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Bank Profitability in a Concentrated, Bank-Dominated Financial System: Evidence from Mongolia

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Abstract

This study examines the determinants of profitability in Mongolian commercial banks using return on assets (ROA) and return on equity (ROE) as the primary performance measures. The analysis incorporates both internal bank-specific factors including bank size, deposit ratio, capital adequacy, the loan-to-asset ratio, and operational efficiency (cost-to-income ratio), and external variables, including GDP growth, inflation, and market concentration. Using unbalanced panel data from nine commercial banks over the period 2014-2025, the study employs Pooled Ordinary Least Squares, Fixed Effects, and Random Effects models, with model selection guided by the Hausman test. The results indicate that bank size and capital adequacy exert positive and statistically significant effects on profitability, while a higher cost-to-income ratio, indicating lower operational efficiency, is associated with significantly lower ROA and ROE. The loan-to-asset ratio positively influences ROA but has no significant effect on ROE, suggesting that banks allocating a larger share of assets to lending earn higher returns on assets. Robustness checks, including system GMM estimation of a dynamic model, confirm the negative effect of the cost-to-income ratio on both measures and the positive effect of capital adequacy on ROA; the capital adequacy effect on ROE is weaker and sensitive to specification, and the effects of bank size and the loan-to-asset ratio are not significant in the dynamic model. Among external factors, inflation is positively associated with ROE, whereas GDP growth and market concentration are statistically insignificant. These findings suggest that bank profitability in Mongolia is driven primarily by internal management factors, highlighting the importance of efficient asset management, capital optimization, and cost control. The study contributes novel, context-specific evidence to the limited literature on bank profitability in Mongolia and offers relevant implications for bank managers and policymakers in resource-dependent and bank-dominated financial systems.

Keywords: Banks, Profitability, Mongolia, ROA, ROE

1. Introduction

A commercial bank's fundamental objective is to achieve sustainable profitability while effectively managing financial risks. As the core intermediary within the financial system, the banking sector mobilizes savings and allocates capital to productive investments, thereby supporting economic growth and financial stability. This role is particularly critical in developing economies, where banks dominate financial intermediation. However, banks in such economies are inherently more exposed to macroeconomic volatility and structural constraints, necessitating strong resilience to both internal and external shocks.

Mongolia is a landlocked country with limited access to global trade and a small, open economy that relies mainly on mining. Fluctuations in global prices for coal, copper, and gold substantially impact its economy. This reliance introduces risks to the banking sector, as changes in bank-specific factors and broader macroeconomic conditions such as deposits, loans, GDP, and inflation can influence profitability.

Like many countries, Mongolia faced notable economic disruptions due to COVID-19, including a decline in GDP, market instability, and higher unemployment. The country also struggled with liquidity shortages, a surge in bankruptcies, and declining household incomes, all of which affected loan repayment capacity (Mendizabal Joffre & Luvsandorj, 2020). Recently, the banking sector in Mongolia has undergone quick changes, propelled by the pandemic, geopolitical tensions, climate change, technological advancements, regulatory reforms, and digital innovations.

The Government and the Bank of Mongolia (BoM) have taken various steps to reduce the pandemic's impact on the financial system and to stabilize the economy. These measures include cutting interest rates, providing tax and social insurance discounts to aid businesses and households, supplying liquidity to commercial banks through low-interest loans, initiating a loan relief program for the majority of companies and households, extending debt repayment deadlines, and offering state-backed loans to businesses.

The BoM issued a strategic policy document outlining reforms for the banking sector from 2020 to 2023 (Bank of Mongolia, 2020). The reforms focus on five key areas: first, improving the legal framework to reduce ownership concentration, strengthen governance, and establish a transparent, publicly supervised banking system; second, enhancing supervision and regulatory tools in alignment with international standards; third, expanding the partnership with international funding organizations; fourth, strengthening systems to fight money laundering and terrorist financing; and fifth, diversifying requirements and licensing to promote digital, customer-friendly banking services.

Under goal 1, five systemically important commercial banks successfully conducted initial public offerings during 2022-2023, and these banks are now listed on the Mongolian Stock Exchange (MSE). For goal 2, the BoM introduced new prudential standards aligned with Basel norms and adopted IFRS 9 in banking operations, ensuring compliance. Under goal 4, legal and regulatory reforms have strengthened measures against money laundering and terrorist financing, and under goal 5, the requirements and licensing procedures for new banks have been tightened. Additionally, the Mongolian Government recognized the information and communication technology sector as a key economic pillar and launched the "Digital Nation" initiative in 2020. The BoM and commercial banks have promoted digital banking, lowered digital transaction fees, and expanded internet banking access. These efforts have advanced digital product development in banking and initiated the adoption of artificial intelligence (Mongolian Bankers Association, 2025).

The BoM and the Financial Regulatory Commission of Mongolia provide a report on the banking sector's financial stability, assessing risk measures such as credit risk, liquidity, profitability, market risk, and capital adequacy using quantitative data and prudential ratios (Bank of Mongolia & Financial Regulatory Commission of Mongolia, 2024).

In 2023, Mongolia's banking sector accounted for 91% of the entire financial sector, decreasing from 96% in 2011 (World Bank, 2024). This reduction is due to recent growth in the securities market and Non-Banking Financial Institutions (NBFIs) (Appendix A, Figure 1).

The COVID-19 pandemic altered the financial behaviors and beliefs of households and companies, leading to increased stock market activity (Fox & Bartholomae, 2020; Yannelis & Amato, 2023). In Mongolia, five commercial banks launched their initial public offerings on the MSE during 2022-2023, leading to a notable expansion of the financial market. The growth rate of NBFIs' assets peaked in 2022, driven by bonds and fintech products. In addition to COVID-19, the surge in fintech products and digitalization further accelerated NBFIs' growth (Mongolian Bankers Association, 2025). Although banks' role has diminished over the past decade, they remain a central component of Mongolia's financial system.

The financial statements of 9 Mongolian commercial banks were analyzed (see Appendix A, Figure 2). Despite the COVID-19 pandemic, these banks' total assets grew gradually, even as many other indicators declined. Since 2020, the cost-to-income ratio has declined, indicating improved operational efficiency, probably owing to cost cuts during lockdowns and higher net interest income. Deposit levels peaked during the pandemic and then declined. The loan-to-asset and loan-to-deposit ratios fell to their lowest levels in 2020, reflecting a contraction in lending relative to the balance sheet as banks accumulated liquid assets amid central bank liquidity support and heightened credit risk. Both ratios recovered within two years, indicating a resumption of credit growth as policy support took effect. Non-performing loans increased during the pandemic and for two subsequent years, then gradually declined. By 2024, the banking sector had stabilized somewhat, which is consistent with the effectiveness of government and BoM policy measures.

Profitable banks are better positioned to build capital buffers, absorb adverse shocks, sustain credit provision, and support long-term economic growth. Empirical evidence consistently shows that weak bank profitability is associated with higher risk-taking, reduced lending capacity, and increased vulnerability to financial crises, particularly in developing and bank-based economies (Bernardelli et al., 2024; Lamothe et al., 2024).

A substantial body of empirical literature demonstrates that profitability plays a crucial role in enhancing banking sector resilience. Studies find that more profitable banks tend to maintain stronger capital adequacy, lower non-performing loan ratios, and greater operational efficiency, which collectively contribute to financial stability (Abdou & Alarabi, 2024; Doğan & Yildiz, 2023). Moreover, profitability influences banks' ability to intermediate savings into productive investment, thereby strengthening monetary policy transmission and supporting macroeconomic performance, especially in economies where financial markets are shallow and heavily bank-dependent.

The effective operation of the financial system and a clear understanding of the determinants of commercial bank profitability are essential for maintaining financial stability, expanding financial intermediation, and fostering sustainable economic growth (Athanasoglou et al., 2008). In addition to preparing for global and domestic economic and financial risks, commercial banks can implement internal strategies to mitigate risks and enhance profitability while preserving financial stability (Bikker & Vervliet, 2018). Core practices such as robust risk management, cost efficiency, and continuous monitoring of financial performance indicators play a crucial role in sustaining bank profitability (Pasiouras & Kosmidou, 2007). Achieving sustainable, long-term profitability strengthens banks' resilience to internal and external shocks and contributes to the overall soundness of the banking system (Brei et al., 2020). Consequently, identifying the factors influencing bank profitability remains a central concern for policymakers, researchers, and banking practitioners seeking to ensure banking system stability and long-term economic development (Demirgüç-Kunt et al., 2021).

This study aims to identify the main factors affecting the profitability of Mongolian commercial banks by examining both internal determinants, such as financial ratios, and external factors, including

GDP growth, inflation, and the concentration ratio, and their effects on return on assets (ROA) and return on equity (ROE). In doing so, the study provides policy and managerial implications for regulators and commercial bank managers in Mongolia, a resource-rich economy whose institutional and structural characteristics distinguish it from the settings examined in much of the existing literature. The novelty of this study lies in providing the first Mongolia-specific empirical evidence on bank profitability since Bilguun (2011), covering the period of post-2020 banking reforms, the initial public offerings of systemically important banks, and the COVID-19 shock in a highly concentrated and resource-dependent economy.

An unbalanced panel data method is used to analyze financial statement data from nine commercial banks from 2014 to 2025. The study applies Pooled Ordinary Least Squares (Pooled OLS), Fixed Effects (FE), and Random Effects (RE) models to assess the effects of these variables.

The remainder of the article is organized as follows. Section 2 reviews the existing literature on bank profitability and develops the research hypotheses. Section 3 describes the data and methodology. Section 4 presents the data analysis, empirical results, and robustness checks. Section 5 discusses empirical findings in relation to existing literature. Section 6 concludes with a summary of the main findings and outlines the study's limitations.

2. Literature Review

Given the significance of the banking system and the many factors influencing it, research on bank profitability and performance has expanded rapidly. In a bibliometric analysis of 1,308 Web of Science documents, Alam et al. (2021) show that publications in this field are increasing, with efficiency measurement and corporate governance among the dominant themes, and that Data Envelopment Analysis (DEA) and the Generalized Method of Moments (GMM) are the most frequently employed methods. Similarly, Rastogi et al. (2022), in a scientometric review of the Scopus database, find that 61% of articles on risk, regulation, and bank profitability were published between 2015 and 2020, indicating a rising demand for high-quality research in this area.

Many studies worldwide have explored both external and internal factors influencing bank profitability. Internal factors are those managed through the bank's internal policies and decisions, enabling the bank to adapt and control them in response to changing circumstances. External factors are the industry-specific and macroeconomic indicators that affect the bank's profitability. This internal and external framework builds on the seminal cross-country study of Demirgüç-Kunt and Huizinga (1999) and on subsequent work by Athanasoglou et al. (2008) and Dietrich and Wanzenried (2011), which distinguish bank-specific, industry-specific, and macroeconomic determinants of profitability.

Jigeer and Koroleva (2023) examined factors influencing the profitability of city commercial banks in China by employing panel data regression techniques of Pooled OLS, fixed effects, and random effects on an unbalanced dataset from 2008 to 2020. Their findings indicate that deposits, loan loss provisions, and GDP positively and significantly impact bank profitability. Conversely, variables such as bank size, non-performing loans, operating ratio, and inflation notably decrease profitability. Additionally, capital adequacy shows a positive relationship with ROA but a negative one with ROE.

Akther et al. (2023) investigated how bank-specific and macroeconomic factors influence the return on assets for 24 commercial banks listed on the Dhaka Stock Exchange in Bangladesh. The study analyzed panel data from 2014 to 2020 using Pooled OLS, FE, and RE models. It found that the number of bank branches, asset management, and asset quality had significant impacts, alongside inflation and exchange rates. However, capital adequacy and deposits showed statistically insignificant effects.

Khan (2022) examined the internal and external factors influencing banks' return on assets (ROA) and return on equity (ROE) within the Gulf Cooperation Council (GCC) countries. The study analyzed data from 59 banks across the GCC from 2011 to 2017. It utilized pooled OLS, fixed effects (FE), and random

effects (RE) models. The results show that bank size (BS) has a positive and significant impact on both ROA and ROE. Additionally, GDP positively influences ROA, while asset management positively affects ROE. Conversely, factors such as capital adequacy, financial risk measures, operating efficiency, and asset quality negatively affect ROE.

Doğan and Yildiz (2023) explored how internal and external factors affect bank profitability, using data from 23 Turkish banks spanning 2007 to 2020. They applied Dynamic GMM and FE models in their analysis. The study included an industry-specific metric, intensity, which represents the share of assets held by the top five banks. They tested model variations using only internal variables and combining both internal and external variables, analyzing all data together and separately by bank ownership type. The findings indicated that capital adequacy, asset size, GDP, inflation, intensity, and the lagged ROA and ROE (1-year and 2-year) had positive and significant impacts, while operating expenses negatively influenced return on assets and return on equity.

Abdou and Alarabi (2024) examined the factors influencing banking profitability, focusing on return on assets and return on equity among Egyptian banks. They used the Generalized Least Squares (GLS) method to analyze data from 15 private banks over 2013-2022. The research revealed that both internal factors, such as capital adequacy and bank size, and external factors, such as economic growth and inflation, exhibit strong positive correlations with ROA and ROE. Conversely, non-performing loans, liquidity issues, and credit risk negatively impact profitability in Egyptian private commercial banks. Interestingly, the development of the banking sector and industry concentration does not significantly affect Egyptian banks.

Bortoluzzo et al. (2024) investigated factors influencing banking profitability with a quantile panel-data regression model using Orbis data. The dataset included 1200 institutions across 101 countries from 2011 to 2018. They utilized Quantile Regression to identify profitability determinants. When measuring profitability with ROE, they found that bank size and capital adequacy significantly negatively impact profitability, while inflation is significantly different for banks with higher profits.

Sufian and Habibullah (2009) analyzed 37 commercial banks in Bangladesh from 1997 to 2004. Their findings indicate that loan intensity, credit risk, and cost are positively and significantly linked to return on assets, return on equity, and net interest margins. Conversely, non-interest income is negatively related to bank profitability. The impact of bank size on profitability is mixed. Additionally, macroeconomic indicators generally do not significantly affect bank profitability, except for inflation, which negatively correlates with it.

Al-Homaidi et al. (2018) explored the factors influencing the profitability of Indian banks. They assessed profitability using metrics like return on assets, return on equity, and net interest margin. The independent variables included bank size, asset quality, capital adequacy, liquidity, operating efficiency, deposits, leverage, asset management, the number of branches, GDP, inflation rate, interest rate, and exchange rate. The researchers applied Pooled OLS, FE, RE, and GMM models using a decade's worth of data from 60 commercial banks. Their findings indicated that, for NIM, all bank-specific factors—except the number of branches—had significant effects, and all macroeconomic variables showed significant but negative impacts. Additionally, ROA, bank size, the number of branches, asset management ratio, and leverage ratio emerged as strong predictors of profitability.

Bilguun (2011) investigated the factors affecting the profitability of commercial banks in Mongolia. The study covered the period from 2004 to 2010 and used data from the balance sheets of 15 banks. As a proxy for profitability, it chose return on assets, and three groups of variables were used as independent variables: micro factors including total assets, loan loss provisions, and non-performing loan ratios; liquidity; non-interest income; operational efficiency; and capital adequacy; macro factors such as GDP and inflation; and industry-specific factors like the concentration ratio and Herfindahl-Hirschman Index (HHI). The author employed FE and RE models to evaluate the variables. The results show that bank size and profitability have no significant relationship; non-performing loans and operational efficiency have a

significant negative effect; and, for non-interest income, capital adequacy, and GDP, there are positive associations with ROA. Other variables do not significantly affect profitability. The study concludes that banks should strengthen their credit risk management and improve internal control systems to enhance profitability.

Internal factors encompass management decisions and the banks' internal policies. The behaviour of bank management in response to changing circumstances impacts the bank's overall performance. Recent studies highlight the most discussed internal factors, including bank size, capital adequacy, deposit ratios, liquidity, and operational efficiency. External influences primarily include GDP growth rate and inflation, while the concentration ratio represents market concentration and competitiveness.

This literature review explores how dependent and independent variables are addressed across three groups: bank-specific, macroeconomic, and industry-specific to establish the foundation for the research hypothesis.

Dependent variables: Profitability measures

Previous research frequently uses return on assets (ROA), return on equity (ROE), and net interest margin (NIM) as key indicators of banking profitability. ROA represents the ratio of a bank's end-of-year net profit to its total assets, calculated by dividing net income by total assets. ROE indicates the returns to equity holders from banking operations and is calculated by dividing net income by total equity. In this study, ROA and ROE are primarily used as metrics for measuring profitability.

Independent variables

Bank-specific factors

Bank size

Bank size, gauged by total assets, is a crucial determinant of profitability, as larger banks can better manage their assets and typically earn higher profits (Bashir et al., 2021). Earlier research by Abdou and Alarabi (2024), Doğan and Yildiz (2023), and Khan (2022) indicates a positive relationship between bank size and profitability in Egypt, Turkey, and the GCC. However, Huber (2021) observed that bigger banks do not always generate higher profits. The findings of Jigeer and Koroleva (2023) and Sufian and Habibullah (2009) are mixed: a positive correlation with ROA but a negative one with ROE. Additionally, Akther et al. (2023) highlight that the number of branches can negatively influence bank profitability in Bangladesh. Bank size is measured as the natural logarithm of total assets, with the assumption that larger asset sizes favor bank profitability (Hypothesis 1).

Deposits

Deposits are the primary source of bank funding and influence bank profits. They are assessed using the deposit-to-asset ratio, which indicates the proportion of assets held as deposits. The theoretical relationship between the bank deposit ratio and profitability is not unidirectional. A higher deposit ratio supports stable loan funding and typically enhances profitability by lowering funding costs and improving stability. However, this effect may be weakened or even reversed by competitive pressures, regulatory constraints, and risk management considerations. In particular, a sudden and large-scale withdrawal of deposits can strain banks' liquidity management, increase operating and funding costs, and heighten liquidity risk, thereby adversely affecting profitability. Consequently, empirical studies often find mixed results, underscoring the need to control for bank-specific, market, and macroeconomic factors. The literature shows mixed findings regarding the effect of deposits on bank profitability. Studies by Jigeer and Koroleva (2023) on Chinese banks, Banke and Yitayaw (2022) on Ethiopian banks, and Apau and Sibindi (2023) on Ghanaian banks demonstrate a positive link between deposits and profitability. Conversely, Al-Harbi (2019) found a negative association in OIC countries, whereas Akther et al. (2023)

observed no effect in Bangladesh. Based on these theoretical insights and empirical results, we hypothesize that the deposit ratio will positively influence banks' profitability (Hypothesis 2).

Capital adequacy

Capital adequacy is the amount of capital a bank must hold as a percentage of its risk-weighted assets, as set by the Basel accords of the Bank for International Settlements (BIS) (Jigeer & Koroleva, 2023). The most common measure is the capital adequacy ratio, which guarantees banks' solvency and reduces the risk of bankruptcy. In this study, the ratio of total equity to total assets is used to assess capital adequacy, a widely employed standard proxy in existing literature; however, some studies prefer the ratio of total capital to risk-weighted assets (Abusharbeh, 2025). The ratio of total equity to total assets is employed because it ensures broad comparability across banks and consistent availability over the sample period. Research by Doğan and Yildiz (2023) and Abdou and Alarabi (2024) shows a positive relationship between the capital adequacy ratio and ROA and ROE. On the other hand, Obiedallah and Abdelaziz (2024) found that the ratio negatively affects profitability in Egyptian banks. Additionally, Akther et al. (2023), examining Bangladesh, found no significant effect of capital adequacy on ROA. Some studies indicate a positive connection with ROA but a negative one with ROE (Jigeer & Koroleva, 2023). Khan (2022) and Bortoluzzo et al. (2024) identified a clear negative impact on ROE. Overall, based on empirical evidence and theory, we propose that the capital adequacy ratio positively affects profitability (Hypothesis 3).

Loan-to-asset ratio

Liquidity refers to a bank's ability to meet its short-term obligations and deposit withdrawals without incurring unacceptable losses. The literature measures liquidity in two broad ways. Direct measures, such as the ratio of liquid assets to total assets (Bougatef, 2017) or of liquid assets to short-term liabilities (Jigeer & Koroleva, 2023), increase as a bank becomes more liquid. Inverse measures, most commonly the loan-to-asset ratio (Apau & Sibindi, 2023; Doğan & Yildiz, 2023), capture the share of assets tied up in loans, which are the least liquid but highest-yielding asset class. Following these studies, we use the ratio of loans to total assets, the loan-to-asset ratio (LTA), which measures lending intensity and is an inverse indicator of liquidity: a higher value indicates greater loan intensity and lower liquidity. Theory suggests a trade-off between liquidity and profitability: holding liquid assets reduces liquidity risk but sacrifices the higher interest income earned on loans. A higher loan-to-asset ratio is therefore expected to raise interest income and profitability, at the cost of greater liquidity and credit risk. Consistent with this view, Sufian and Habibullah (2009) find that loan intensity is positively and significantly related to ROA, ROE, and net interest margin in Bangladesh, and Bilal et al. (2024) show that the relationship between liquidity risk and bank performance varies across financial systems, with higher liquidity risk associated with better performance in bank-based countries. However, the evidence is not uniform. Bougatef (2017), using a direct liquidity measure, reports a positive relationship between liquidity and profitability in Tunisia, implying that more liquid banks earn more, whereas Apau and Sibindi (2023), using the loan-to-asset ratio, find no significant effect for Ghanaian banks. Al-Homaidi et al. (2018) find that liquidity significantly affects the net interest margin of Indian banks. Given that Mongolia's financial system is heavily bank-based and that loans are the main source of bank income, we hypothesize that the loan-to-asset ratio positively affects profitability (Hypothesis 4).

Operational efficiency

Banking profit is derived from income minus expenses, making it dependent on the performance of banking operations and management efficiency. Operational efficiency is typically assessed by the ratio of operating expenses to operating income (Lotto, 2019). Several studies examine the efficiency ratio of operating expenses relative to total assets (Doğan & Yildiz, 2023). A lower efficiency ratio indicates more effective management, implying that the bank uses its resources more profitably and maintains better control over operational costs, leading to higher profits. In this study, we evaluate operational efficiency as the ratio of operating expenses to operating income, as we believe this comparison offers a

clearer insight into management's ability to generate profits efficiently. Past research shows that higher operational efficiency positively influences banking profitability (Bernardelli et al., 2024). Aderogba et al. (2025) analyzed BRICS economies and found that capital management, risk-taking, and efficiency are key factors. Lamothe et al. (2024), examining both global and regional banks, concluded that efficiency significantly impacts profitability. Because EFF is a cost-to-income ratio, higher values indicate lower efficiency; we therefore hypothesize that the cost-to-income ratio (EFF) has a negative effect on banking profitability (Hypothesis 5).

Macroeconomic and industry-specific factors: GDP, Inflation, and Concentration ratio

Macroeconomic factors are expected to influence banks' performance. To examine how macroeconomic indicators impact banks' profitability, several studies analyze the annual GDP growth rate and inflation rate (Al-Homaidi et al., 2018). The GDP growth rate reflects overall economic activity, while the inflation rate reflects changes in the general price level. These variables are presumed to influence the supply and demand for capital by affecting bank loans and deposits. Koroleva et al. (2021) examined the factors affecting the profitability of state-owned banks in China from 2007 to 2019 and found that GDP negatively affects their profitability. Similarly, Apau and Sibindi (2023) studied banks in Ghana and observed a significant negative relationship between GDP and profitability.

Inflation affects bank profitability mainly through interest rates and operating costs. As discussed by Athanasoglou et al. (2008), the effect depends on whether inflation is anticipated: when banks correctly anticipate inflation, they can adjust lending rates faster than deposit rates, widening interest margins and raising profits; when inflation is unanticipated, banks may be slow to reprice, and costs such as wages and rents may rise faster than revenues. The empirical evidence is therefore mixed. Sufian and Habibullah (2009) find that inflation has a negative but insignificant effect on banks' profitability, and Mirović et al. (2024) find that GDP growth is positively correlated with the profitability of Eurozone commercial banks, whereas inflation is negatively correlated. In contrast, Doğan and Yildiz (2023) find that both the inflation rate and GDP growth are positively and significantly related to ROA and ROE in Turkey. Based on these findings, we hypothesize that GDP growth positively influences banks' profitability, whereas inflation negatively affects it (Hypotheses 6 and 7).

According to the structure-conduct-performance theory, there is a positive relationship between concentration and profitability. However, the efficient-structure hypothesis posits that when efficiency is highest, the firm will possess a large market share, which, in turn, leads to higher market concentration; thus, higher concentration does not necessarily associate with higher profitability. Empirical studies such as Karadžić & Đalović (2021) and Al-Harbi (2019) have shown that the concentration ratio positively influences bank profitability, though Yao et al. (2018) and Al-Homaidi et al. (2018) reported a negative correlation. Abdou & Alarabi (2024) found no significant effect of the concentration ratio on ROA or ROE. Meanwhile, Doojav & Purevdorj (2024) examined how macro-financial shocks affect bank liquidity creation in Mongolia and identified competition as a key factor in liquidity creation. We hypothesize a positive link between the concentration ratio and bank profitability (Hypothesis 8).

3. Data and Methodology

This empirical study investigates the impact of internal and external factors on bank profitability. ROA and ROE serve as dependent variables, representing bank profitability, while independent variables are categorized into three groups based on their source. Internal factors include financial ratios derived from commercial banks' financial statements, such as bank size, capital adequacy, deposit ratio, the loan-to-asset ratio, and operational efficiency. External variables include macroeconomic indicators such as the annual GDP growth rate and the inflation rate (measured by changes in the CPI). Additionally, the industry-specific external factor examined is the concentration ratio.

In 2025, Mongolia had 12 commercial banks, but only 9 were analyzed due to data constraints. The missing data was addressed by selecting banks with the most complete information available on their websites, as reflected in their financial statements (see Appendix B for links). Table 1 lists the commercial banks and the time periods included in this study.

Based on the available data, the banks included in the empirical analysis account for, on average, more than 93% of aggregate banking sector assets over the full sample period, with coverage exceeding 98% during the most recent five years. This extensive coverage ensures a broad representation of Mongolia's banking system and captures the dominant dynamics of sector-wide activity. Accordingly, banks omitted from the analysis due to data unavailability constitute a relatively small fraction of the overall sector and exert negligible influence on research outcomes. Hence, their exclusion is unlikely to introduce significant bias in our estimated empirical results.

Table 1. List of commercial banks and covered time periods

	Name of the bank	Start	End	Number of years
1	Khan Bank	2014	2025	12
2	Trade and Development Bank of Mongolia	2015	2025	11
3	Golomt Bank	2014	2025	12
4	XacBank	2014	2025	12
5	State Bank	2014	2025	12
6	Capitron Bank	2014	2025	12
7	Trans Bank	2020	2025	6
8	Bogd Bank	2016	2025	10
9	M Bank	2022	2025	4
10	Arig Bank	-	-	no data
11	Chinggis Khaan Bank	-	-	no data
12	National Investment Bank	-	-	no data
	Total number of observations			91

Source: Authors' compilation

9 banks have available data, which limits the selection of variables based on the number of observations, considering their relevance and prior research. The GDP annual growth rate and annual inflation rate are sourced from the National Statistical Office of Mongolia's database (https://www.1212.mn/en). The concentration ratio is calculated from aggregate data from the BoM database (https://stat.mongolbank.mn) and the disclosed financial statements of individual banks. Table 2 outlines all variables, their descriptions, and the hypotheses previously discussed in this article.

Table 2. The variables and the hypothesis

	Variables	Notations	Measurements	Hypothesis
Dependent variables	Return on Asset	**ROA**	Net Profit/ Total Assets	
	Return on Equity	**ROE**	Net Profit/ Total Equity	
Independent variables	Bank Size	**BS**	Natural Logarithm of Assets	H(1) +
	Deposit Ratio	**DEP**	Total Deposits/ Total Assets	H(2) +
	Capital Adequacy	**CAD**	Total Equity/ Total Assets	H(3) +
	Loan-to-asset ratio	**LTA**	Total Loans/ Total Assets	H(4) +
	Operational Efficiency	**EFF**	Operating Expense/ Operating Income	H(5) -

Gross Domestic Product	**GDP**	Annual GDP Growth Rate	H(6) +
Inflation	**INF**	Annual Change in Consumer Price Index	H(7) -
Concentration Ratio	**CR**	Total Bank Assets of TOP 3/ Aggregate Total Bank Assets	H(8) +

Source: Authors' compilation

The panel data and chosen variables are utilized to define the linear regression equations for ROA and ROE in models 1 and 2. In model 1, ROA or ROE are influenced by both internal and external variables, whereas in model 2, only internal variables are included.

Model 1:

$$ROA_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 DEP_{it} + \beta_3 CAD_{it} + \beta_4 LTA_{it} + \beta_5 EFF_{it} + \beta_6 GDP_{it} + \beta_7 INF_{it} + \beta_8 CR_{it} + \varepsilon_{it} \quad (1)$$

$$ROE_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 DEP_{it} + \beta_3 CAD_{it} + \beta_4 LTA_{it} + \beta_5 EFF_{it} + \beta_6 GDP_{it} + \beta_7 INF_{it} + \beta_8 CR_{it} + \varepsilon_{it} \quad (2)$$

Model 2:

$$ROA_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 DEP_{it} + \beta_3 CAD_{it} + \beta_4 LTA_{it} + \beta_5 EFF_{it} + \varepsilon_{it} \quad (3)$$

$$ROE_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 DEP_{it} + \beta_3 CAD_{it} + \beta_4 LTA_{it} + \beta_5 EFF_{it} + \varepsilon_{it} \quad (4)$$

where the dependent variable ROA_{it} is the return on assets, and ROE_{it} is the return on equity of the bank i on time period t; β_0 denotes an intercept, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$ are coefficients of independent variables, and ε_{it} is an error term. i ($i = 1, 2, \ldots, 9$) indicates each bank, and t ($t = 2014, 2015, \ldots, 2025$) for time or year in the models.

Panel data analysis can capture both common and individual behaviors within groups, enabling it to measure statistical effects that neither time-series nor cross-sectional data can detect. The most frequently used methods are Pooled OLS, FE, and RE, which we applied to analyze factors influencing bank profitability in Mongolia. Pooled OLS treats the entire dataset as a single entity and ignores individual differences (unobserved heterogeneity), assuming constant intercepts and slopes across time and units. While Pooled OLS is efficient and straightforward in the absence of individual effects, it can yield biased results when such effects are present. The FE method allows intercepts to vary across banks, capturing time-invariant unobserved heterogeneity while keeping slope coefficients constant. Because GDP growth, inflation, and the concentration ratio are common to all banks in a given year, we use one-way (cross-section) fixed effects; period fixed effects would absorb these variables. The RE model treats individual-specific effects as random variables (Baltagi, 2021). Considering the diverse operational environments and management practices of Mongolian banks, the assumption of unobserved heterogeneity is reasonable, making FE or RE models more suitable than Pooled OLS. When unobserved heterogeneity correlates with independent variables, fixed effects are preferred; if it is uncorrelated with the explanatory variables, the RE model is more efficient. These models' appropriateness can be tested statistically using the F (Fisher) test, Breusch-Pagan Lagrange Multiplier test, and Hausman test.

4. Data Analysis and Empirical Findings

The dataset comprises 91 observations from nine commercial banks over the 2014-2025 period. Owing to missing observations for certain banks and years, the panel is unbalanced. Descriptive statistics

summarize the distribution of the variables, including the mean, median, minimum, maximum, and standard deviation. As reported in Table 3, the sample exhibits an average return on assets (ROA) of 0.0129 (1.29%) with a standard deviation of 0.0124, and an average return on equity (ROE) of 0.1117 (11.17%) with a standard deviation of 0.0876. There are several years in which banks recorded losses, as reflected in the minimum values of ROA and ROE. These negative performance outcomes are primarily attributable to bank-specific factors rather than systemic conditions. In particular, the losses are associated with the early operational phase of M Bank following its establishment in 2022, the exclusion of major shareholders, and management adjustments at Golomt Bank in 2017, and bank-specific managerial and operational challenges faced by Capitron Bank during 2014-2015. The average bank size, measured as the natural logarithm of total assets, is 14.8375, with a range of 11.0269 to 16.9912 and a standard deviation of 1.3352. Total deposits are defined as the sum of demand, savings, and time deposits held by customers. On average, deposits account for 56.67% of total assets, indicating that banks primarily rely on deposit funding. The remaining funding consists of equity and non-deposit liabilities, such as domestic and foreign borrowings. The deposit-to-asset ratio ranges from 18.01% to 77.74% across banks and years. Capital adequacy averages 0.1246 with a standard deviation of 0.0713, ranging from 0.0646 to 0.4005. The loan-to-asset ratio (LTA) averages 0.4769 with a standard deviation of 0.0970, indicating that loans account for slightly less than half of bank assets, with the remainder held in liquid assets, securities, and other assets. LTA ranges from 0.0986 to 0.6338; the minimum value corresponds to Bogd Bank in 2016. Although operational efficiency largely depends on the capabilities of the managerial team, profit is maximized when income exceeds expenses as much as possible. Therefore, the share of operational expenses in operational income should be kept as low as possible. EFF has an average value of 0.5827, indicating that banks, on average, spend 58.27% of their operational income on operational expenses. The highest EFF value is 1.3996, meaning the bank spent 39.96% more than its operational income and incurred a loss. The lowest EFF value corresponds to the most profitable bank, with the largest gap between operational income and expenses, spending only 15.31% of its income on operational expenses.

Regarding external variables, the average annual GDP growth rate over the sample period is 4.3%, peaking at 8.1% in 2014 and contracting to -4.4% in 2020 during the COVID-19 shock. The mean inflation rate is 7.6%, ranging from a low of 0.7% in 2016 to a post-pandemic peak of 15.2% in 2022, reflecting elevated price pressures. The concentration ratio defined as the asset share of the three largest banks averaged 70.8%, ranging from 64.6% in 2014 to 75.7% in 2021.

Bank size exhibits the highest standard deviation (1.3352), reflecting considerable variation among banks. The historical trends of each bank's variables are summarized in Figure 3 in Appendix A. During the COVID-19 period, the deposit ratio reached its peak, while the cost-to-income ratio (EFF) decreased, indicating improved efficiency. The loan-to-asset ratio (LTA) fell to its lowest level in 2020 as lending contracted relative to total assets, implying that banks held more liquid balance sheets during the pandemic. Since then, both ROA and ROE have generally shown an upward trend.

Table 3. Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROA	0.0129	0.0115	0.0397	-0.0416	0.0124	91
ROE	0.1117	0.1027	0.2961	-0.1441	0.0876	91
BS	14.8375	15.0632	16.9912	11.0269	1.3352	91
DEP	0.5667	0.5931	0.7774	0.1801	0.1278	91
CAD	0.1246	0.1015	0.4005	0.0646	0.0713	91
LTA	0.4769	0.4812	0.6338	0.0986	0.0970	91
EFF	0.5827	0.5538	1.3996	0.1531	0.1843	91
GDP	0.0429	0.0505	0.0810	-0.0440	0.0341	91
INF	0.0763	0.0730	0.1520	0.0070	0.0378	91

CR	0.7080	0.7104	0.7574	0.6463	0.0307	91

Source: Authors' calculation

Table 4 presents the correlation coefficients, their significance levels, and the results of the Variance Inflation Factor (VIF) analysis. The correlation analysis shows that bank size (BS) is positively correlated with ROA and ROE, whereas the cost-to-income ratio (EFF) is negatively correlated with both. Among internal variables, BS has the strongest positive correlation with both dependent variables. EFF exhibits the highest negative correlations at -0.61 and -0.58, respectively. Moreover, the correlation between CAD and BS is the strongest negative at -0.66, while DEP and BS have the strongest positive relationship at 0.49. LTA is only weakly correlated with ROA (0.09, insignificant) and ROE (0.18, significant only at the 10% level), suggesting that its effect emerges only after other bank characteristics are controlled for. LTA is also negatively correlated with CAD (-0.41), indicating that better-capitalized banks tend to hold a smaller share of their assets in loans.

Table 4. Results of correlation and Variance Inflation Factor (VIF) analysis

Variables	ROA	ROE	BS	DEP	CAD	LTA	EFF	GDP	INF	CR
ROA	1.00									
ROE	0.85***	1.00								
BS	0.22**	0.52***	1.00							
DEP	-0.03	0.14	0.49***	1.00						
CAD	0.13	-0.16	-0.66***	-0.58***	1.00					
LTA	0.09	0.18*	0.28***	0.21**	-0.41***	1.00				
EFF	-0.61***	-0.58***	-0.37***	-0.16	0.22**	-0.13	1.00			
GDP	0.08	0.18*	0.10	-0.06	-0.13	0.04	0.06	1.00		
INF	0.14	0.25**	0.08	-0.03	0.00	0.09	-0.10	0.52***	1.00	
CR	0.22**	0.15	0.10	0.11	0.20*	-0.14	-0.24**	-0.56***	0.04	1.00
VIF			2.20	1.68	2.73	1.28	1.24	2.75	1.84	2.36

Note: *, **, *** significant at 10%, 5%, 1% level respectively.

Source: Authors' calculation

All external factors show a positive correlation with the dependent variables. The concentration ratio (CR) shows the strongest negative correlation with the GDP growth rate at -0.56. Conversely, the annual GDP growth rate and INF are positively correlated at 0.52.

When two or more independent variables in a regression model are highly correlated, it can skew coefficient estimates and decrease model reliability. Variance inflation factor (VIF) analysis measures how much the variance of an estimated regression coefficient increases because of multicollinearity; a VIF value of 5 or higher signals serious multicollinearity among independent variables (Baltagi, 2021). Initially, we included variables such as loan loss provision (LLP), non-performing loan (NPL), net interest margin (NIM), and Herfindahl-Hirschman index in our dataset; however, some were excluded due to multicollinearity (between NPL, LLP, LTA, and CR, HHI). This is expected, as loan loss provisions and non-performing loans grow mechanically with the size of the loan portfolio, and the HHI and CR both measure market concentration. Variables are chosen based on VIF analysis results, and diagnostics show no serious multicollinearity in the final dataset (Table 4).

We developed two regression models for each of ROA and ROE, as described in the Data and Methodology section, using the dataset of Mongolian commercial banks. Model 1 incorporates five internal and three external variables, whereas Model 2 uses only five internal variables. The estimation methods employed include Pooled OLS, FE, and RE models.

As in Baltagi (2021), the presence of unobserved or individual-specific effects is tested to select appropriate estimation methods and ensure the model's validity and proper specification. F-tests or Redundant fixed effects-Likelihood Ratio tests determine whether a set of variables has a combined effect on the dependent variable and whether fixed effects significantly improve the model compared to Pooled OLS. For ROA, the cross-section F-statistics are 12.16 and 13.27 with p-values of 0.00 in models 1 and 2, respectively. For ROE, the statistics are 9.07 and 9.04, with p-values of 0.00, indicating that fixed effects improve estimation in all models. The Breusch-Pagan Lagrange Multiplier (omitted random effects) test assesses whether the variance of the bank-specific effects is zero; p-values below 0.05 in all four models indicate that panel effects are present and that Pooled OLS is inadequate. To choose between FE and RE, the Hausman test is used to test whether the random effects are correlated with the regressors. For ROA, the Chi-square statistics are 97.30 and 15.54 with p-values of 0.00 and 0.01, respectively, favoring the FE model. For ROE, the statistics are 72.55 and 6.18, with p-values of 0.00 and 0.29; the test does not reject the RE specification for ROE Model 2. We therefore treat FE as the preferred estimator for ROA Models 1 and 2 and ROE Model 1, and RE as the preferred estimator for ROE Model 2; the FE results for ROE Model 2 are reported for comparability and yield the same significance pattern and the same signs for all significant variables. Results from Pooled OLS, FE, and RE models are summarized in Tables 5 and 6.

To validate the estimation, we tested for heteroscedasticity, autocorrelation, and cross-sectional dependence in the error term. The likelihood ratio test for cross-section heteroscedasticity indicates heteroscedasticity only in ROA Model 1, and only at the 10% level (LR = 15.30, p = 0.054). The Durbin-Watson statistics of the fixed-effects models range from 1.33 to 1.61. Because the Durbin-Watson statistic is designed for time series, we also apply the Wooldridge (2010) test for serial correlation in panel data, which provides at most weak evidence of first-order autocorrelation (ROA: F = 3.48, p = 0.099; ROE: F = 2.80, p = 0.133). The Pesaran (2021) CD test does not detect cross-sectional dependence in the fixed-effects residuals of Model 1 (ROA: CD = 1.09, p = 0.276; ROE: CD = 1.58, p = 0.114), but it does for Model 2 (ROA: CD = 2.11, p = 0.035; ROE: CD = 2.84, p = 0.005). Given these mixed diagnostic results, the robustness checks below also report Driscoll and Kraay (1998) standard errors, which are robust to heteroscedasticity, serial correlation, and cross-sectional dependence.

The literature, including Baltagi (2021), advises using robust standard errors to correct for heteroscedasticity and ensure valid inference. If left uncorrected, heteroscedasticity biases the estimated standard errors, which can lead to misleading significance tests. Therefore, cross-section weights and White diagonal (heteroscedasticity-consistent) standard errors were used to enhance the reliability of hypothesis testing.

Table 5. Estimation results for ROA

Variables/		Model 1			Model 2	
Models	OLS	FE	RE	OLS	FE	RE
Internal factors						
BS	0.0038***	0.0068***	0.0021*	0.0044***	0.0076***	0.0052***
	(0.0009)	(0.0019)	(0.0013)	(0.0008)	(0.0012)	(0.0016)
DEP	0.0020	0.0004	0.0009	0.0013	-0.0009	0.0000
	(0.0080)	(0.0075)	(0.0094)	(0.0073)	(0.0073)	(0.0073)
CAD	0.1099***	0.0564**	0.0854***	0.1174***	0.0591**	0.0348
	(0.0222)	(0.0259)	(0.0305)	(0.0229)	(0.0230)	(0.0359)
LTA	0.0220***	0.0177**	0.0217**	0.0223***	0.0198**	0.0099
	(0.0081)	(0.0072)	(0.0092)	(0.0080)	(0.0080)	(0.0104)
EFF	-0.0236***	-0.0198***	-0.0406***	-0.0253***	-0.0208***	-0.0281***
	(0.0073)	(0.0049)	(0.0123)	(0.0065)	(0.0049)	(0.0072)
External factors						

GDP	0.0651* (0.0341)	0.0191 (0.0350)	0.1049** (0.0426)			
INF	0.0071 (0.0287)	0.0296 (0.0198)	-0.0376 (0.0456)			
CR	0.0430 (0.0359)	-0.0018 (0.0409)	0.0588 (0.0403)			
C	-0.0876*** (0.0275)	-0.0938*** (0.0211)	-0.0596 (0.0400)	-0.0635*** (0.0167)	-0.1039*** (0.0213)	-0.0570* (0.0310)
Adj R^2	0.5347	0.7895	0.4903	0.5415	0.7714	0.5040
F-statistic	13.9288	22.0942	11.8216	22.2583	24.3645	19.2937
Prob (F-Stat)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausman test chi-sq		97.2969			15.5445	
Hausman test prob		0.0000			0.0083	

Note: *, **, *** significant at 10%, 5%, 1% level respectively. The standard errors are in parentheses.

Source: Authors' estimation results

Adjusted R^2 values of 0.79 (Model 1) and 0.77 (Model 2) indicate a good fit, although part of the explanatory power of the FE models comes from the bank-specific intercepts. The F-statistics of 22.09 and 24.36 ($p < 0.001$) confirm that the regressors are jointly significant.

In Model 1 of the ROA analysis, which considers both internal and external factors, the coefficient of BS is positive (0.0068) and that of EFF is negative (-0.0198), and both are significant at the 1% level. Because BS is measured in logarithms, a 1% increase in total assets is associated with an increase in ROA of approximately 0.007 percentage points, while a 1 percentage point increase in the operating expense-to-income ratio is associated with a 0.0198 percentage point decrease in ROA. CAD and LTA have positive coefficients (0.0564 and 0.0177, respectively) that are significant at the 5% level. For LTA, a one-standard-deviation increase in the loan-to-asset ratio (about 10 percentage points) is associated with a 0.17 percentage point rise in ROA, roughly 13% of the sample mean ROA of 1.29%. DEP and the external variables have no significant impact on ROA. Overall, BS, CAD, LTA, and EFF are the key factors influencing bank profitability in this model.

In ROA Model 2, which considers only internal variables, BS shows a positive coefficient of 0.0076, while EFF shows a negative coefficient of -0.0208; both are statistically significant at the 1% level. Additionally, CAD and LTA have positive coefficients of 0.0591 and 0.0198, respectively and are significant at the 5% level. Overall, the findings are similar to those of ROA Model 1; BS, CAD, LTA, and EFF are the primary variables influencing banks' profitability as measured by ROA.

Based on the results of both models, bank size, capital adequacy, the loan-to-asset ratio, and operational efficiency are the main drivers of ROA. Because these variables are measured on different scales, their raw coefficients cannot be compared directly. Scaling each coefficient by the standard deviation of the corresponding variable (FE, Model 1) shows that bank size has the largest economic effect on ROA (about 0.91 percentage points per standard deviation), followed by capital adequacy (0.40), operational efficiency (-0.37), and the loan-to-asset ratio (0.17). While a higher loan share raises ROA, this gain comes with greater liquidity and credit risk; expanding lending should therefore remain within prudential liquidity requirements. DEP has no significant impact on ROA in either model. The annual GDP growth rate and inflation are positively related, whereas CR is negatively related to ROA in the FE model; all three estimates are insignificant, indicating that the inclusion of external variables has not altered the contribution of internal factors.

Table 6. Estimation results for ROE

Variables/ Models	Model 1 OLS	Model 1 FE	Model 1 RE	Model 2 OLS	Model 2 FE	Model 2 RE
Internal factors						
BS	0.0369*** (0.0079)	0.0603*** (0.0178)	0.0342*** (0.0080)	0.0404*** (0.0079)	0.0692*** (0.0116)	0.0632*** (0.0117)
DEP	0.0216 (0.0671)	-0.0467 (0.0516)	0.0051 (0.0696)	-0.0213 (0.0618)	-0.0465 (0.0496)	-0.0876 (0.0600)
CAD	0.4137*** (0.1427)	0.2514* (0.1431)	0.4228*** (0.1483)	0.3765*** (0.1350)	0.2914** (0.1193)	0.3235** (0.1299)
LTA	0.0547 (0.0571)	-0.0066 (0.0575)	0.1023* (0.0590)	0.0662 (0.0617)	0.0096 (0.0543)	0.0330 (0.0564)
EFF	-0.2062*** (0.0441)	-0.1391*** (0.0328)	-0.2102*** (0.0438)	-0.2059*** (0.0398)	-0.1323*** (0.0328)	-0.1441*** (0.0355)
External factors						
GDP	0.3479 (0.3009)	0.0273 (0.2901)	0.5253* (0.3118)			
INF	0.2088 (0.2327)	0.4083** (0.1579)	0.1024 (0.2385)			
CR	-0.0113 (0.3175)	-0.1169 (0.3409)	0.1422 (0.3272)			
C	-0.4231* (0.2486)	-0.6540*** (0.1827)	-0.5087** (0.2571)	-0.4266*** (0.1367)	-0.8521*** (0.1877)	-0.7508*** (0.1914)
Adj R^2	0.5219	0.7845	0.5100	0.5310	0.7481	0.5329
F-statistic	13.2807	21.4750	12.7097	21.3834	21.5594	21.5318
Prob (F-Stat)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausman test chi-sq		72.5459			6.1753	
Hausman test prob		0.0000			0.2895	

Note: *, **, *** significant at 10%, 5%, 1% level respectively. The standard errors are in parentheses.

Source: Authors' estimation results

In ROE models, the adjusted R-squared values are 0.78 and 0.75, indicating a good fit. The coefficients are larger in absolute value than in the ROA models, reflecting the larger scale of ROE rather than stronger effects.

BS, CAD, and EFF have significant coefficients in both models, suggesting that they all affect banking profitability (ROE). Notably, the coefficient of BS is positive, and EFF's is negative, and both are significant at the 1% level across both models, whereas CAD shows a positive effect that is significant at the 10% level in Model 1 and at the 5% level in Model 2.

External variables reveal that INF significantly and positively impacts ROE, while the effects of GDP (positive) and CR (negative) are statistically insignificant.

In Model 2, bank size (BS) and capital adequacy (CAD) exhibit positive coefficients that are statistically significant at the 1% and 5% levels, respectively, indicating their important roles in enhancing bank profitability. In contrast, the cost-to-income ratio (EFF) continues to exert a negative and statistically significant effect at the 1% level. A comparison of the estimation results from Models 1 and 2 reveals that

they are largely consistent, except for the significance of inflation (INF). This suggests that including external variables in Model 1 does not materially alter the relationship between internal bank-specific factors and ROE.

Robustness checks

To assess the sensitivity of the baseline results, we re-estimate Model 1 for ROA and ROE under five alternative specifications (Table 7). Column (1) re-estimates the fixed-effects model without cross-section weights. Column (2) retains the baseline estimates but reports Driscoll and Kraay (1998) standard errors, which are robust to heteroscedasticity, serial correlation, and cross-sectional dependence (Newey-West lag length of 2). Column (3) adds a COVID-19 dummy equal to one in 2020 and 2021. Column (4) replaces the internal variables with their one-year lags to mitigate reverse causality, which reduces the sample to 82 observations. Column (5) excludes eight bank-year observations associated with start-up operations, bank-specific distress, or extreme values: M Bank in 2022-2025 (all of its observations), Capitron Bank in 2014-2015, Golomt Bank in 2017, and Bogd Bank in 2016.

For ROA, the effect of the cost-to-income ratio is robust: EFF remains negative and significant at the 1% level in every column. BS remains positive and significant in four of the five checks (at the 10% level without cross-section weights and at the 5% level or better elsewhere) but loses significance when lagged values are used. Capital adequacy remains positive and significant in four of the five checks, including the lagged specification, which reduces the concern that the CAD effect is driven solely by reverse causality; however, it is significant only at the 10% level with the COVID-19 dummy and loses significance when the cross-section weights are removed. The positive effect of the loan-to-asset ratio (LTA) on ROA is significant with Driscoll-Kraay standard errors, with the COVID-19 dummy, after excluding outliers, and, at the 10% level, when lagged values are used, but not in the unweighted model. The COVID-19 dummy is negative and significant (-0.0068, $p < 0.01$), indicating that ROA was about 0.7 percentage points lower in 2020-2021, other things being equal. Inflation is positive and significant for ROA in columns (2), (4), and (5), suggesting that its insignificance in the baseline model partly reflects imprecise estimation.

For ROE, BS and EFF retain their signs and statistical significance at the 1% level in all five specifications, whereas LTA remains insignificant throughout. CAD remains positive in every column but is less robust than in the ROA models: it is significant at the 10% level in the baseline and at the 5% level or better without weights, with Driscoll-Kraay standard errors, and with lagged regressors, but it is insignificant with the COVID-19 dummy and after excluding outliers. Inflation is positive and significant in all columns, while GDP growth and the concentration ratio remain insignificant, and the COVID-19 dummy is negative but insignificant. Overall, the positive effect of bank size and the negative effect of the cost-to-income ratio are robust; the positive effect of capital adequacy is robust for ROA but weaker for ROE, and the effect of the loan-to-asset ratio on ROA holds in most, but not all, specifications.

Table 7. Robustness checks for Model 1 (fixed effects)

Variables	Baseline FE	(1) No weights	(2) Driscoll-Kraay SE	(3) COVID dummy	(4) Lagged regressors	(5) Excl. outliers
Panel A. Dependent variable: ROA						
BS	0.0068***	0.0049*	0.0068***	0.0049**	0.0033	0.0065***
	(0.0019)	(0.0027)	(0.0013)	(0.0020)	(0.0021)	(0.0020)
DEP	0.0004	0.0015	0.0004	0.0000	0.0060	-0.0023
	(0.0075)	(0.0078)	(0.0049)	(0.0075)	(0.0081)	(0.0076)
CAD	0.0564**	0.0169	0.0564***	0.0470*	0.0327**	0.0889***
	(0.0259)	(0.0362)	(0.0203)	(0.0251)	(0.0162)	(0.0212)
LTA	0.0177**	0.0100	0.0177***	0.0234***	0.0112*	0.0227***
	(0.0072)	(0.0093)	(0.0058)	(0.0073)	(0.0062)	(0.0078)
EFF	-0.0198***	-0.0240***	-0.0198***	-0.0202***	-0.0182***	-0.0163***
	(0.0049)	(0.0062)	(0.0068)	(0.0049)	(0.0043)	(0.0057)
GDP	0.0191	0.0482	0.0191	0.0017	0.0340	0.0147
	(0.0350)	(0.0435)	(0.0260)	(0.0282)	(0.0375)	(0.0332)

Variables	Baseline FE	(1) No weights	(2) Driscoll-Kraay SE	(3) COVID dummy	(4) Lagged regressors	(5) Excl. outliers
INF	0.0296	0.0052	0.0296**	0.0259	0.0514***	0.0420**
	(0.0198)	(0.0270)	(0.0131)	(0.0169)	(0.0166)	(0.0173)
CR	-0.0018	0.0391	-0.0018	0.0670	0.0394	0.0007
	(0.0409)	(0.0576)	(0.0216)	(0.0452)	(0.0451)	(0.0398)
COVID				-0.0068***		
				(0.0023)		
Observations	91	91	91	91	82	83
Adj. R^2	0.7895	0.7560	0.7895	0.8137	0.8511	0.7762
Panel B. Dependent variable: ROE						
BS	0.0603***	0.0707***	0.0603***	0.0533***	0.0542***	0.0557***
	(0.0178)	(0.0210)	(0.0149)	(0.0193)	(0.0190)	(0.0183)
DEP	-0.0467	-0.0572	-0.0467	-0.0464	0.0704	-0.0226
	(0.0516)	(0.0562)	(0.0284)	(0.0523)	(0.0577)	(0.0538)
CAD	0.2514*	0.3398**	0.2514***	0.2021	0.3398**	0.1941
	(0.1431)	(0.1693)	(0.0903)	(0.1514)	(0.1353)	(0.1734)
LTA	-0.0066	0.0069	-0.0066	0.0157	0.0798	0.0555
	(0.0575)	(0.0506)	(0.0446)	(0.0587)	(0.0541)	(0.0686)
EFF	-0.1391***	-0.1226***	-0.1391***	-0.1396***	-0.1245***	-0.1599***
	(0.0328)	(0.0383)	(0.0391)	(0.0328)	(0.0396)	(0.0450)
GDP	0.0273	0.0683	0.0273	-0.0676	0.1363	-0.0105
	(0.2901)	(0.2974)	(0.3157)	(0.2840)	(0.3262)	(0.2894)
INF	0.4083**	0.3229*	0.4083***	0.3770**	0.3219*	0.4095**
	(0.1579)	(0.1696)	(0.1152)	(0.1660)	(0.1842)	(0.1659)
CR	-0.1169	-0.1854	-0.1169	0.1803	0.0543	-0.2224
	(0.3409)	(0.3919)	(0.2731)	(0.4377)	(0.3695)	(0.3517)
COVID				-0.0319		
				(0.0235)		
Observations	91	91	91	91	82	83
Adj. R^2	0.7845	0.7258	0.7845	0.7897	0.8095	0.7161

Note: All columns are estimated with bank fixed effects. The baseline and columns (2)-(5) use cross-section weights; column (1) is unweighted. Standard errors in parentheses are White diagonal (heteroscedasticity-consistent) standard errors, except in column (2), which reports Driscoll-Kraay standard errors. COVID equals one in 2020 and 2021. *, **, *** significant at 10%, 5%, 1% level, respectively.

Source: Authors' estimation results

Because bank profitability may persist over time, we also estimate a dynamic version of Model 1 that includes the lagged dependent variable, using the system GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998) (Table 8). This estimator also addresses the bias of fixed-effects estimates in dynamic panels. Instruments for the lagged dependent variable are collapsed to limit instrument proliferation (Roodman, 2009), and the other regressors are treated as strictly exogenous, because the small number of banks does not allow them to be instrumented as well. With nine banks, the two-step estimator is not feasible for the full specification: its 11 instruments exceed the number of banks, so the optimal weighting matrix is singular. Column (1) therefore reports the one-step estimator for the full specification with standard errors clustered by bank, and column (2) reports the two-step estimator with the Windmeijer (2005) finite-sample correction for a parsimonious specification that contains only the internal variables, which reduces the number of instruments to eight, below the number of banks. The Arellano and Bond (1991) AR(2) test does not detect second-order serial correlation in any column, and the Sargan and Hansen tests do not reject the validity of the instruments at the 5% level.

For ROA, the coefficient on lagged ROA is small (0.20 to 0.40) and insignificant, which indicates little persistence and supports the static specification of the baseline models; the AR(1) statistic is likewise insignificant in column (1) and only marginally significant in column (2). Capital adequacy remains positive and significant at the 1% level, and the cost-to-income ratio remains negative and significant at the 1% level in both columns. Bank size keeps its positive sign but is insignificant in both columns, and LTA is

also insignificant, which suggests that the effects of bank size and the loan-to-asset ratio on ROA are sensitive to the dynamic specification. For ROE, the lagged dependent variable is positive and significant (0.51 to 0.58), indicating moderate persistence. The negative effect of the cost-to-income ratio is confirmed, but bank size and capital adequacy lose significance in the dynamic specification. The external variables are insignificant in column (1) for both measures. Given the small number of banks, the GMM estimates are imprecise and should be read as supplementary evidence. They confirm the roles of capital adequacy and cost efficiency for ROA and of cost efficiency for ROE, while the effects of bank size on both measures and of capital adequacy on ROE are less robust than the static estimates suggest.

Table 8. System GMM estimates of the dynamic model

Variables	Dependent variable: ROA		Dependent variable: ROE	
	(1) One-step, full	(2) Two-step, internal	(1) One-step, full	(2) Two-step, internal
Lagged dependent variable	0.2040 (0.3426)	0.4031 (0.2546)	0.5796** (0.2331)	0.5129** (0.2035)
BS	0.0024 (0.0015)	0.0020 (0.0015)	0.0053 (0.0113)	0.0099 (0.0083)
DEP	-0.0006 (0.0081)	0.0025 (0.0055)	-0.0150 (0.0575)	-0.0279 (0.0662)
CAD	0.1130*** (0.0375)	0.0971*** (0.0320)	0.0519 (0.1685)	0.1295 (0.1268)
LTA	0.0082 (0.0147)	0.0000 (0.0104)	-0.0614 (0.0902)	-0.0227 (0.0700)
EFF	-0.0184*** (0.0062)	-0.0160*** (0.0052)	-0.1642*** (0.0428)	-0.2055*** (0.0351)
GDP	0.0314 (0.0222)		0.0927 (0.1656)	
INF	0.0057 (0.0369)		0.0513 (0.2239)	
CR	0.0339 (0.0282)		0.1785 (0.2072)	
Constant	-0.0574** (0.0262)	-0.0249 (0.0217)	-0.0337 (0.1247)	0.0446 (0.1148)
Observations	73	73	73	73
Banks	9	9	9	9
Instruments	11	8	11	8
AR(1) p-value	0.278	0.054	0.027	0.037
AR(2) p-value	0.490	0.494	0.983	0.891
Sargan p-value	0.597	0.323	0.295	0.411
Hansen p-value	n.a.	0.418	n.a.	0.372

Note: System GMM estimates of the dynamic version of Model 1. Column (1) is the one-step estimator for the full specification, with standard errors robust to heteroscedasticity and within-bank serial correlation. Column (2) is the two-step estimator for the internal variables only, with Windmeijer (2005) corrected standard errors. The second lag of the dependent variable instruments the differenced equation, and the lagged first difference instruments the levels equation; GMM-type instruments are collapsed, and the other regressors enter as standard instruments. AR(1) and AR(2) are Arellano-Bond tests for serial correlation in the first-differenced residuals. The Hansen test is not available (n.a.) for column (1) because the two-step weighting matrix is singular when the number of instruments exceeds the number of banks. Standard errors in parentheses. *, **, *** significant at 10%, 5%, 1% level, respectively.

Source: Authors' estimation results

5. Discussion

Capital adequacy (CAD) is measured as the ratio of equity to total assets, reflecting the extent to which a bank's assets are funded by its own capital and its capacity to absorb losses. Empirical results show that CAD has the largest coefficient among the internal variables and, in standardized terms, is the second most influential factor after bank size in the ROA models and the third, after bank size and the cost-to-

income ratio, in the ROE models. CAD has a positive impact, significant at the 5% level for ROA and at the 10% level for ROE in Model 1, which may reflect lower funding costs and risk premia for better-capitalized banks, a greater capacity to absorb losses, and a supportive regulatory environment. Two caveats apply. First, the relationship may partly reflect reverse causality, because profitable banks retain earnings and thereby increase their equity-to-assets ratio; although the CAD effect remains significant when lagged regressors are used (Table 7) and in the dynamic GMM model for ROA (Table 8), the estimates should be interpreted as associations rather than causal effects. Second, because ROE equals ROA divided by the equity-to-assets ratio, a higher CAD mechanically lowers ROE for a given ROA; the positive CAD coefficient in the ROE models therefore implies that better-capitalized banks earn substantially higher returns on assets, enough to offset this mechanical effect. This finding aligns with those of Doğan and Yildiz (2023) and Abdou and Alarabi (2024) but contradicts those of Obiedallah and Abdelaziz (2024), Khan (2022), and Bortoluzzo et al. (2024). Hypothesis 3 is therefore supported for ROA and only weakly supported for ROE, where the effect is less robust across specifications (Tables 7 and 8).

Operating efficiency is measured by the cost-to-income ratio (EFF), calculated by dividing operating expenses by operating income; a higher value indicates lower efficiency. The analysis reveals that operating efficiency is the second most influential profitability factor for ROE, after bank size, and the third for ROA, after bank size and CAD, among Mongolia's commercial banks. The cost-to-income ratio has a consistently negative impact across all models; specifically, a 1 percentage point increase in EFF leads to a 0.0198 percentage point decrease in ROA and a 0.1391 percentage point decrease in ROE in Model 1 (which included both internal and external variables). In Model 2, which considers only internal factors, a 1 percentage point rise in EFF results in a 0.0208 percentage point reduction in ROA and a 0.1323 percentage point reduction in ROE. Higher corporate expenses as a share of income directly reduce profitability, aligning with existing theory and prior research, such as studies by Lamothe et al. (2024) and Laporšek et al. (2025), which also find that higher cost-to-income ratios reduce ROA and ROE. Consequently, Hypothesis 5 of this study is supported.

It is evident that larger banks tend to exhibit higher profitability due to economies of scale, greater operational efficiency, and enhanced diversification opportunities. Our results show that bank size (BS) has a positive impact, which is statistically significant at the 1% level in all fixed-effects models, and this finding is in line with previous research, including Abdou and Alarabi (2024), Doğan and Yildiz (2023), and Khan (2022). Thus, the five systemically important banks have a greater opportunity to earn higher profits by managing their assets. Because bank size in the fixed-effects models varies mainly through asset growth over time, this effect may partly capture the sector’s post-2020 recovery. Hypothesis 1 is therefore supported.

The loan-to-asset ratio (LTA), which measures lending intensity and is inversely related to liquidity, has a positive and statistically significant effect on ROA at the 5% level in the fixed-effects models, indicating that banks allocating a larger share of their assets to lending earn higher interest income relative to their asset base. This result supports the liquidity-profitability trade-off: holding fewer low-yielding liquid assets raises returns at the cost of greater liquidity risk. It is consistent with Sufian and Habibullah (2009), who find a positive effect of loan intensity on profitability, and with Bilal et al. (2024), who show that liquidity risk is rewarded in bank-based financial systems such as Mongolia’s, but it contrasts with Apau and Sibindi (2023), who find no significant effect of the loan-to-asset ratio in Ghana. In the ROE models, LTA has no significant effect, and its sign varies across estimators. One plausible explanation is that loans carry higher risk weights and therefore require more capital, which dilutes the return to equity; the ROE estimates are also imprecise, with standard errors several times larger than the coefficients. Hypothesis 4 is therefore supported for ROA but not for ROE, although the ROA effect is not significant in the unweighted fixed-effects model or in the dynamic GMM model (Tables 7 and 8).

The deposit ratio represents the proportion of deposits in total assets. While deposits fund loans and boost profitability, excessive deposits can lead to inefficiency and higher interest expenses. Managing the

deposit volume is therefore a key aspect of banking operations. In this study, we find mixed signs across models, and the effects are statistically insignificant in all models, which aligns with Al-Harbi (2019) and Akther et al. (2023). This implies that higher funding volumes do not necessarily enhance earnings when deposit costs and intermediation inefficiencies dominate. Consequently, Hypothesis 2 is not supported.

Regarding external variables, the coefficients for inflation are positive in the fixed-effects models and statistically significant only in ROE Model 1. This finding is consistent with those reported by Doğan and Yildiz (2023) and Abdou and Alarabi (2024). A positive association between inflation and banking profitability means that banks can adjust lending rates more rapidly than their funding costs, thereby widening interest spreads and enhancing returns to equity. Hypothesis 7, which predicted a negative relationship, is therefore not supported.

From the empirical analysis, the coefficients on the annual GDP growth rate are positive in both the ROA and ROE fixed-effects models; however, the estimates are statistically insignificant. The positive relationship is in line with Mirović et al. (2024) and Doğan and Yildiz (2023). Consequently, Hypothesis 6 regarding GDP growth is not supported. Because the macroeconomic variables are common to all banks in a given year, they are identified from only 12 annual observations; the absence of significant effects may therefore reflect limited statistical power rather than the absence of macroeconomic influence.

The concentration ratio is negative and insignificant in both models, consistent with Abdou and Alarabi (2024). Thus, hypothesis 8 is not supported. Given the high level of concentration in Mongolia's banking sector, the relationship between market structure and profitability remains an important question for future research using longer time series or bank-level measures of market power.

6. Conclusion

This study examined the impact of internal and external factors on the profitability of nine commercial banks in Mongolia using unbalanced panel data covering the period 2014-2025.

Among the explanatory variables, BS and CAD have positive and significant effects on ROA and ROE, although the CAD effect on ROE is weaker and less robust, while the cost-to-income ratio (EFF) has a negative and significant effect on both profitability measures. LTA (the loan-to-asset ratio) positively influences ROA, whereas INF has a significant positive impact on ROE. These findings are broadly consistent with previous literature. Abdou and Alarabi (2024), Doğan and Yildiz (2023), and Khan (2022) found that bank size positively affects bank profitability. Sufian and Habibullah (2009) and Bilal et al. (2024) showed that greater loan intensity and liquidity risk are associated with higher bank profitability. Lamothe et al. (2024) and Laporšek et al. (2025) likewise find that higher cost-to-income ratios reduce ROA and ROE, whereas our positive CAD effect contrasts with the negative effect reported by Obiedallah and Abdelaziz (2024). Overall, the results suggest that Mongolian banks could enhance profitability by improving bank asset size, reducing operational inefficiencies, and improving capital adequacy.

Capital adequacy, defined as the ratio of equity to total assets, is, after bank size, the most important determinant of ROA, and an important determinant of ROE, for Mongolian commercial banks over the period 2014-2025. Higher capital adequacy may enhance profitability by lowering funding costs, improving risk absorption, fostering a supportive regulatory environment, and reducing the opportunity cost of holding excess capital. In contrast, the cost-to-income ratio (EFF) negatively and significantly affects both profitability measures, indicating that higher operating costs substantially erode returns. Revenue generation through effective asset management and the expansion of economic activities plays a key role in improving bank profitability, underscoring the importance of efficient portfolio management. Consistent with the existing literature, bank size (BS) significantly and positively affects both ROA and ROE, suggesting that asset expansion enhances banks' capacity to allocate funds efficiently and generate income. The loan-to-asset ratio (LTA) positively and significantly influences ROA, reflecting higher

interest income from a larger loan share, albeit at the cost of thinner liquidity buffers, while its association with ROE is negative but statistically insignificant. Overall, these findings highlight the importance of prudent capital management, cost efficiency, and effective asset-liability management in sustaining bank profitability.

The inclusion of external variables, such as annual GDP growth and inflation, does not materially alter the core findings, and the main results are robust to alternative weighting, Driscoll-Kraay standard errors, a COVID-19 control, lagged regressors, and the exclusion of outlier observations. A dynamic system GMM specification confirms the effects of capital adequacy and cost efficiency on ROA and of cost efficiency on ROE, although the effects of bank size on both measures and of capital adequacy on ROE are weaker in that specification. Inflation is positively associated with bank profitability, although this relationship is statistically significant only in the ROE model. The concentration ratio, as an industry-specific indicator, is negatively related to profitability, but the estimated effects are statistically insignificant. Taken together, these results suggest that greater attention to capital adequacy, operational efficiency, and balancing loan expansion against liquidity buffers may contribute to more stable and sustainable profitability in Mongolia's banking sector, with implications for both policymakers and bank management.

Policy considerations may enhance the practical relevance of this study for both academic and policy audiences. From a regulatory perspective, the findings suggest that greater attention to asset management practices, capital reserve frameworks, and supervisory monitoring could support stability and resilience in the banking sector. From a managerial standpoint, bank managers may benefit from maintaining appropriate levels of capital adequacy to better absorb economic fluctuations, alongside adjustments in asset-liability management that balance loan expansion against liquidity buffers and the Bank of Mongolia's prudential liquidity requirements. In addition, selective investments in technology and data analytics may help improve operational efficiency and support banks' adaptation to evolving market conditions, thereby contributing to longer-term profitability.

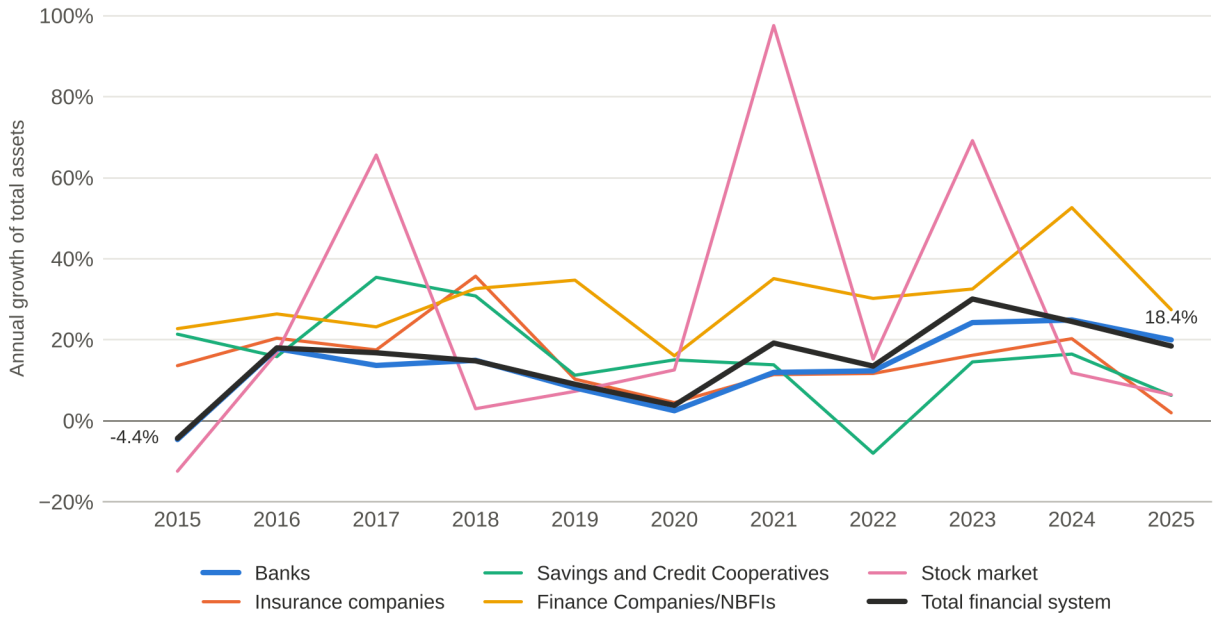
This study contributes to the current literature by examining the factors influencing bank profitability in Mongolia. However, it has limitations due to the small number of banks and limited data. Although system GMM estimates are reported as a robustness check, the small number of banks limits the number of usable instruments and the precision of dynamic panel estimators; with more banks or longer series, future research could model the persistence of bank profitability more fully, for example with bias-corrected least-squares dummy variable (LSDV) estimators. Although lagged regressors and a COVID-19 dummy were used as robustness checks, future research could address the potential endogeneity of capital adequacy more fully, for example with instrumental variables.

A limitation of this study is its exclusive focus on commercial banks, excluding other financial institutions operating under different mandates and regulatory frameworks. Data constraints and institutional heterogeneity limit their inclusion in a unified panel analysis. Future research could extend the framework by examining non-bank financial institutions using appropriate approaches.

Another limitation is that the analysis does not explicitly incorporate commodity price related profitability channels. Future research could integrate additional risk, digitalization, and fintech indicators such as non-performing loans, loan-loss provisions, and digital transaction volumes, and conduct comparative analyses with structurally similar economies to enhance the robustness of the findings.

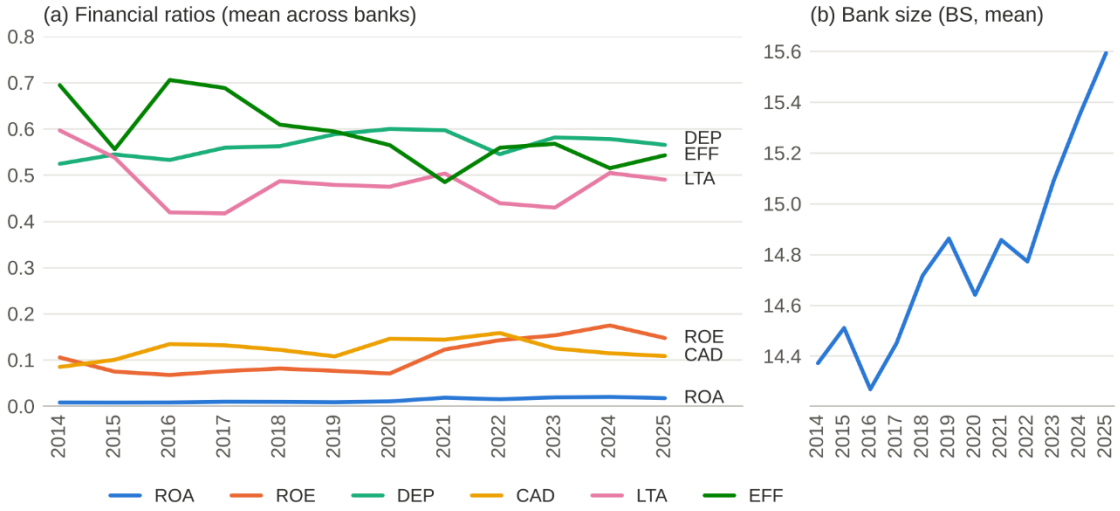
Appendix A. Bank-Specific Factors of Banks and Asset Growth of Financial Institutions in Mongolia

Figure 1. Annual Growth of Financial Institutions in Mongolia, 2015-2025



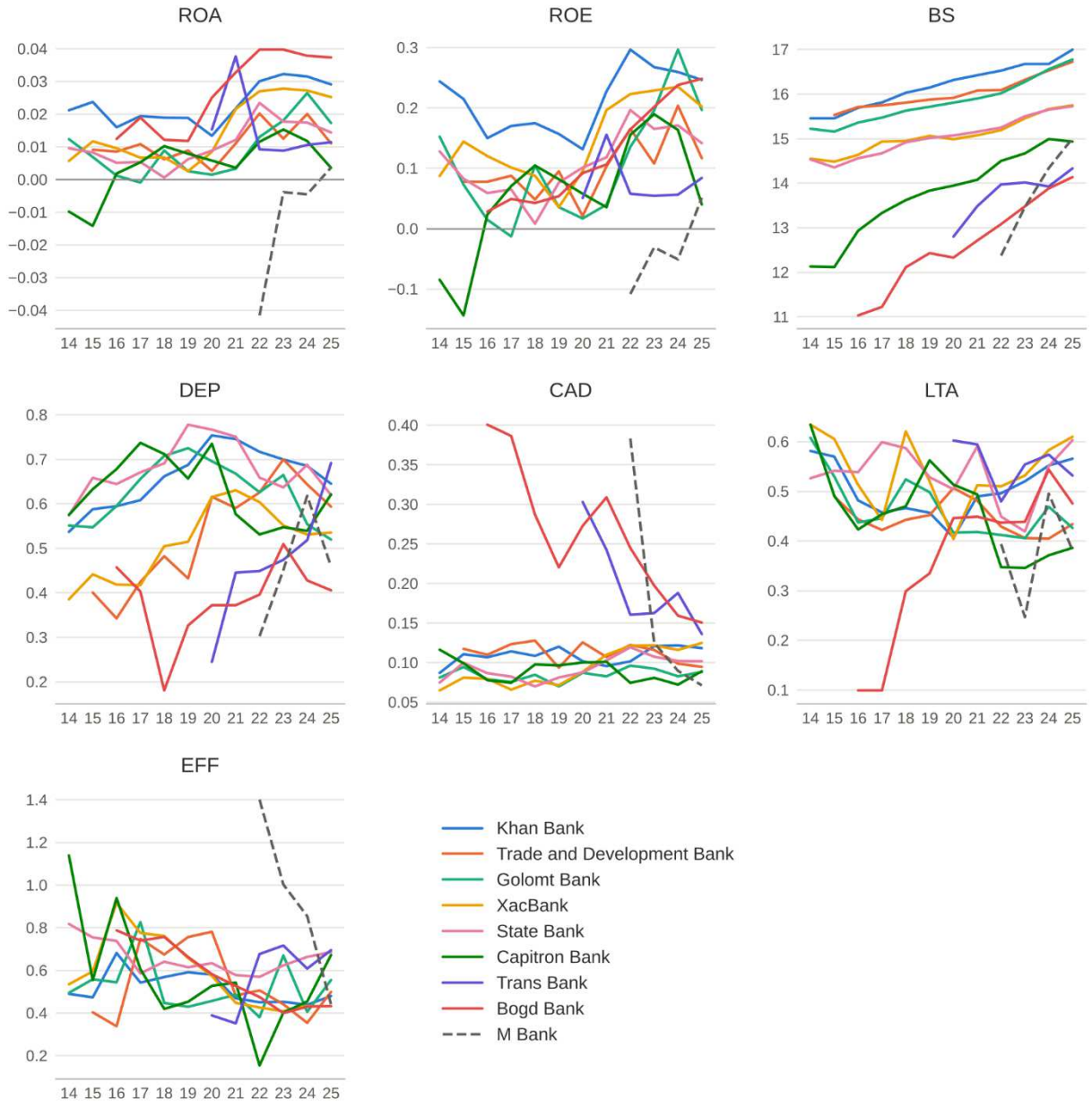
Source: Authors' calculation, Database: Financial Market Review, Financial Regulatory Commission of Mongolia; Consolidated Balance Sheet data of Commercial banks, the Central Bank of Mongolia.

Figure 2. Annual Averages of Bank-Specific Factors, 2014-2025



Source: Authors' calculation, Balance Sheet data of commercial banks, and the data from the National Statistical Office of Mongolia, https://1212.mn/en. Note: Panel (b) shows bank size (BS), the mean natural logarithm of total assets.

Figure 3. Historical Movements in Bank-Specific Factors across Mongolian Banks, 2014-2025



Source: Authors' depiction

Appendix B. Links to the banks' websites

	Name of the bank	Links
1	Khan Bank	Khanbank
2	Trade and Development Bank of Mongolia	TDBM
3	Golomt Bank	Golomt bank
4	XacBank	Khas bank | Investors
5	State Bank	State bank
6	Capitron Bank	Capitron bank
7	Trans Bank	Trans bank
8	Bogd Bank	Bogd Bank | Investors
9	M Bank	M bank

Source: Authors' compilation

Ethics approval and consent to participate

The authors declare that there are no potential risks or burdens associated with this study. The data employed are publicly available. All comments and insights are those of the authors and not of the institutions at which they work. This study is not directly related to human participants, human data, or human tissue. Not applicable.

Consent for publication

Not applicable.

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