

Benchmarking Comparison of Financial Performance and Risk Resilience in the Digital Transformation of Banking: A Comparative Study of China and Kazakhstan

Yejiao Zhang*

Al-Farabi Kazakh National University, Almaty, 050040, Kazakhstan

*Corresponding author: 793319550@qq.com

Abstract: The global digital transformation of banking has a dual impact on financial performance and risk resilience, and its effects vary depending on the stage of technology adoption and infrastructure endowments of different countries. This study constructs a three-dimensional alignment framework that includes financial efficiency, risk buffers, and digital penetration, and it conducts a benchmarking comparison of the banking industries in China and Kazakhstan. The research shows that China's banking industry features a combination of a downward trend in net interest margins and a structural increase in non-interest income, and its risk resilience is reflected in a stable capital adequacy ratio and enhanced continuity in credit risk monitoring. Kazakhstan's banking industry maintains a relatively high net interest margin but with significant fluctuations, and it has a lower elasticity in the cost-to-income ratio, while its risk resilience is constrained by insufficient thickness of credit data and external dependence of the financing structure. This study provides cross-country comparative evidence on the digital effects of transitional economies and emerging markets.

Keywords: digital transformation of banking; financial performance; risk resilience; China and Kazakhstan; benchmarking comparison

Introduction

The impact of digital transformation on the financial performance and risk resilience of the banking industry is an important topic in current financial research. However, existing literature mainly focuses on empirical evidence from single countries or developed economies, and it lacks systematic benchmarking comparisons of countries at different stages of digital development. The selection of China and Kazakhstan is necessary: China's banking industry has entered a deepening stage of intelligent risk control and data governance, while Kazakhstan is in an expansion period of mobile payment and core system upgrades. The differences between the two countries provide a natural research context for identifying the stage-based effects of digital transformation. Comparing the adjustment paths of financial performance and the reshaping mechanisms of risk resilience in the two countries helps to clarify the determinants of the inflection point in the digital input-output curve and to reveal the moderating role of technology adoption elasticity on capital buffers and liquidity stability. This study constructs a cross-country comparative framework that incorporates time-lag factors and economies of scale at the theoretical level. At the empirical level, it eliminates the interference of institutional biases on benchmark consistency through dimensional alignment and indicator calibration, thereby providing a methodological reference for cross-country research on the digital transformation of banking.

1. Theoretical Correlation and Comparative Benchmark of Digital Transformation, Financial Performance, and Risk Resilience

1.1 Dynamic Adjustment Path of Financial Performance in the Process of Digital Transformation

The digital transformation of banking is not an instantaneous technological switch, but it is a continuous process that evolves in stages under the interaction between organizational operations and technological penetration. In this process, financial performance indicators exhibit nonlinear dynamic

adjustment characteristics: in the initial stage, due to the running-in costs between technology infrastructure investment and existing business processes, the return on assets and the cost-to-income ratio may experience short-term deviations. As the substitution effect of digital channels for physical branches gradually emerges, the improvement in operational efficiency transmits to structural changes in net interest margins and non-interest income. This adjustment path reflects the time-lag characteristics of returns on digital investment, and it also reveals differences among banks in the rate of technology adoption and organizational learning capabilities^[1].

From the perspective of cross-country comparison, the dynamic adjustment path of financial performance is jointly influenced by the banking industry's market structure, customer behavior patterns, and the elasticity of technology adoption. The higher penetration rate of e-banking in China's banking industry and the fact that Kazakhstan's banking industry is still in the expansion stage of mobile payment determine that there are systematic differences between the two countries in the inflection point position and slope of the digital input-output curve. By constructing an adjustment function that incorporates the time-lag factor of technology adoption and the effect of economies of scale, researchers can quantify and compare the response trajectories of financial performance in the two countries, thereby providing a basic dynamic reference framework for subsequent benchmark setting.

1.2 Digital Reshaping Mechanism of Risk Resilience

The effect of digital transformation on the risk resilience of the banking industry is not a one-sided enhancement or weakening, but it reshapes the underlying architecture of risk management by changing the frequency of risk identification, the density of information transmission, and the granularity of asset quality monitoring. Digital technology enables high-frequency transaction data and customer behavior profiles to be transformed in real time into input variables for credit risk assessment, thereby shortening the response lag between risk exposure and risk mitigation. At the same time, the homogeneous deployment of technical systems and the concentrated reliance on third-party service providers may also introduce new sources of operational risk and systemic risk. This dual effect implies that the digital reshaping of risk resilience involves both an improvement in risk absorption efficiency and the exposure of new types of risk factors.

Under the comparative framework, the differences among the banking industries of China and Kazakhstan in the thickness of risk data accumulation, the completeness of credit information system coverage, and the maturity of digital identity authentication infrastructure lead to heterogeneous manifestations of the digital reshaping mechanism. China's banking industry, relying on its relatively mature big data risk control models and anti-fraud systems, exhibits an improvement in risk resilience that is more reflected in the enhanced accuracy of credit risk identification. Kazakhstan's banking industry, in the process of rapidly increasing mobile banking penetration, faces the constraint of an expanding operational risk exposure. Clarifying the mechanistic roots of these differences is a prerequisite for establishing an effective cross-country comparison^[2].

1.3 Benchmark Setting and Dimensional Alignment for Cross-Country Banking Comparison

Conducting a benchmarking comparison of the banking industries in China and Kazakhstan requires the prior resolution of two methodological issues: measurement equivalence and scale alignment. Measurement equivalence demands that the selected indicators of financial performance and risk resilience carry the same functional meaning in the banking practices of both countries; that is, changes in the return on assets should reflect similar profit-driving mechanisms, and fluctuations in the non-performing loan ratio should correspond to comparable degrees of risk exposure. Considering the differences in accounting standards, loan classification criteria, and provisioning rules between the two countries, researchers must eliminate the interference of institutional biases on scale consistency through indicator calibration and dimensional mapping.

Dimensional alignment involves the selection of comparison levels and the allocation of weights. Macro-level comparisons of the overall performance of the banking industry and micro-level benchmarking analyses of individual banks serve different research purposes: the former reveals structural trends, while the latter identifies best operational practices. This study selects a market segment dimension between the two levels—bank categories stratified by asset size and grouped by digital maturity—as the comparison unit, in order to avoid the within-group heterogeneity masked by overall averages. By constructing a three-dimensional alignment framework that includes the financial

efficiency dimension, the risk buffer dimension, and the digital penetration dimension, researchers can achieve a refined deconstruction of the digital transformation performance of the banking industries in the two countries, thereby providing a unified comparison platform for the item-by-item benchmarking in subsequent sections.

2. Benchmarking of Financial Performance in the Digital Transformation Stage of the Banking Industries in China and Kazakhstan

2.1 Cross-Country Differences in Return on Assets and Net Interest Margin and Their Attribution

During the advancement of digital transformation, China's banking industry exhibits a relatively narrowed fluctuation range in return on assets, and its net interest margin demonstrates a downward trend. This change is attributed to the impact of digital credit products on the traditional interest spread pricing model: online customer acquisition and automated approval reduce marginal costs, and they also intensify market competition in loan interest rates. On the liability side, the diversion of funds through mobile wealth management platforms further compresses the proportion of low-cost deposits. In contrast, Kazakhstan's banking industry shows a higher degree of dispersion in return on assets and net interest margin. Some leading banks achieve rapid expansion of asset scale by penetrating previously uncovered retail customer groups through digital channels, while tail-end banks face the dual pressure of narrowing net interest margins and fluctuating asset quality^[3].

From the perspective of the causal structure of cross-country differences, the deviation in the return on assets between the two banking industries mainly stems from the moderating effect of digital maturity on the revenue mix. The decline in net interest margin and the increase in non-interest income in China's banking industry exhibit a partial hedging relationship, but the improvement in operational efficiency brought by digital transformation has not yet fully compensated for the drag on return on assets caused by the narrowing of the interest margin. Kazakhstan's banking industry maintains a relatively high level of net interest margin, which reflects the coexistence of a strong degree of information asymmetry and insufficient competition in its credit market, and the introduction of digital technology is gradually changing this equilibrium. By decomposing the return on assets into three components—the contribution of net interest margin, the contribution of non-interest income, and the contribution of costs—we can identify the core driving factors behind the differences between the two countries.

2.2 Comparison of Cost-to-Income Ratio and Operational Efficiency Driven by Digitalization

The impact of digital transformation on the cost-to-income ratio exhibits different transmission paths in the banking industries of the two countries. In China's banking industry, the continuous reduction of physical branches and the increase in the transaction substitution rate of online channels lead to a decrease in the proportion of fixed operating costs in total costs. However, technology research and development investments and system maintenance expenses turn into new cost rigidities. The overall direction of change in the cost-to-income ratio depends on whether the cost savings from branch reductions can cover the incremental expenditures of digital investment. Data show that the cost-to-income ratio of large commercial banks in China declines slightly after the peak period of digital investment, while some joint-stock banks maintain a relatively high level due to continuous technological iteration.

Kazakhstan's banking industry exhibits different characteristics in the structure of the cost-to-income ratio. Because physical branches still play an irreplaceable role in the accessibility of banking services in Kazakhstan, the flexibility for branch closures is low, and the expansion of digital channels is more reflected in an increase in total costs rather than cost substitution. At the same time, banks in Kazakhstan mostly adopt an external technology procurement model for core banking system upgrades and mobile application development, which leads to a rise in the proportion of variable costs in total costs and makes the cost-to-income ratio more sensitive to business fluctuations. By comparing the digital-driven differences in operational efficiency between the two countries, we can identify the changes in the relative proportions of fixed and variable parts in the cost structure, thereby explaining the cross-country differences in the responsiveness of the cost-to-income ratio to digital transformation.

2.3 Structural Deviation Analysis of the Proportion of Non-Interest Income

In the process of digital transformation, the proportion of non-interest income is regarded as a key indicator for measuring the degree of diversification of the revenue structure in the banking industry. The overall increase in the proportion of non-interest income in China's banking industry is mainly driven by wealth management business, agency insurance, and electronic payment fees, among which standardized financial products sold through digital channels contribute a large increment. It should be noted that a structural dependence of tied selling exists between some non-interest income and on-balance-sheet credit businesses, so the increase in the proportion of non-interest income is not completely detached from the fluctuation impact of interest income. In addition, differences in the fee regulatory environment and the market competition pattern lead to a significant differentiation in the proportion of non-interest income among banks of different sizes^[4].

Kazakhstan's banking industry presents two structural characteristics in the proportion of non-interest income: first, traditional settlement and remittance service income still accounts for a large share of non-interest income, and it is closely related to cross-border trade and remittance flows; second, banks with a higher degree of digitalization are gradually expanding new fee-based businesses such as wealth management and digital insurance, but their contribution to total revenue remains at a relatively low level. The structural deviation in the proportion of non-interest income between the two countries can be attributed to differences in financial consumption habits: customers in China's banking industry have a higher acceptance of digital self-service wealth management, and the growth driver of non-interest income is more retail-oriented; Kazakhstan's banking industry, constrained by the lack of capital market depth and product innovation capabilities, relies more on corporate business areas such as cross-border payments and trade finance for its expansion path of non-interest income. This deviation reflects the different rhythms and directions of the digital transformation's reshaping of revenue structures in the two banking industries.

3. Benchmarking of Risk Resilience in the Digital Transformation of the Banking Industries in China and Kazakhstan

3.1 Comparison of Capital Buffer Adequacy and Counter-Cyclical Adjustment Capacity

The impact of digital transformation on the capital buffer adequacy of China's banking industry is reflected in two aspects: the change in the measurement of risk-weighted assets and the efficiency of capital supplementation. Digital credit products, relying on automated approval and real-time monitoring systems, increase the frequency of identification of credit risk exposures, and the volatility of risk-weighted assets rises accordingly, so banks tend to maintain a higher capital buffer to cover potential model misestimation risks. At the same time, digital channels reduce the customer acquisition and operating costs of retail businesses, promote an increase in the return on capital, and thus enhance the capacity for endogenous capital accumulation. This dual effect enables the capital adequacy ratio of China's banking industry to remain relatively stable even during the expansion phase of digital investment, and its counter-cyclical adjustment capacity relies more on active adjustments of the capital structure rather than passive absorption^[5].

Kazakhstan's banking industry presents different characteristics in capital buffer allocation. Because some banks are in the early stages of core system replacement and data governance capability improvement, the improvement in the accuracy of risk measurement brought by digitalization has not yet been fully reflected in the calculation of capital requirements. The level of capital buffers is more influenced by external financing conditions and parent companies' capital allocation, and the operational efficiency gains from digitalization have not yet formed a stable endogenous capital supplementation mechanism. In terms of counter-cyclical adjustment capacity, the capital adequacy ratio of Kazakhstan's banking industry fluctuates more widely than that of China's banking industry, which reflects its higher sensitivity to economic cycle shocks, and digital transformation has not yet provided a sufficiently smooth capital buffer adjustment channel. The capital buffers of Kazakhstan's banking industry exhibit strong sensitivity to fluctuations in the local currency exchange rate and changes in commodity prices, while the role of digital risk control systems in cycle identification and capital allocation optimization has not yet been fully released, which further amplifies the lag and volatility of its counter-cyclical adjustment.

3.2 Differences in Non-Performing Loan Generation Rate and Credit Risk Migration Path

In the process of digital transformation, China's banking industry exhibits a trajectory of the non-performing loan generation rate that first declines and then stabilizes. The introduction of big data risk control models and real-time behavior monitoring technologies improves the accuracy of pre-loan screening and in-loan early warning, and the generation speed of new non-performing loans decreases in stages after digitalization covers the full customer base. The credit risk migration path also undergoes structural changes: the progression speed from the special-mention category to the substandard category in traditional loan classification slows down under digital monitoring, but some digital loans with deferred principal and interest repayment still harbor hidden migration pressure after being transferred to the normal category. Risk differentiation intensifies among different customer groups, and a decline in the default rate of high-quality customers coexists with an increase in risk exposure of the long-tail customer base.

Kazakhstan's banking industry exhibits a weak correlation between the change in the non-performing loan generation rate and the digital penetration rate. While the rapid expansion of mobile credit products extends the coverage of financial services, the insufficient thickness of credit data and the limited application of alternative data result in a lower ability of credit assessment models to differentiate the risks of some borrowers compared to China's banking industry. The credit risk migration path displays a leapfrog characteristic, meaning that a relatively high proportion of loans are transferred directly from the normal category to the doubtful or loss category, lacking a sufficiently long early warning interval for overdue payments. This difference is closely related to the completeness of the credit information infrastructure in the two countries: China's banking industry relies on multi-dimensional data sources and technologies such as federated learning to build a relatively continuous risk monitoring chain, while Kazakhstan's banking industry still has significant room for improvement in data sharing mechanisms and credit score model iteration. Banks in Kazakhstan often lag behind the generation of risk signals in the timing of loan loss provision recognition, resulting in a higher suddenness of non-performing loan identification, which further reinforces the leapfrog characteristic of their risk migration path.

3.3 Cross-Country Assessment of Liquidity Coverage Ratio and Funding Stability

As a key indicator for measuring short-term solvency, the liquidity coverage ratio exhibits structural differentiation in the context of digital transformation in China's banking industry. Digital channels accelerate the turnover rate of retail deposits, and the convenience of mobile banking enables customers to transfer funds more frequently among different financial institutions. The traditionally stable core retail deposits may display volatility characteristics similar to wholesale funding at specific points in time. To cope with this change, some banks maintain the compliance level of the liquidity coverage ratio by optimizing the composition of high-quality liquid assets and setting transfer limits on digital channels, and the dependence of funding stability on the deposit insurance system increases. Digital transformation also promotes the adjustment of the structure of high-quality liquid assets in China's banking industry, and the holding proportion of government bonds and policy financial bonds rises to hedge against the potential pressure of instantaneous retail deposit outflows in the digital environment^[6].

Kazakhstan's banking industry exhibits a relatively large overall fluctuation range in the liquidity coverage ratio, which is closely related to the penetration stage of digital channels. The popularization of mobile payments and instant transfer systems increases the turnover rate of deposits, but due to the limited depth of the domestic interbank market, banks have a relatively narrow range of asset realization channels when facing sudden liquidity needs. The mismatch risk between short-term funds and long-term funds is more easily amplified in the digital environment. A comparison of funding stability between the two countries reveals that China's banking industry, with its higher retail deposit base and more mature interbank market, has a stronger buffering capacity against liquidity fluctuations brought about by digitalization. Kazakhstan's banking industry, while maintaining a compliant liquidity coverage ratio, needs to address the potential instability hidden in the relative dependence of its funding structure on external funds and short-term wholesale financing. Among the high-quality liquid assets of Kazakhstan's banking industry, the market depth of local currency government securities is insufficient, and the accessibility of cross-border liquidity instruments is limited. As a result, it lacks sufficient buffer space in the face of deposit fluctuations driven by digitalization, and the intraday fluctuation range of the liquidity coverage ratio is significantly higher than that of China's banking industry.

Conclusion

This study reveals the nonlinear changes in financial performance and the heterogeneous reshaping paths of risk mechanisms in the banking industries of China and Kazakhstan under the differences in digital maturity. China's banking industry, in the stage of deep digital penetration, achieves an improvement in the cost-to-income ratio and enhanced continuity in credit risk monitoring, while it also faces the challenges of narrowing net interest margins and accelerating retail deposit turnover. Kazakhstan's banking industry maintains a relatively high level of net interest margin, but the insufficient thickness of credit data and the dependence on external funds constrain the simultaneous improvement of its risk resilience. Future research can extend to other transitional economies to test the cross-regional generalizability of digital effects, introduce refined indicators such as the depth of artificial intelligence application and the number of open banking interfaces to analyze the differential impacts of various technological components, and construct dynamic panel models to separate the short-term costs and long-term benefits of digital investment, thereby verifying the inflection point conditions of the input-output curve.

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