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Proskurnya Olena, Candidate of Technical Sciences, Associate Professor, Department of Business Economics and International Economic Relations, Proskurna.Olena@khpi.edu.ua, ORCID ID: 0000-0002-8367-0442,
National Technical University «Kharkiv Polytechnic Institute»
2, Kirpychova St., Kharkiv, Ukraine, 61002
Kodochigov Dmytro, postgraduate student of the Department of Management, Dmytro.Kodochygov@khpi.edu.ua, ORCID ID: 0000-0001-6660-7997
National Technical University «Kharkiv Polytechnic Institute»
2, Kirpychova St., Kharkiv, Ukraine, 61002
Synigovets Olha, Candidate of Technical Sciences, Associate Professor, Department of Business Economics and International Economic Relations, Olga.Synigovets@khpi.edu.ua, ORCID ID: 0000-0003-1623-5798
National Technical University «Kharkiv Polytechnic Institute»
2, Kirpychova St., Kharkiv, Ukraine, 61002
Zhong Lan, Master of Business Economics and International Economic Relations, 450926312@qq.com, ORCID ID: 0009-0007-4577-4375
National Technical University «Kharkiv Polytechnic Institute»
2, Kirpychova St., Kharkiv, Ukraine, 61002
Necheporenko Denys, Postgraduate student of the Department of Business Economics and International Economic Relations, nechepurka92@gmail.com, ORCID ID: 0009-0008-0550-3615
National Technical University «Kharkiv Polytechnic Institute»
2, Kirpychova St., Kharkiv, Ukraine, 61002

DETERMINING THE IMPACT OF ASSET SIZE DURING DIGITAL TRANSFORMATION ON THE ECONOMIC EFFICIENCY OF BANKS

Abstract. *This study examines how asset size influences the effectiveness of digital transformation initiatives in Chinese commercial banks. The object of research is the process of digital transformation and analysis of financial indicators of banks. Despite substantial investments in digital technologies across the banking sector, transformation outcomes exhibit significant heterogeneity, prompting investigation into institutional characteristics that moderate effectiveness. Using panel data from Chinese commercial banks categorized by asset size, this research employs fixed-effects regression models to analyze the relationship between digital transformation intensity and return on equity. Digital transformation is quantified through systematic textual analysis of annual reports, constructing a comprehensive index capturing transformation intensity. The empirical findings reveal that while digital transformation generally enhances banking performance, asset size significantly moderates this relationship. Large banks (assets exceeding 2 trillion yuan, equivalent to 280.808 billion US dollars) demonstrate a positive transformation coefficient of 2.038, medium banks (300 billion (42.121 billion US dollars) – 2 trillion yuan (280.808 billion US dollars)) exhibit an even stronger coefficient of 4.584, while small banks (below 300 billion yuan (42.121 billion US dollars)) show a negative coefficient of –0.122. These heterogeneous outcomes are attributable to resource-dependent implementation capabilities, with larger institutions benefiting from economies of scale, superior talent acquisition, and comprehensive implementation frameworks. This research contributes to strategic consistency theory, IT capability framework, and resource-based perspectives by identifying asset size as a critical*

moderator of transformation success, providing practical insights for banking executives and regulators regarding asset-appropriate digital strategies.
Keywords: *economics, finance, reform, innovation, digital transformation, commercial banks, coping strategy, asset size.*

Проскурня Олена Михайлівна, кандидат технічних наук, доцент, кафедри економіки бізнесу і міжнародних економічних відносин, Proskurna.Olena@khpi.edu.ua, ORCID ID: 0000-0002-8367-0442,
Національний технічний університет «Харківський політехнічний інститут» вул. Кирпичова, 2, Харків, Україна, 61002
Кодочигов Дмитро Олексійович, аспірант кафедри менеджменту, Dmytro.Kodochygov@khpi.edu.ua, ORCID ID: 0000-0001-6660-7997
Національний технічний університет «Харківський політехнічний інститут» вул. Кирпичова, 2, Харків, Україна, 61002
Синіговець Ольга Миколаївна, кандидат економічних наук, доцент кафедри економіки бізнесу і міжнародних економічних відносин, Olga.Synigovets@khpi.edu.ua, ORCID ID: 0000-0003-1623-5798
Національний технічний університет «Харківський політехнічний інститут» вул. Кирпичова, 2, Харків, Україна, 61002
Чжун Лань, магистр кафедри економіки бізнесу і міжнародних економічних відносин, 450926312@qq.com, ORCID ID: 0009-0007-4577-4375
Національний технічний університет «Харківський політехнічний інститут» вул. Кирпичова, 2, Харків, Україна, 61002
Нечепоренко Денис Анатолійович, аспірант кафедри економіки бізнесу і міжнародних економічних відносин, nechepurka92@gmail.com, ORCID ID: 0009-0008-0550-3615
Національний технічний університет «Харківський політехнічний інститут» вул. Кирпичова, 2, Харків, Україна, 61002

ВИЗНАЧЕННЯ ВПЛИВУ РОЗМІРУ АКТИВІВ ПІД ЧАС ЦИФРОВОЇ ТРАНСФОРМАЦІЇ НА ЕКОНОМІЧНУ ЕФЕКТИВНІСТЬ БАНКІВ

Анотація. *У цьому дослідженні розглядається вплив розміру активів на ефективність ініціатив з цифрової трансформації в китайських комерційних банках. Об'єктом дослідження є процес цифрової трансформації та аналіз фінансових показників банків.*
Незважаючи на значні інвестиції в цифрові технології в банківському секторі, результати трансформації демонструють значну неоднорідність, що спонукає до дослідження інституційних характеристик, які впливають на ефективність. Використовуючи відкриті дані китайських комерційних банків, класифікованих за розміром активів. У цьому дослідженні застосовуються регресійні моделі з фіксованими ефектами для аналізу взаємозв'язку між інтенсивністю цифрової трансформації та рентабельністю власного капіталу. Цифрова трансформація кількісно оцінюється за допомогою систематичного текстового аналізу річних звітів, що дозволяє скласти комплексний індекс, який відображає інтенсивність трансформації. Емпіричні результати показують, що, хоча цифрова трансформація загалом покращує результати діяльності банків, розмір активів значно впливає на цей взаємозв'язок. Великі банки (активи понад 2 трлн юанів, що еквівалентно 280,808 млрд доларів США) демонструють позитивний коефіцієнт трансформації 2,038, середні банки (300 млрд (42,121 млрд доларів США) – 2 трлн юанів (280,808 млрд доларів США)) демонструють ще сильніший коефіцієнт 4,584, тоді як малі бан-

ки (менше 300 млрд юанів (що відповідає менше 42,121 млрд доларів США)) демонструють негативний коефіцієнт – 0,122. Ці неоднорідні результати можна пояснити залежністю можливостей впровадження від ресурсів, оскільки більші установи мають переваги від ефекту масштабу, залучення кращих фахівців та комплексних систем впровадження. Це дослідження сприяє розвитку теорії стратегічної узгодженості, системи ІТ-можливостей та ресурсно-орієнтованих підходів, визначаючи розмір активів як критичний фактор успіху трансформації та надаючи практичні рекомендації керівникам банків та регуляторним органам щодо цифрових стратегій, що відповідають розміру активів.
Ключові слова: *економіка, фінанси, реформа, інновація, цифрова трансформація, комерційні банки, стратегія подолання, розмір активів.*

Introduction. Digital transformation, as an advanced form of the evolution of the information age, its profound meaning goes far beyond the simple technical category, but also creates a sharp contrast with the essential characteristics of the information age [1].

This process is not limited to innovation at the technical level, but also a comprehensive transformation that covers multiple dimensions such as corporate strategy, cultural philosophy, organizational structure, infrastructure and operating model. Through the introduction and integration of advanced information technologies, digital transformation aims to significantly improve the operational efficiency and competitiveness of enterprises in the market, thereby allowing them to better adapt to the wave of the digital economy and lead it. In this transformation process, enterprises need to abandon the traditional way of thinking, actively use innovation and deeply integrate information technology into every link of business development. This can not only promote systematic changes in enterprises, but also enable them to achieve sustainable development in the face of fierce market competition [2]. Therefore, digital transformation is not only the embodiment of technological progress, but also an important driving force for the strategic transformation and modernization of enterprises.

Analysis of the situation. The practice of digital transformation is an important element for deepening and improving the concept of enterprise development. By integrating advanced digital technologies into daily operations and management, companies can significantly improve business efficiency and stand out from the fierce market competition. This practice has not only brought impressive results for the short-term development of the enterprise, but also laid a solid foundation for its long-term stable growth. Digital transformation is not only about improving efficiency or reducing costs, its far-

reaching significance is to lead enterprises in the era of the digital economy, seize opportunities, respond to challenges, and create a brighter future [3]. Through digital transformation, companies can better understand market needs, optimize products and services, and improve customer experience to remain invincible in the digital economy and achieve sustainable development.

Analysis of basic research and literature. Today, financial technology has opened up new opportunities for development and shown good prospects for development. Domestic commercial banks have consistently implemented digital transformation programs to enhance the innovation and creativity of enterprises through the use of advanced digital technologies, and have developed and designed a variety of innovative products and services to meet the differentiated and personalized needs of consumers [4]. In terms of resource capital, large state-owned banks undoubtedly have more significant competitive advantages than other types of financial institutions such as joint-stock banks and city commercial banks. This advantage is reflected not only in the scale of capital, brand influence, but also in risk prevention and control, customer service and technological innovation, as well as other aspects, laying a solid foundation for the digital transformation of the bank [5]. A particularly understudied aspect of this field is the role of asset size in determining the effectiveness of digital transformation initiatives. Theoretical perspectives, including the enterprise resource perspective and IT capability theory, suggest that resource availability is a critical factor in technology adoption. Given that asset size fundamentally influences a bank's resource allocation capabilities, technology infrastructure, and talent acquisition potential, it makes sense that transformation outcomes may exhibit systematic differences across asset size categories [6]. For banks with relatively open organizational structures or open to new thinking, digital transformation is not a far-fetched dream. By actively embracing change and proactively exploring the application of new technologies and new models, these banks can well achieve rapid digital transformation in a short period of time [7]. It should be noted that joint-stock banks have certain advantages in digital transformation. Compared with state-owned commercial banks, joint-stock commercial banks have obvious advantages in autonomous performance [8]. But joint-stock commercial banks are

limited by their own scale of development and distribution of core resources and cannot demonstrate a strong sense of digital transformation [9]. Regional banks that are distributed across different regions can also be considered. However, they are not as good as joint-stock and state-owned banks in terms of distribution of professional human resources and technical level [10]. The authors of the article [11] point out that digital strategy indicates the direction of transformation, digital capabilities provide the driving force of transformation, and digital operation plans are a specific way to achieve transformation goals. In addition, it is also important to determine the size of assets, because the difference in the size of assets will lead to some heterogeneity in the degree and relationship of impact on the operational activities of commercial banks after digital transformation [12]. An important factor in change and transformation is the collaboration between banks and IT companies to increase the penetration of financial technologies and the development of highly qualified specialists [13]. Nevertheless, empirical studies examining this relationship remain remarkably rare, which creates a significant gap in our understanding of the dynamics of digital transformation in the financial sector.

Purpose of the work. The purpose of this study is to empirically investigate the relationship between the intensity of digital transformation and financial performance indicators in commercial banks with different asset sizes. The object of the study is the process of digital transformation and the analysis of financial indicators of banks. The subject of the study is the relationship between asset size and economic efficiency of banks in the context of digital transformation. The significance of this study extends to both theoretical and practical aspects. From a theoretical point of view, it contributes to the enrichment of the literature on digital transformation by introducing asset size as a critical modifying variable, thereby increasing the explanatory power of existing models. The results of the study serve to clarify our understanding of the theory of strategic alignment, the view of IT capabilities and resource perspectives in the specific context of financial institutions. Based on this, the main objectives of the study are: to quantify the efforts of commercial banks in digital transformation using a comprehensive system of indices; to investigate the relationship between digital transformation and operational efficiency; to analyze how this relationship depends on the size of institutional assets; to

determine the strategic implications for optimizing transformation in different categories of bank**s.**

Presentation of the main research material. This study uses a comprehensive methodological framework to examine the relationship between the intensity of digital transformation and the financial performance of commercial banks with different asset sizes. The sampling process was systematically structured to ensure representativeness across a wide range of Chinese banking institutions, resulting in the inclusion of thirty-seven commercial banks with different ownership structures and business scales: six large state-owned commercial banks (Agricultural Bank of China, China Construction Bank, ICBC, Bank of Communications, Bank of China, and Postal Savings Bank); eight joint-stock banking institutions (Everbright, CITIC, Minsheng, Huaxia, China Merchants, Industrial, Zheshang, and Shenzhen Development); fifteen urban commercial banks (distributed across major urban centers, including Nanjing, Beijing, Ningbo, Chongqing, Shanghai, Chengdu, Xi'an, Hangzhou, Guiyang, Xiamen, Zhengzhou, Jiangsu, Suzhou, Qingdao, and Changsha); eight rural commercial banking institutions (Qingrural Commercial Bank, Zhangjiagang Bank, Zijin Rural Commercial Bank, Wuxi Rural Commercial Bank, Chongqing Rural Commercial Bank, Suzhou Rural Commercial Bank, Jiangyin Bank, and Changsha Bank). The stratification of the sample facilitates a nuanced comparative analysis of the transformation effectiveness in different institutional categories, thereby enhancing the generalizability and contextual relevance of the study results. The empirical study uses open-ended data with unbalanced characteristics, which requires the use of appropriate econometric methods to ensure statistical consistency, despite the structural asymmetry in the data set. The data collection methodology includes several additional sources to ensure completeness and accuracy of information. The selection and construction of variables were carried out systematically to ensure interpretability of the results. The dependent variable used in this study is return on equity (ROE), which is "the result of the ratio of net income to average net assets", as stated in the methodological framework. This financial indicator serves as a comprehensive indicator of the efficiency of banking activities, reflecting the profitability of the institution relative to shareholders' investments. The choice of ROE as the primary

performance measure is consistent with the established banking literature, which recognizes its importance in determining operating efficiency and financial sustainability. The methodology for calculating ROE follows standardized accounting principles, ensuring inter-institutional comparability and temporal consistency. Correlation analysis reveals significant relationships between several control variables and the dependent variable (ROE) [14], with GDP growth rates, debt-to-asset ratio, equity multiplier, loan loss provision ratio, capital adequacy ratio, and non-performing loan provision ratio all demonstrating statistical significance at the 1 % level.

A basic regression model was used to examine the direct relationship between digital transformation and return on equity, including several control variables to mitigate potential side effects. The basic regression equation is structured as follows:

$$ROEit = \alpha + \beta_1 InCountit + \beta_2 GDPgroit + \beta_3 Levit + \beta_4 CARit + \\ + \beta_5 ProvCovit + \beta_6 EMit + \beta_7 LoanResevit + \mu_i + \varepsilon it,$$

де *ROEit* – is the return on equity for institution i for period t;

InCountit – is the digital transformation intensity index obtained through text analysis, and the following terms represent the control variables:

GDPgroit is the GDP growth rate;

GDPgroit – is the GDP growth rate;

Levit – is the debt-to-asset ratio;

CARit – is the capital adequacy ratio;

ProvCovit – provision coverage for non-performing loans;

EMit – equity multiplier;

LoanResevit – loan loss reserve adequacy ratio. The μ_i indicator captures the institution-specific unobserved heterogeneity that remains constant over time, while εit represents an idiosyncratic error term that varies across institutions and time periods.

The robustness testing methodology includes alternative specifications to confirm the stability and reliability of the primary findings. The basic approach involves replacing the dependent variable with an alternative performance measure – return on assets (ROA) – while maintaining identical specifications for the independent, moderating,

and control variables. This replacement allows us to assess whether the observed relationship between digital transformation and performance remains consistent across performance measures.

A comprehensive robustness testing methodology ensures that the results are not artifacts of specific analytical solutions, but rather reflect robust empirical relationships that hold across different methodological approaches.

Table 1 presents comprehensive summary statistics for all variables included in the analytical framework, which covers 234 observations in banking institutions.

Return on equity (ROE), which serves as the main dependent variable, exhibits significant variability with a mean value of 15.645 % and a standard deviation of 5.445 %. The distribution parameters indicate significant heterogeneity in institutional profitability with minimum and maximum values of 2.956 % and 32.729 %, respectively.

It is noteworthy that observations with ROE values below 5 % mainly correspond to the financial period, which is explained by the “outbreak of the corona epidemic, which caused a more or less decrease in the revenues of the financial industry.” The Digital Transformation Intensity Index (InCount), built using a complex analysis of annual reports, shows more limited variability with a mean value of 7.076 and a standard deviation of 0.418.

Table 1 – Descriptive statistics of variables

Indicator	Obs	Mean	Std.Dev	Min	Max
ROE	234	15.645	5.445	2.956	32.729
InCount	234	7.076	0.418	5.649	7.955
GDPgro	234	0.075	0.027	0.024	0.149
Lev	234	97.923	1.554	91.655	102.617
CAR	234	13.503	2.480	2.415	25.326
ProvCov	234	251.160	103.352	34.829	687.120
EM	234	17.105	5.480	8.394	46.263
LoanResev	234	511.245	267.960	77.417	2181

Notes: The table provides summary statistics for all variables in the analysis based on 234 observations of banking institutions. ROE is return on equity, InCount is the digital transformation index, GDPgro is the GDP growth rate, Lev is the debt-to-asset ratio, CAR is the capital adequacy ratio, ProvCov is the coverage of non-performing loans by provisions, EM is the equity multiplier, and LoanResev is the loan loss provision ratio.

Source: Compiled by the authors based on static data using AI

The relatively small standard deviation "varies relatively little, implying that there is no obvious difference in the degree and impact of digital transformation across commercial banks." However, this apparent homogeneity becomes more nuanced when looking at different asset categories, with large-asset institutions showing a mean InCount of 7.359, medium-asset institutions showing a mean of 6.927, and small-asset institutions showing a mean of 6.813. Thus, the larger the scale, the greater the impact of transformation. The GDP growth rate shows a mean of 0.075 with a standard deviation of 0.027, reflecting macroeconomic conditions over the observation period. The debt-to-asset ratio shows a mean of 97.923 % with a standard deviation of 1.554 %, indicating a relatively high level of leverage across the banking sector with moderate inter-institutional variability. The capital adequacy ratio shows a mean of 13.503 % with a standard deviation of 2.480 %, reflecting general compliance with regulatory requirements, while showing moderate heterogeneity across institutions. The non-performing loan provisioning ratio shows significant variability with a mean of 251.160 % and a standard deviation of 103.352 %, indicating different approaches to risk provisioning in the banking sector. The equity multiplier shows a mean of 17.105 with a standard deviation of 5.480, reflecting the heterogeneous capital structure in the sample institutions. Finally, the loan loss provision adequacy ratio shows a mean of 511.245 % with a significant standard deviation of 267.960 %, indicating different approaches to the formation of loan loss provisions relative to provisions for payments. The correlation analysis presented in Table 2 reveals significant relationships between several variables, which provides a preliminary idea of potential causal relationships.

The correlation between digital transformation (InCount) and return on equity (ROE) shows a positive but statistically insignificant coefficient of 0.088, indicating a potentially nuanced relationship that requires more sophisticated analytical methods to detect. GDP growth rates show a strong positive correlation of 0.698, indicating that "GDP growth rates are an important variable in the model," as stated in the analytical framework.

Table 2 – Correlation analysis of results

Variable	ROE	InCount	GDPgro	Lev	CAR	ProvCov	EM	Loan

								Resev
ROE	1	–	–	–	–	–	–	–
InCount	0.088	1	–	–	–	–	–	–
GDPgro	0.698***	– 0.029	1	–	–	–	–	–
Lev	0.462***	– 0.0810	0.436***	1	–	–	–	–
CAR	– 0.246***	0.098	– 0.321***	– 0.764***	1	–	–	–
ProvCov	0.311***	– 0.0962	– 0.151**	– 0.0813	0.245***	1	–	–
EM	0.269***	– 0.112	0.446***	0.846***	– 0.728***	– 0.235***	1	–
Loan Resev	0.049	– 0.039	– 0.312***	– 0.121	0.188***	0.873***	– 0.328***	1

*Note: *, *, *** indicate significance at the 10%, 5% and 1% significance levels respectively.*
Source: Compiled by the authors based on static data using AI

The debt-to-asset ratio shows a positive correlation of 0.462, indicating that higher leverage is potentially associated with increased profitability in the banking sector. The capital adequacy ratio shows a negative correlation of -0.246, indicating a potential trade-off between regulatory compliance and short-term profitability. The provision coverage ratio of non-performing loans exhibits a positive correlation of 0.311, indicating that stronger provisioning practices are associated with higher profitability, potentially reflecting the quality of institutions in risk management. The equity multiplier exhibits a positive correlation of 0.269, indicating a positive impact of financial leverage on institutional profitability. It is noteworthy that the correlation analysis reveals significant relationships between several control variables, which requires careful econometric specification to reduce potential multicollinearity problems. GDP growth rates (Table 2) exhibit significant correlations with several variables, including positive relationships with the debt-to-asset ratio (0.436) and the equity multiplier (0.446), as well as negative relationships with the capital adequacy ratio (–0.321) and the loan loss provision ratio (–0.312).

Similarly, the debt-to-asset ratio exhibits a strong correlation with the capital adequacy ratio (–0.764) and the equity multiplier (0.846), while the non-performing loan provisioning ratio exhibits significant correlations with the capital adequacy ratio (0.245), the equity multiplier (–0.235) and the loan loss provisioning ratio (0.873). These relationships highlight the complex financial dynamics in the banking sector and un-

derscore the importance of comprehensive analytical approaches that take into account the multifaceted relationships of variables.

Basic regression analysis using a fixed effects estimation methodology reveals significant empirical evidence on the relationship between the intensity of digital transformation and banking performance indicators. Table 3 presents the comprehensive regression results, where the digital transformation coefficient (InCount) demonstrates a statistically significant positive value of 3.110, significant at the 5 % level (t-statistic: 2.49). This finding provides robust empirical support for hypothesis H1, confirming that "digital transformation can improve banks' operational performance," as postulated in the theoretical framework. The magnitude of this coefficient indicates that a one-unit increase in the digital transformation index corresponds to a 3.110 percentage point increase in return on equity, indicating significant economic significance beyond a simple statistical relationship. The coefficient of determination (R^2) for the baseline model is 0.796, indicating that these variables together explain approximately 79.6 % of the variance in return on equity across observations, indicating significant explanatory power and adequacy of the model.

Table 3 – Results of the basic regression

Indicator	Coefficient	*t-statistic*	*p-value*
InCount	3.110**	2.49	0.013
GDPgro	143.4***	5.28	0.000
Lev	0.707	0.70	0.484
CAR	– 0.216	– 0.42	0.675
ProvCov	0.0326**	2.66	0.008
EM	– 0.0917	– 0.22	0.826
LoanResev	0.00624	– 1.56	0.120
_cons	– 82.97	– 0.98	0.328
N	234	–	–
R^2	0.796	–	–

*Notes: *, *, *** indicate significance at the 10%, 5% and 1% significance levels respectively. The dependent variable is return on equity (ROE). The fixed effects model was selected based on the F-test value of 18.345 (p-value: 0.000) and the Hausman chi-square value of 12.788 (p-value: 0.047).*

Source: compiled by the authors based on static data using AI

GDP growth rate demonstrates the most significant impact on banking performance with a high coefficient of 143.4 (t-statistic: 5.28, significant at the 1 % level). This finding is consistent with theoretical expectations regarding the impact of macroe-

conomic conditions on banking profitability and confirms that “GDP growth rate is an important variable in the model”. Debt-to-asset ratio (coefficient: 0.707), capital adequacy ratio (coefficient: –0.216), equity multiplier (coefficient: –0.0917) and loan loss provision ratio (coefficient: 0.00624) – demonstrate statistically insignificant relationships with return on equity in the basic specification. The heterogeneous relationship between digital transformation and banking performance across asset classes is a central dimension of this study. Stratified regression analyses conducted on asset-based subsamples provide nuanced empirical evidence on the moderating effect of institutional scale on transformation performance, supporting theoretical propositions about resource-dependent digital profitability. Analysis of the large-asset subsample, which includes 85 observations from institutions with total assets exceeding RMB 2 trillion, demonstrates a statistically significant positive relationship between digital transformation intensity and return on equity. As shown in Table 2, the regression coefficient for InCount shows a t-statistic value of 2.49, p-value of 0.013. This finding indicates that “the digital transformation strategy (InCount) implemented by commercial banks can positively impact operational efficiency and maintain the trend of return on assets.” The coefficient of determination (R^2) for this subsample shows an extremely high value of 0.962, indicating that these variables explain approximately 96.2 % of the variance in return on equity for large-asset institutions. The non-performing loan coverage ratio shows a highly significant positive relationship with a coefficient of 0.0204 (t-statistic: 3.55, p-value: 0.004), while the equity multiplier shows a significant positive relationship with a coefficient of 0.816 (t-statistic 3.41, p-value: 0.005). Together, these results suggest that institutions with large assets derive substantial efficiency benefits from digital transformation initiatives, which can potentially be explained by their enhanced resource capabilities, technological sophistication, and implementation capabilities. Analysis of the medium-asset subsample, which includes 97 observations of institutions with total assets ranging from RMB 300 billion to RMB 2 trillion, reveals an even stronger positive relationship between digital transformation and efficiency measures. As shown in Table 1, the regression coefficient for InCount exhibits a value of 4.584, which is significant at the 10 % level (t-statistic: 1.92, p-value: 0.077). Analysis of the small-

asset subsample, which includes 40 observations of institutions with total assets of less than 300 billion yuan, reveals a strikingly different relationship between digital transformation and performance indicators

As shown in Table 4, the regression coefficient for InCount exhibits a negative value of -0.122, although it is not statistically significant (t-statistic: -0.09, p-value: 0.925).

This finding indicates that "commercial banks' digital transformation is negatively correlated with operational efficiency" for institutions with small assets, suggesting a potential negative impact of transformation initiatives on financial performance for this category.

Table 4 – Results of the fixed effects regression model for commercial banks with small assets.

Indicator	Commercial banks with small assets. (*ROE*)		
	Coefficient	t-statistic	p-value
1	2	3	4
nCount	–0.122	–0.09	0.925
GDPgro	126.718	6.98	0
Lev	1.412	2.83	0.005
CAR	0.179	0.86	0.392
ProvCov	0.006	0.52	0.006
EM	–0.319	–2.74	0.005
LoanResev	0.001	0.41	0.68
cons	–127.021	–2.65	0.008
N	40		–
R^2	0.820		–

*Note: *, **, *** indicate significance at the 10%, 5% and 1% significance levels respectively.*
Source: Compiled by the authors based on static data using AI

The coefficient of determination (R^2) for this subsample shows a value of 0.820, indicating that these variables explain approximately 82.0 % of the variance in return on equity for institutions with small assets, indicating significant model adequacy, despite the insignificant coefficient of digital transformation. Among the control variables, GDP growth rate shows a significant positive effect with a coefficient of 126.718 (t-statistic: 6.98, significant at the 1 % level), while debt-to-asset ratio shows a significant positive association with a coefficient of 1.412 (t-statistic: 2.83, p-value: 0.005). Equity multiplier shows a significant negative association with a coefficient of -0.319 (t-

statistic: -2.74, p-value: 0.005), which contrasts with the positive associations observed in larger institutions. These results suggest that institutions with small assets potentially face difficulties in reaping the benefits of digital transformation initiatives, which may be due to resource constraints, implementation difficulties, or disproportionate costs relative to the scale of the institution.

A comparative analysis of the subsamples by asset size reveals significant heterogeneity in the relationship between digital transformation and bank performance, providing robust empirical support for hypothesis H2 regarding the moderating effect of asset size on transformation performance. The regression coefficients for digital transformation gradually change from 2.038 for institutions with large assets to 4.584 for institutions with medium assets and –0.122 for banks with small assets, revealing a nonlinear relationship between asset size and transformation benefits. This pattern is consistent with theoretical expectations for resource-dependent digital profitability, with regression analysis demonstrating that "the impact of digital transformation on efficiency depends on the size of assets." Positive and significant coefficients for institutions with large and medium assets confirm that "large banks can significantly improve their efficiency through digital transformation," while the negative coefficient for institutions with small assets suggests that "digital transformation of small banks is negatively correlated with operational efficiency, with a correlation coefficient of 0.820 and a regression coefficient of -0.122." The heterogeneous nature of these findings suggests that "if small banks invest too much in digital transformation, this may affect other enterprises and lead to a decrease in efficiency. These empirical results support the theoretical assumption that asset size fundamentally moderates the relationship between digital transformation and performance outcomes, with institutional resources potentially determining the effectiveness of transformation initiatives." The comparative analysis also reveals differences in the relationships between control variables and performance measures across asset classes, suggesting different operational dynamics across institutional scales. The debt-to-asset ratio exhibits a negative relationship with performance for institutions with large assets (–0.863) but a positive relationship for institutions with small assets (1.412), potentially indicating different optimal leverage structures across

institutional scales. Similarly, the equity multiplier exhibits a positive relationship with efficiency for institutions with large and medium assets (0.816 and 1.528, respectively), but a negative relationship for institutions with small assets (–0.319), suggesting potentially different capital structure dynamics across institutional categories.

These divergent patterns highlight the importance of asset-based analytical approaches when studying banking operations, as institutional scale can potentially mitigate numerous financial relationships that go beyond the effectiveness of digital transformation.

Empirical evidence consistently indicates a positive relationship between digital transformation and performance, moderated by the size of institutional assets, with institutions with large and medium assets benefiting significantly, while institutions with small assets potentially facing challenges in transformation performance. These results provide a solid empirical basis for further theoretical interpretation and practical recommendations on optimal digital transformation strategies in different banking contexts.

When studying banking institutions, one should focus on five main areas of digitalization implementation, namely:

– the functioning of the customer management platform;

– the development of an environmentally friendly comprehensive business expansion platform;

– the expansion of the financial supply chain business, the implementation of solutions for optimizing accounts;

– the integration of different investment and financial businesses.

Through a multi-format joint development strategy, it is necessary to implement and promote various advanced technologies and lay a solid foundation for the digital construction and development of the bank's corporate business. It is also necessary to modernize the existing business of pocket financial applications, establish long-term trade relations with partners through platform support and upgrades, and program supply chains. Through high-quality services for customers, the transformation of the structure of the real sector of the economy is the basis for the digital economy.

It should also be noted that the era of the digital economy highlights the importance of scientific and technological talents, which are crucial for digital transformation. To promote the digital strategy, it is necessary to actively build a technical team, attract and retain talents by raising salaries, and expand the size of the team. It is necessary to cooperate with domestic colleges and universities to attract potential talents and provide personnel and stimulate the talent development strategy.

Conclusions. During the study, we applied empirical methods, collected, systematized and analyzed a large amount of data. We concluded that return on equity (ROE), which is the main dependent variable, exhibits significant variability with a mean value of 15.645% and a standard deviation of 5.445%. The relationship between digital transformation and operational efficiency was investigated. Basic regression analysis using a fixed effects estimation methodology reveals significant empirical evidence on the relationship between the intensity of digital transformation and banking performance indicators.

In our opinion, the following suggestions can be made:

– Increase the penetration of financial technologies and develop highly qualified talents. Banks should establish long-term cooperative relationships with Internet companies to increase the penetration of financial technology, pay attention to the development of internal research and development, and attract and develop sophisticated talents.

– Create differentiated innovative products and services. Banks should have a deep understanding of customer needs, develop targeted products and services, and also pay attention to the development and expansion of domestic and foreign investment and financial channels to meet customer needs for consulting services.

– Combine digital transformation with the coordinated development of corporate and interbank business, as well as the adjustment and upgrading of business structure.

– Implement advanced customer management plans. Banks should classify customers according to their differences, use big data technology to understand customer needs, and develop differentiated products and services suitable for different customers.

– In the process of transformation, banks should not only pay attention to innovation and the application of technology, but also comprehensively consider and properly

address a number of related challenges and problems.

Economic, regulatory and technological changes in China will significantly affect the effectiveness of banks' digital transformation, so the results may be contextually limited. We see prospects for further research in expanding the geographical coverage. We plan to conduct a similar analysis for banks in other countries, in particular in Ukraine, to clarify the universality or specificity of the identified patterns**.**

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