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PROFITABILITY OF KOREAN BANKS: IMPACT OF CAR AND NIM

Charoensook Banchongsan*, **Lee Hayeong**
Department of International Business, Adams College, Keimyung University,
Daegu, South Korea
*Corresponding Author, E-mail: 11596@kmu.ac.kr

ABSTRACT
This study investigates the relationship between profitability and financial solvency in South Korea's major banks. It addresses empirical challenges by modifying data into percentage changes to reduce multicollinearity and employing logarithmic transformations to clarify variable relationships. The study validates certain theoretical predictions through hypothesis testing. Our analysis finds that there is a significant and positive relation between Return on Assets (ROA) and Capital Adequacy Ratio (CAR) and Net Interest Margin (NIM). In terms of application, we identify the expected minimum positive percentage changes in CAR and NIM that are required in order to maintain the current level of ROA of Korean banks. The paper is structured to enhance readability and comprehension, providing clear explanations suitable for non-economists and newcomers to the field. Each section begins with a brief overview of its main objectives and findings, contributing to the study's accessibility and reliability.

KEY WORDS
Profitability, asset quality, return on asset, capital adequacy ratio, net interest margin.

In 2023, South Korean banks experienced a 15% increase in combined net profits, totaling 21.3 trillion won, primarily due to higher interest rates and a significant boost in noninterest income (Byun, 2024). Despite this growth, there was a notable rise in loan-loss provisions by 55.6%, signaling underlying financial risks. Amid economic stagnation, banks face increasing pressure to fulfill social responsibilities, as highlighted by Chang Hea-kyu from Fitch Ratings. These responsibilities include demands from local authorities to reinvest profits into public goods and compensate for specific financial losses (Eun-Byel, 2024). These challenges, combined with demographic shifts and the risks associated with international expansion, create a complex environment where banks must balance profitability with social and regulatory expectations.

Motivated by the above challenges of Korea banks, this paper explores the impact of two fundamental financial performance measures — Net Interest Margin (NIM) and Capital Adequacy Ratio (CAR) — on the profitability of Korean banks. The relevance of examining the relationship between bank profitability, CAR, and NIM within the Korean context is underscored by numerous studies within the Indonesian banking sector that highlight the significant effects of CAR and NIM on profitability, such as the work by Surtikanti et al (2011). This study seeks to determine whether similar relationships exist in the context of Korean banks, which place a greater strategic emphasis on digital banking and overseas expansion.

Regarding data collection and methodology, our study utilizes secondary data from the Korea Deposit Insurance Corporation (KDIC), covering the period from 2009 to 2022 for the five largest Korean banks: KEB Hana Bank, Woori Bank, Shinhan Bank, KB Kookmin Bank and Citibank Korea. We employ a multiple linear regression analysis, with ROA as the dependent variable and CAR and NIM as independent variables. To address potential multicollinearity issues and ensure that our estimates are the Best Linear Unbiased Estimators (BLUE), we transform these variables into percentage changes.

Our findings indicate that both CAR and NIM are statistically significantly related to ROA. We conclude that CAR and NIM are crucial in determining the profitability of Korean banks. In the discussion and conclusion section, we leverage our findings to estimate the optimal percentages of CAR and NIM that prevent declines in the profitability of Korean banks.

The paper is organized as follows: The second section comprises a literature review, divided into two subsections—one on definitions and theoretical overviews of the concepts, and the other on related existing literature. The third section outlines the hypothesis formulation, methodology, and data collection. Section 4, the main analysis section, is divided into three subsections: preliminary tests to confirm that estimates from the regression are BLUE, results of hypothesis testing, and discussion. The final section concludes the paper, addressing limitations and suggesting avenues for further research.

LITERATURE REVIEW

According to Mishkin and Eakins (2018), a basic measure of profitability called "ROA is calculated by dividing a firm's net income by the average of its total assets. It is then expressed as a percentage". It determines the net profit made per unit of assets in a given business (Hargrave, 2024). This ratio provides information about how well a business makes use of its resources to turn a profit.

$$ROA = \frac{Net\ Profit}{Total\ Assets}$$

As a result, ROA will be the main profitability indicator used in this study, making comparisons with other metrics easier.

CAR, often known as the BIS Capital Ratio, is a measure of a bank's capacity to pay its debts. Greater financial stability is indicated by a higher CAR, with a ratio of more than 8% considered safe for banks (Hein et al., 2005).

For instance, a CAR of 6% indicates a certain level of risk, signaling the need to adjust to enhance the stability of bank capital.

$$CAR = \frac{Tier\ 1\ Capital + Tier\ 2\ Capital}{Risk\ Weighted\ Assets}$$

The components of Tier-1 capital, often known as core capital, include audited revenue reserves, equity capital, ordinary share capital, and intangible assets. General loss reserves, unaudited reserves, and unaudited retained earnings make up Tier-2 capital. The minimal amount of capital that banks and other institutions must hold in order to lower the risk of insolvency is determined using risk-weighted assets (Hayes, 2023).

Accordingly, variations in risk-weighted assets can affect the CAR, which can then be used as a measure to evaluate how these variations affect profitability (Hayes, 2023).

By dividing the difference between interest income (derived from asset usage) and interest expenses (related to deposit acquisition), divided by total assets. This ratio is crucial for determining a bank's profitability because it contrasts interest income and expenses (Deok, 2017).

$$NIM = \frac{Interest\ Revenue - Interest\ Expenses}{Total\ Assets}$$

A financial indicator called the NIM indicates a bank's net interest revenue concerning its total assets. It contrasts the interest paid to holders of savings accounts and certificates of deposit with the income from credit products like loans and mortgages. This ratio sheds light on how well a bank uses its assets and how well it can profit from its assets that yield interest while controlling interest costs. According to Rose and Hudgins (2013), NIM is a pivotal measure of a bank's financial performance and profitability. A bank's total profitability can be increased by efficiently managing its interest-earning assets to create more income than interest expenses, as indicated by a higher net interest margin. In conclusion, net interest margin (NIM) is an important performance indicator for banks that offers important

information about how well they can control interest expenses and turn a profit on interest-earning assets. For stakeholders and decision-makers in the banking industry, these metrics—ROA, CAR, and NIM—are essential instruments for evaluating the profitability and financial stability of banks.

The complex interplay between bank profitability, Net Interest Margin (NIM), and Capital Adequacy Ratio (CAR) has garnered significant attention in various banking studies. Bank profitability, often assessed using Return on Assets (ROA) among other indicators, is affected by several elements such as CAR and NIM. These analyses offer crucial understanding of the interactions between financial stability and operational efficiency in the banking industry.

CAR is essential for assessing a bank's financial health and its ability to take up potential losses. Research on this topic presents mixed findings. Heriyanto and Kurniawan (2022) found a significant and negative effect of CAR on profitability, whereas Savanero S. (2022) noted that the impact of CAR on profitability was positive but not significant. Conversely, Noel and Sekar (2022) reported a positive and significant effect. These variations can be attributed to differences in banking environments, study periods, and research methodologies. Additionally, J Joni et al (2022) discussed an indirect effect of CAR on ROA through the Financing to Deposit Ratio (FDR), showcasing the complex pathways through which CAR influences profitability.

NIM, indicating the differential between the interest expenses against the bank's interest- earning assets and the interest income generated, directly impacts bank profitability. Studies uniformly suggest a positive correlation between NIM and profitability (Trifonia et al., 2020; Rosandy and Sha, 2022; Prasetyo, 2015; Ariyanti et al., 2017; Priharta et al., 2022). A higher NIM reflects better management of interest-earning assets and liabilities, enhancing a bank's income-generating capability.

The combined examination of CAR and NIM provides a holistic view of a bank's financial health. The studies reveal both direct and indirect effects of these financial ratios on profitability, which varies by regulatory environment, market conditions, and the specific financial health of banks. The analysis by Fanny et al (2020) underscores this relationship, emphasizing the intricate balance between operational efficiency and financial stability.

This review section primarily utilizes quantitative methods and secondary data, focusing on specific geographic and temporal contexts—predominantly Indonesian banks. This method could restrict how applicable the results are to different areas or wider economic situations. Nevertheless, these studies contribute methodological diversity and sector-specific insights, enhancing the global discourse on banking profitability and efficiency.

Future studies might explore the impact of digital banking services, environmental, social, and governance (ESG) criteria, and the long-term effects of credit restructuring on bank profitability. Additionally, the adoption of international financial reporting standards (IFRS) could also be a pivotal area of research, given the ongoing global trends towards financial reporting standardization.

This review section encapsulates a range of studies that explore the nuanced relationships between CAR, NIM, and bank profitability. The findings highlight both the potential and challenges in harnessing these financial ratios to boost bank profitability, offering valuable insights for banking professionals and policymakers aiming to enhance financial stability and operational efficiency.

THEORETICAL FRAMEWORK AND HYPOTHESIS FORMULATION

Net Interest Margin (NIM) highlights the disparity between the interest earned on assets and the interest expenses on liabilities. A higher NIM usually signifies strong profitability, indicating that the bank effectively uses its assets to produce income. On the other hand, the Capital Adequacy Ratio (CAR) assesses a bank's capital compared to its risk-weighted assets. A higher CAR demonstrates more financial robustness and the capacity to endure losses, showcasing the bank's resilience in challenging economic scenarios.

The study examines the relationships between NIM, CAR, and bank profitability to elucidate the factors influencing financial performance. This investigation considers the broader economic environment's impact on these relationships.

The hypotheses formulated to guide this study are as follows.

Null Hypothesis (H0) for NIM:

- H0: There is no significant relationship between Net Interest Margin (NIM) and profitability.

Alternative Hypothesis (Ha) for NIM:

- Ha: There is a significant relationship between Net Interest Margin (NIM) and profitability.

Null Hypothesis (H0) for CAR:

- H0: There is no significant relationship between Capital Adequacy Ratio (CAR) and profitability.

Alternative Hypothesis (Ha) for CAR:

- Ha: There is a significant relationship between Capital Adequacy Ratio (CAR) and profitability.

The relationships among these variables can be visually represented as follows:

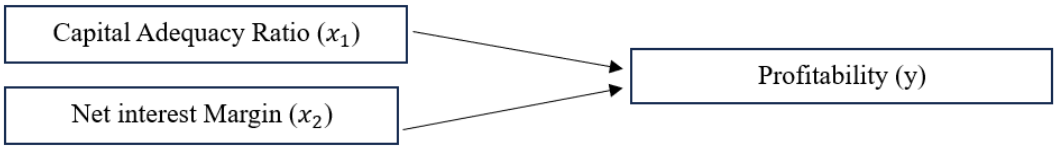

Figure 1 – Framework

The relationships can also be expressed mathematically:

$$ROA = \beta_0 + \beta_1 CAR + \beta_1 NIM + s \quad (1)$$

In our main analysis section, we convert the dependent and independent variables into percentage changes. Hence,

$$\Delta\%ROA = \beta_0 + \beta_1 \Delta\%CAR + \beta_1 \Delta\%NIM + s \quad (2)$$

METHODOLOGY AND DATA COLLECTION

This subsection outlines the methodologies employed in this study to validate theoretical assertions and ensure accurate, reliable results. The research methodology integrates quantitative analysis with descriptive and verificative approaches:

Descriptive Methodology: This method involves detailing the characteristics or phenomena under investigation (Hayes, 2023). It utilizes data from financial records, historical performance metrics, and other relevant sources, focusing on various banking and financial performance indicators like NIM, ROA, and CAR.

Verificative Methodology: This approach employs empirical data analysis to confirm or refute existing theories, hypotheses, or relationships (Verification Methodologies, n.d.). It includes quantitative tools such as regression and correlation analysis to assess hypotheses and examine relationships among variables like profitability, NIM, ROA, and CAR. Quantitative Approaches: Quantitative research collects and analyzes numerical data to explore research questions or test hypotheses (Singh, 2007). This method utilizes statistical tools and objective measurements, including multiple linear regression, multicollinearity analysis, heteroskedasticity analysis, and the evaluation of financial performance metrics.

Analytical tools used include EViews, Microsoft Excel, and XLSTAT. EViews provides robust statistical and modeling capabilities particularly useful in financial analysis. Microsoft Excel supports extensive data visualization and analysis, ensuring accurate computation and equation validation. XLSTAT supplements Excel's capabilities, offering additional statistical

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analysis tools.

By combining these methodologies and tools, the research comprehensively assessed the financial performance of banks and explored the interrelations among key performance indicators.

This section details the processes for gathering and organizing data to enhance the validity of the computational methods and findings. It also ensures the availability of data for future research, thereby enhancing the credibility of the results.

The study utilizes quarterly statistical data sourced from the Korea Deposit Insurance Corporation (KDIC) spanning from 2009 to 2022. KDIC is essential in protecting depositors and ensuring the stability of South Korea's financial system by guarding against losses from bank failures due to bankruptcy or other reasons (KDIC, n.d.). This agency is crucial for maintaining financial stability and boosting public trust in financial activities.

KDIC's comprehensive data from major commercial banks like Citibank Korea, Hana Bank, Woori Bank, Kookmin Bank, and Shinhan Bank facilitates thorough assessments of banking trends and performance metrics. This enables researchers and policymakers to track the financial stability of these institutions, pinpoint potential risks, and develop strategies to ensure a resilient and stable financial sector.

Additionally, the KDIC website serves as a valuable resource not only for researchers but also for the general public. It offers insights into the organization's objectives, activities, and achievements, thus fostering public engagement and enhancing transparency and accountability within the financial regulatory framework. Overall, leveraging KDIC data significantly bolsters the study's authority and relevance, providing key insights into the dynamics of South Korea's banking industry.

This paper discusses the utilization of data from the Korea Deposit Insurance Corporation (KDIC) and the necessary modifications applied to enhance the validity of the analysis and ensure clarity in presentation.

Data transformation was crucial in this study, particularly due to the high correlation coefficients initially observed in the raw data. A prominent initial correlation coefficient of -0.713 indicated a strong relationship between variables, complicating further analysis. To address this, the data required transformation into a format conducive to analytical clarity.

Several transformation techniques were explored, including squaring, square root extraction, and natural logarithmic transformations. Ultimately, the double logarithmic (dlog) transformation method was selected for its effectiveness in linearizing relationships between variables. As noted by Zelmer (2022), "Log transformation of both variables can make a straight line out of almost anything." This transformation significantly reduced the correlation coefficient to 0.065, bringing it within an acceptable range for analysis.

Overall, data transformation has been integral to conducting a nuanced examination of the relationships among key variables. Through methodological refinement and iterative testing, the study successfully navigated initial challenges to yield robust and reliable results.

RESULTS OF STUDY

The initial phase of our primary analysis involves conducting four standard preliminary tests on data transformed into percentage changes. These tests—normality, heteroskedasticity, multicollinearity, and autocorrelation—are essential to ensure the integrity of the data prior to further analysis.

The effectiveness of these tests is critical as they confirm the assumptions required for our multiple linear regression model, as detailed in Equation 2, to provide valid outputs. Specifically, the results of these tests validate that our model estimates are BLUE (Best Linear Unbiased Estimator), signifying that they are the most reliable and efficient estimates given the data and assumptions. This foundation is crucial for upholding the statistical rigor of our analysis and supporting the credibility of our findings.

To guarantee the accuracy and reliability of our regression analysis, it was essential to conduct a Normality Test, a fundamental step to determine if the data adheres to a normal distribution. This assumption is central to many statistical methods, and deviations from

normality can significantly impact the validity of the results. To thoroughly evaluate this assumption, we employed the Kolmogorov-Smirnov test. Additionally, graphical methods such as Q-Q plots were utilized to visually assess how closely the data conform to a normal distribution. The results from the Kolmogorov-Smirnov test, specifically, showed a p-value of 0.07, as indicated in Table 2. This result suggests that the residuals from our data set are normally distributed, thus affirming the normality assumption crucial for linear regression analysis.

Further supporting our findings, the Q-Q plots demonstrated a close alignment of the data points with the theoretical normal distribution line, indicating no significant deviations from normality. This visual confirmation, along with the statistical test results, provides a robust validation of our model's assumptions. In addition to normality tests, our analysis included comprehensive checks for multicollinearity, heteroscedasticity, and autocorrelation—key components of the Classic Assumption Test needed to develop a Best Linear Unbiased Estimator (BLUE) for the regression models. Employing SPSS Version 16.0, these extensive tests ensured that all foundational assumptions of our regression analysis were rigorously verified. By combining detailed assumption testing with careful examination of data distribution, we enhanced the integrity and robustness of our statistical findings, thereby bolstering the validity of the hypotheses tested in this study.

Multicollinearity is a statistical issue in regression analysis, arising when two or more predictor variables are highly correlated. This correlation can compromise the statistical validity of a regression model, as it leads to inflated standard errors for estimated coefficients and makes them sensitive to minor model changes. Consequently, this instability makes it difficult to rely on p-values to assess the significance of predictors (Frost, 2019).

Table 1 – Results of the One-Sample Kolmogorov-Smirnov Test for Normality

Variable	Statistic
Sample Size (N)	55
Mean	4.72e-17
Standard Deviation	0.248
Absolute Difference (D)	0.171
Positive Difference (D+)	0.171
Negative Difference (D-)	0.000
Kolmogorov-Smirnov Z	1.27
Asymptotic Significance (2-tailed)	0.070

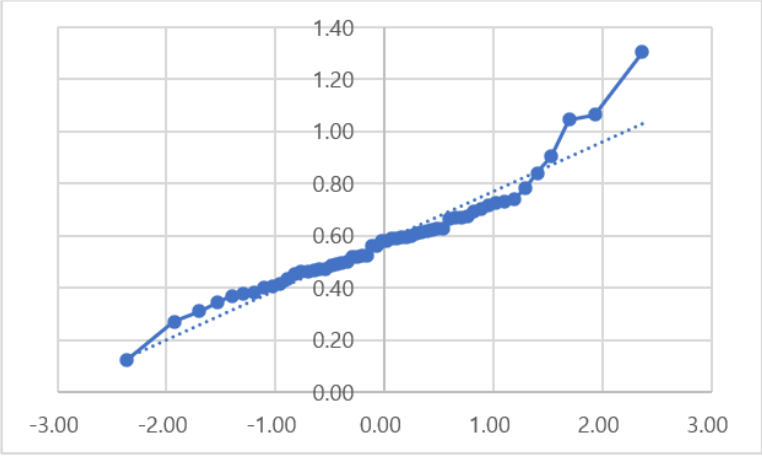

Figure 2 – Q-Q Plot (The graph was created using data from KDIC in 2023; this is the authors' own work)

Moreover, the presence of multicollinearity reduces the statistical power of the model, obstructing the detection of significant predictors and complicating the interpretation of results. To address these issues, Variance Inflation Factors (VIFs) are calculated to measure the degree of multicollinearity. A VIF (Variance Inflation Factor) value of 1 signifies no

correlation, while values ranging from 1 to 5 indicate a moderate correlation. Values exceeding 5 suggest significant multicollinearity, which can lead to unreliable estimates of coefficients and p-values (Frost, 2019).

The VIF values were calculated using KDIC's data (2023), indicating an acceptable level of multicollinearity among predictor variables.

Table 3 above displays the outcomes of the multicollinearity test. Based on the data in the table, the tolerance values for the two independent variables are 0.995, which is greater than 0.1, and the Variance Inflation Factor (VIF) is 1.004309, which is less than 10. This suggests that there is no issue of multicollinearity in our model.

Table 2 – Multicollinearity Test Results

Variable	Tolerance Level	VIF
$\Delta\%CAR$	0.995709488	1.004309
$\Delta\%NIM$	0.995709488	1.004309

Heteroskedasticity occurs in regression models when the variance of residuals—differences between observed and predicted values—varies across levels of explanatory variables. In contrast, homoskedasticity features consistent residual variance regardless of predictor values. The presence of heteroskedasticity undermines hypothesis testing reliability, leads to biased standard errors, and results in unreliable statistical tests and confidence intervals, potentially misrepresenting the significance of predictors (White, 1985).

The Breusch-Pagan test is a primary method for detecting heteroskedasticity, challenging the assumption of constant residual variance and positing variance as a function of explanatory variables. It involves regressing squared residuals on predictors and is noted for its simplicity and effectiveness (Greene, 2003). A significant Breusch-Pagan test result (test statistic = 11.43, p-value = 0.003) confirms heteroskedasticity, suggesting the need for robust error measures or alternative estimation approaches.

However, a specific application of the studentized Breusch-Pagan test on is based on variables converted into percentage change as in Equation (2) showed a test statistic of 3.6031 with a p-value of .165, indicating no significant evidence of heteroskedasticity and supporting the validity of the OLS assumptions for this model.

Table 3 – Breusch-Pagan Test for Heteroscedasticity

Test	BP Statistic	Degrees of Freedom	p-Value
Studentized Breusch-Pagan	3.6031	2	.165

Note. p-values are reported without leading zeros.

This concise discussion and structured table emphasize the importance of statistical tests in validating the assumptions of econometric models and ensuring accurate regression analysis.

Autocorrelation, a common problem in time-series data analysis, occurs when sequential observations are correlated, potentially violating the assumption of independent error terms in regression models. To address potential autocorrelation, the Durbin-Watson (DW) test is applied, with a DW statistic between 1 and 3 generally indicating an absence of autocorrelation (Sarwono, 2017). The DW statistic was 2.1969 with a p-value of 0.7534, suggesting no significant evidence of first-order autocorrelation and supporting the independence of residuals.

This finding is crucial as it validates the assumptions underlying the regression model, affirming that the estimated coefficients and standard errors are reliable for hypothesis testing. The lack of autocorrelation enhances the model's integrity, indicating that the results can be trusted without the need for corrective measures such as differencing or the introduction of lagged terms.

Table 4 – e Results of the Durbin-Watson Test for Autocorrelation

Test	DW Statistic	p-Value
Durbin-Watson	2.1969	0.7534

Utilizing R software, we conducted a partial correlation analysis to investigate the relationships between Capital Adequacy Ratio (CAR), Net Interest Margin (NIM), and Profitability (Return on Assets, ROA). The results are presented below:

Table 5 – Results of Partial Correlation Analysis

Variable	Pearson Correlation	Significance (2-tailed)	N
$\Delta\%ROA$ vs. $\Delta\%CAR$	.338**	.012	53
$\Delta\%ROA$ vs. $\Delta\%NIM$	.306**	.023	53

*Note: **p < .05, 2-tailed.*

The analysis reveals a statistically significant positive correlation between Capital Adequacy Ratio (CAR) and Return on Assets (ROA), with a correlation coefficient of 0.338 (p = 0.012), and between CAR and Net Interest Margin (NIM), with a correlation coefficient of 0.306 (p = 0.023). These results indicate weak linear relationships.

We conducted a multiple linear regression analysis using statistical software Eviews to predict the dependent variable, percentage change in ROA, from independent variables percentage change in CAR and percentage change in NIM. The coefficients indicate the expected change in dlog_ROA for a one-unit change in the respective independent variables, holding all else constant.

Table 6 – Summary of Linear Regression Analysis

Variable	B	SE	β	t(52)	p
Intercept	0.024	0.035		0.67	.504
$\Delta\%CAR$	3.355	1.310	0.318	2.56	.013*
$\Delta\%NIM$	2.111	0.923	0.292	2.29	.026*

Table 7 – Model Fit Statistics

Statistic	Value
Residual Std. Error	0.253 (df = 52)
R-squared	0.195
Adjusted R-squared	0.164
F-statistic (2, 52)	6.30
p-value	.004

*Note. *p < .05. The coefficients were calculated with the intent to predict ∆%ROA where B represents the unstandardized regression coefficients, SE is the standard error, β is the standardized coefficient, and p-values indicate significance levels.*

From Table 1, we derived the multiple linear regression equation:

$$\Delta\%ROA = 0.0235 + 3.3546\Delta\%CAR + 2.1108\Delta\%NIM + e$$

This equation allows for predicting percentage changes in ROA based on percentage changes in CAR and NIM, reinforcing the analysis's significance in evaluating how the independent variables impact the dependent variable.

Based on table 8, it is known that the p-value obtained by the variable $\Delta\%CAR$ is 0.0134. In accordance with the hypothesis testing criteria (*p < 0.05) that H_0 was rejected in favor of H_a. That is, the percentage change in Capital Adequacy Ratio ($\Delta\%ROA$) affects the percentage change in profitability ($\Delta\%ROA$). Similarly the p-value obtained by the variable

∆%*NIM* is 0.0263. In accordance with the hypothesis testing criteria (*p < 0.05) that H_0 was rejected in favor of H_a. That is, the percentage change in NIM (∆%*NIM*) affects the percentage change in profitability (∆%*ROA*).

Table 8 – Partial Correlation Analysis Results Predicting ∆%ROA

Term	Estimate	Std. Error	t value	p value	Significance
Intercept	0.02351	0.03492	0.673	0.5037	
∆%CAR	3.35462	1.31035	2.560	0.0134	*
∆%NIM	2.11080	0.92279	2.287	0.0263	*

*Note. *p < .05.*
Residual Standard Error: 0.2531 on 52 degrees of freedom.
Multiple R-squared: 0.1951; Adjusted R-squared: 0.1642.
F-statistic: 6.304 on 2 and 52 DF; p-value: 0.003538.

DISCUSSION OF RESULTS

In terms of application, considering our estimated regression equation and the fact that both percentage change in CAR and percentage change in NIM have a statistically significant relation with the percentage change in ROA, by setting the percentage change of ROA to be zero, it is predicted that for a Korean bank to sustain ROA at current levels, the percentage change in CAR needs to be greater than 2.35/3.35, assuming that NIM stays constant (i.e., the percentage change in NIM = 0). Likewise, for a Korean bank to sustain the current level of ROA, the percentage change in NIM must be more than 2.11/2.35, assuming that CAR stays unchanged.

In relations to existing literature, our results on the statistically significant relation between CAR and ROA in South Korean banks is in line with that of Tahu et al., which found that CAR has a positive and significant impact on profitability in banking companies listed on the Indonesia Stock Exchange (Tahu et al (2023) and Song 2006, which find that banks with higher capital ratios tend to exhibit better profitability by effectively leveraging factors like asset size, capital ratio, and operating leverage. On the other hand, our results contrast with that of the study of Nurinfiaa and Damayanti (2023), which indicated that CAR had no significant effect on bank profitability (ROA) as well as Septiani and Widati (2023)'s research on Islamic commercial banks in Indonesia, which showed that CAR had an insignificant positive effect on profitability. These contrasting results suggest that the relationship between CAR and bank profitability may be influenced by factors specific to different types of banks or financial environments.

In terms of our result on the statistically significant relation between NIM and ROA in South Korean banks is in line with those of Tsany and Bagana (2022) and Lestari and Setianegara (2020), which find the significant role of NIM in influencing Indonesian banks. While our result contrasts with those of Silva, Chinna and Azam (2020) which finds no such evidence within the context of banks Sri Lanka.

CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

This section synthesizes the findings presented in the outcomes section, concluding the study and ensuring the research objectives were met. It begins by affirming the validity of the results derived from the hypothesis tests conducted. Specifically, the correlation analysis revealed significant relationships between the variables under study, as indicated by p-values of 0.0134 and 0.0263, both of which are below the conventional threshold of 0.05. This supports the rejection of the null hypothesis in favor of the alternative, thereby confirming the statistical significance of the correlations and their reliability for further analysis.

The results of the hypothesis testing are twofold:

- Net Interest Margin (NIM): A substantial correlation exists between NIM and enhanced profitability, resulting in the rejection of the null hypothesis in favor of the alternative

hypothesis. This outcome highlights the influence of NIM fluctuations on bank profitability;

- Capital Adequacy Ratio (CAR): Similarly, the data demonstrates a significant correlation between CAR and enhanced profitability, supporting the alternative hypothesis. This suggests that fluctuations in CAR are critical to bank profits.

Overall, the hypothesis testing confirms that both NIM and CAR are pivotal in enhancing bank profitability.

Further examination addressed empirical challenges, particularly multicollinearity, which required transformations such as the use of logarithmic differences to simplify interpretations and clarify variable relationships. This approach effectively mitigated multicollinearity and ensured the robustness of the hypothesis tests.

An intriguing finding was the absence of a significant correlation between adjusted levels of CAR and NIM and Return on Assets (ROA), which contradicts existing literature. This suggests that adjusted levels might not directly influence profitability as previously thought. However, a significant correlation was observed between the percentage changes in CAR and NIM and the percentage change in ROA, indicating that for ROA to maintain or increase, significant changes in CAR and NIM are necessary. For instance, to stabilize ROA, a percentage increase in CAR of more than 2.35/3.35 is required, assuming NIM remains constant. Conversely, to prevent a decline in ROA, the percentage increase in NIM must exceed 2.11/2.35, assuming CAR is unchanged.

These findings not only confirm some expected associations but also refute others, validating the study's conclusions that the interplay between ROA, CAR, and NIM aligns with theoretical expectations and underscores the importance of considering percentage changes over absolute values in analyzing profitability dynamics within the banking sector.

Finally, we reflect on the study's accomplishments and outlines directions for future research as follows. The meticulous testing and validation of the initial hypotheses, supported by reliable data from the Korea Deposit Insurance Corporation (KDIC) and appropriate data transformation techniques, have fulfilled the study's objectives. The insights gained advance both academic knowledge and practical applications in banking, highlighting the complex dynamics within the sector.

Looking forward, the scope of this research could be expanded by incorporating additional variables and exploring the impacts of external factors such as regulatory changes or economic fluctuations. Including more recent data up to 2023 would provide a comprehensive understanding of ongoing trends and market conditions. Furthermore, given the significant impacts of technological advancements and the COVID-19 pandemic, incorporating these factors into future studies would be pivotal in understanding the evolving landscape.

In essence, this study reinforces the value of empirical research in elucidating the intricacies of financial solvency and profitability in the banking industry. By employing robust methodologies and reliable data sources, it contributes significantly to the existing body of knowledge, providing stakeholders with actionable insights and setting the stage for future research endeavors in this vital field.

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