ECONOMETRIC ASSESSMENT OF DIGITAL COMPETITIVENESS AND OPERATIONAL EFFICIENCY OF COMMERCIAL BANKS

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Abstract. *This article examines the theoretical and methodological aspects of the relationship between digital competitiveness and the operational efficiency of commercial banks in the context of the digital economy. Based on the scientific approaches of foreign and Uzbek scholars, the main components for assessing digital competitiveness are identified. It is proposed to assess the digital competitiveness of commercial banks using a composite index that incorporates digital services, customers' digital activity, technological and innovative potential, operational efficiency, and digital security.*

Keywords: *digital economy, commercial banks, digital transformation, digital competitiveness, DRI, ROA, ROE, CIR, panel data, System GMM.*

INTRODUCTION

Today, the rapid development of the digital economy is fundamentally changing the nature and forms of competition in the financial and banking sector. The widespread adoption of mobile banking, internet banking, digital payments, remote identification, artificial intelligence, big data, cloud technologies, and fintech solutions requires commercial banks to transform their traditional business models. As a result, banks' competitiveness in the market is no longer determined solely by the size of their capital, branch network, loan portfolio, or interest rates, but also by the quality of digital services, the level of technological innovation adoption, customers' digital activity, operational efficiency, and cybersecurity.

In Uzbekistan's banking system, digital transformation processes are also accelerating. The development of remote banking services, mobile applications, digital payments, and other innovative financial services is bringing competition among commercial banks to a new stage. Local studies have also examined the impact of digital transformation on banking services, business models, and operational efficiency [4, 29]. In particular, a study by A. Maksudov identified a strong negative correlation of –0.985 between the level of digital technology adoption and banks' Cost-to-Income Ratio [7, 4].

At the same time, existing studies have not sufficiently investigated the development of a multi-component integrated indicator of digital competitiveness and the assessment of its impact on the efficiency of commercial banks in Uzbekistan using panel econometric models. This circumstance determines the scientific and practical relevance of the research topic.

The main objective of this study is to assess the digital competitiveness of commercial banks in Uzbekistan, determine its impact on bank performance using econometric methods, and improve existing scientific and methodological approaches.

The object of the study is the digital transformation and financial-economic activities of commercial banks operating in the Republic of Uzbekistan. The subject of the study comprises the economic relationships between the digital competitiveness of commercial banks and their operational efficiency, as well as the scientific, methodological, and econometric mechanisms for assessing these relationships.

In addition to statistical, comparative, and index methods, the study is expected to employ correlation analysis, Fixed Effects and Random Effects models based on panel data, the Hausman test, and the System GMM method, which takes into account the problem of endogeneity. This approach makes it possible to substantiate the impact of digital competitiveness on bank performance not only descriptively but also quantitatively and econometrically.

1. Development of the Digital Competitiveness Index

In this study, the digital competitiveness of commercial banks is assessed using the DRI (Digital Competitiveness Index). The index incorporates the following five main components:

D_1 — Development of digital services: mobile banking; internet banking; online lending; remote account opening; digital cards; QR payments; online deposits.

D_2 — Digital customer activity: number of digital users; mobile banking users; number and volume of digital transactions; level of use of remote banking services.

D_3 — Technological and innovation capacity: IT expenditures; digital investments; fintech projects; API integrations; artificial intelligence; automated processes.

D_4 — Operational digital efficiency: Cost-to-Income Ratio; share of digital operations; service delivery speed; cost of digital operations.

D_5 — Digital security: cybersecurity; number of fraud incidents; failed transactions; system continuity; biometric identification.

Since the indicators are measured in different units, they need to be standardized within the range of 0–1.

For positive indicators: $Zij=Xij−Xmin,jXmax,j−Xmin,j$

For negative indicators: $Zij=Xmax,j−XijXmax,j−Xmin,j$

At the next stage, the weighting coefficients of the indicators are determined using the entropy method. The integrated Digital Competitiveness Index is calculated as follows: $DRIi=\sum j=1nwjZij$

where: DRIi — Digital Competitiveness Index of bank i; wj — weight of indicator j; Zij — standardized value of indicator j for bank i.

2. Assessment of Bank Performance

Three main financial indicators are proposed to assess the impact of digital competitiveness on bank performance.

Return on Assets — ROA

$ROA=Net\ ProfitAverage\ Assets\times100$

ROA reflects the efficiency with which a bank utilizes its assets.

Return on Equity — ROE

$ROE=Net\ ProfitAverage\ Equity\times100$

ROE indicates the efficiency of the bank's use of its equity capital.

Cost-to-Income Ratio — CIR

$CIR=Operating\ ExpensesOperating\ Income\times100$

A decrease in CIR generally indicates an improvement in the bank's operational efficiency.

3. Econometric Model

To assess the impact of digital competitiveness on bank profitability, the following panel model is proposed:

$ROAit=\beta0+\beta1DRIit+\beta2SIZEit+\beta3CAPit+\beta4LIQit+\beta5NPLit+\mu i+\lambda t+\varepsilon it$

where: ROAit — return on assets of bank i in period t; DRIit — Digital Competitiveness Index; SIZE — bank size; CAP — capital adequacy; LIQ — liquidity; NPL — share of non-performing loans; μi — bank-specific individual effect; λt — time effect; εit — random error term.

The main hypothesis is: **H1: β1>0**

That is, an increase in digital competitiveness is expected to increase banks' return on assets.

For return on equity, the following model can be used: $ROEit=\beta0+\beta1DRIit+\beta2SIZEit+\beta3CAPit+\beta4LIQit+\beta5NPLit+\mu i+\lambda t+\varepsilon it$

In this model, the main expected result is also **β1>0**.

4. Impact of Digitalization on Operational Efficiency

To assess the impact of digital transformation on operational efficiency, CIR is used as the dependent variable: [CIR_{it}=\beta_0+\beta_1DRI_{it}+\beta_

6. Empirical Evidence and Scientific Novelty on Uzbek Banks

The number of studies examining the relationship between digitalization and efficiency in the Uzbek banking system has been increasing. Existing studies indicate that the adoption of digital technologies can reduce banks' operating costs and improve their financial efficiency [6; 7; 8].

At the same time, the majority of existing studies assess digitalization through individual indicators or correlation relationships. The integrated indicator of digital competitiveness, which combines digital services, customer activity, technological capacity, operational efficiency, and security, as well as its impact on bank efficiency, has not yet been sufficiently evaluated in a comprehensive manner.

The scientific novelty of this study consists of the following:

1. An approach is proposed for assessing the digital competitiveness of commercial banks based on five key dimensions.
2. A methodology for constructing an integrated Digital Readiness Index (DRI) is developed.
3. The impact of the DRI on ROA, ROE, and CIR indicators is proposed to be assessed within a unified econometric framework.
4. The use of the System GMM model is justified in order to mitigate the endogeneity problem.
5. The impact of digital transformation on bank efficiency is assessed together with control variables such as bank size, capital adequacy, liquidity, and credit risk.

CONCLUSION

Digital transformation is becoming an important factor in the competitiveness of modern commercial banks. The development of mobile banking, internet banking, digital payments, artificial intelligence, big data, and fintech technologies is transforming banks' business models and, at the same time, affecting their efficiency.

International studies indicate that digital transformation can improve the efficiency of banking operations. Xie and Wang empirically demonstrated the positive impact of digital transformation on the efficiency of Chinese commercial banks [2, 40]. X. Vives, in turn, emphasizes that digital technologies can intensify competition among banks while also creating opportunities to improve efficiency [1, 246].

Studies conducted by Uzbek scholars also support this trend. In particular, Maksudov's study identified a strong negative correlation of –0.985 between the level of digital technology adoption and the CIR [7, 1].

This study proposes assessing the digital competitiveness of Uzbek commercial banks based on digital services, customer activity, technological and innovative capacity, operational efficiency, and digital security. A methodology is developed for constructing an integrated DRI by standardizing and weighting these indicators and subsequently assessing its impact on ROA, ROE, and CIR using panel econometric models.

Thus, the proposed approach is based on the following sequence: **"development of digital indicators → calculation of the DRI → assessment of bank efficiency → panel regression → testing causality using System GMM."** This methodology makes it possible to evaluate the digital transformation of Uzbek commercial banks not only from a technological perspective but also in terms of economic efficiency and competitiveness.

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