENDATIONS

The findings of the study provide a basis for drawing the following conclusions.

First, the assessment of lending efficiency requires a differentiated methodological approach, as each existing methodology has its own advantages and specific application requirements. Ratio analysis is relatively straightforward but may produce differing assessments depending on the indicators selected. CAMELS provides a comprehensive assessment but relies on supervisory data that are not always publicly available. DEA and SFA offer well-established analytical frameworks, although their application in management decision-making requires appropriate methodological and technical resources. RAROC and EVA provide value-oriented assessments but depend on the availability of internal banking data.

Second, based on the selected criteria and assigned expert weights, the multi-criteria evaluation identified the integral index (4.05 points) and RAROC (3.75 points) as the highest-scoring methodologies among those examined. The integral index is particularly appropriate for external analysis and supervisory assessments, while RAROC can be effectively applied to internal loan pricing and credit limit determination.

Third, the empirical analysis of 19 commercial banks revealed a very weak negative correlation between rankings based on loan portfolio growth and credit quality ($\rho = -0.13$). This finding indicates that assessments based on a single indicator may not fully reflect the multidimensional nature of lending efficiency. Therefore, combining quantitative and qualitative indicators within an integrated assessment framework can contribute to more comprehensive and reliable evaluations.

Based on these findings, the following recommendations are proposed to improve the methodology for assessing lending efficiency:

1. Introduce an integrated assessment framework. Assess the efficiency of banks' loan portfolios using an integral index that incorporates four principal dimensions: lending volume, portfolio quality, changes in key indicators over time, and profitability. This approach would facilitate a more comprehensive evaluation of lending performance.

2. Expand the application of RAROC in commercial banks. Introduce risk-adjusted return on capital assessments in large commercial banks at the level of individual credit products and branches. The results could also be incorporated into performance evaluation and incentive systems for loan officers to strengthen the relationship between lending decisions, profitability, and risk management.

3. Improve the availability of banking statistics. Consider expanding the Central Bank's monthly statistical publications to include loan portfolio yield and cost-of-risk indicators for individual commercial banks. Greater availability of these indicators would support comparative analysis and improve the transparency of lending efficiency assessments.

4. Strengthen the empirical justification of indicator weights. Determine the weights used in the integral index on the basis of historical banking data, including the possible application of principal component analysis, as a complement or alternative to expert-based weighting. This would help improve the objectivity and methodological consistency of the assessment framework.

5. Apply comparative methodological validation. Regularly compare lending efficiency assessments obtained using at least two different methodologies. Such comparisons would make it possible to identify differences in evaluation results and enhance the reliability of conclusions used in banking management and supervisory analysis.

Overall, the findings indicate that improving the assessment of lending efficiency in Uzbekistan requires the combined application of integral, risk-adjusted, and comparative analytical approaches. The proposed recommendations provide a methodological basis for strengthening the evaluation of loan portfolio performance, supporting informed management decisions, and promoting the financial stability of commercial banks.

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