INFORMATION TECHNOLOGY CAPABILITY, COMPETITIVE ADVANTAGE AND BANK PROFITABILITY: EVIDENCE FROM VIETNAMESE COMMERCIAL BANKS

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Abstract - This study examines the impact of information and communication technology capability (ICT), bank competitive advantage (measured by market power LERNER index) and their interaction on the profitability of Vietnamese commercial banks. Using panel data from 31 banks between 2006 and 2022, the analysis applies the fixed-effect model with robust clustered standard errors. The results indicate that ICT capability and bank competitive advantage are both important determinants of bank profitability; however, their interaction reveals a long-term negative effect, indicating that ICT diminishes the profit advantage of banks with strong market power and that the marginal returns from ICT investment are lower for larger, more dominant banks compared to smaller ones. These findings contribute empirical evidence of how technology and market structure jointly shape financial performance of commerical banks in emerging markets. Policy implications highlight the need to optimize ICT strategies, promote fair competition and support digital transformation across different bank sizes.

Key words - Information and Communication Technology (ICT); competitive advantage; market power; bank profitability; Vietnamese commercial banks

1. Introduction

The Fourth Industrial Revolution, marked with the rapid advancement of digital technologies, has confoundingly transformed the operations of all sectors, with the banking industry being one of the pioneers in this digitalization era. The adoption of technology has enabled commercial banks to enhance the functionality and convenience of their products and services, while expanding access to a broader customer base and promoting financial inclusion. Moreover, the Covid-19 pandemic served as a strong catalyst that accelerated digital transformation and technological adoption across commercial banks. Furthermore, the growing sophistication of information technology and the expansion of financial markets have intensified competition within the commercial banking system - not only among traditional banks but also between banks and emerging fintech firms. To maintain competitiveness, traditional commercial banks have been compelled to innovate. Within this context, investing in and strengthening information technology capabilities, along with enhancing competitive advantage, have become essential and strategic priorities for commercial banks today.

Given this context, examining the impact of information technology capability on the competitive advantage and profitability of commercial banks has become an important and widely discussed topic among scholars. A growing body of research has documented the positive impact of digital transformation and ICT adoption on bank profitability [1]-[4], as well as the positive effect of ICT capability on banks' competitive advantage [5]-[7].

However, as far as the author's concern, the interaction between ICT and market power remains a critical yet underexplored dimension of bank performance. Limited existing literature investigates how ICT capability and market power jointly influence profitability – ie. whether ICT amplifies or weakens the effect of market power on bank earnings, and vice versa. Analyzing this interaction is crucial for developing a comprehensive understanding of how ICT investments translate into profitability within contemporary banking markets.

Therefore, this study aims to clarify the joint effect and moderating role of ICT capability and market power on the profitability of commercial banks. Using an unbalanced panel dataset of 31 Vietnamese commercial banks from 2006 to 2022, the study evaluates both the direct and interaction effects of ICT capability and competitive advantage from market power on bank profitability. The empirical findings provide additional evidence supporting the positive influence of ICT on profitability, while also revealing that ICT tends to weaken the benefits of market power, particularly over the long term.

2. Literature review and Hypothesis development

Information and Communication Technology (ICT) comprises of the technologies, systems, and tools used to collect, process, store, and disseminate information [8], [9]. In the banking sector, ICT includes core banking systems, ATMs, mobile and internet banking platforms, as well as the application of artificial intelligence and machine learning in data processing. Theoretically, ICT is expected to enhance bank profitability by improving productivity and reducing information asymmetry. Empirical evidence consistently supports a positive relationship between ICT investment and profitability indicators such as return on assets (ROA) and return on equity (ROE). For instance, Dabwor et al. [10], Gupta et al. [11], Pierri and Timmer [2], and Del Gaudio et al. [1] find that ICT adoption significantly improves bank profitability across Nigeria, India, the United States, and Europe, respectively. Similar results are reported in

Vietnam by scholars such as N. V. Thuy [12], N.T.T. Quang et al. [3], and H.X. Thuy [4]. Collectively, these studies emphasize three primary roles of ICT in banking operations: reducing operating costs, increasing revenue generation, and improving customer experience and satisfaction.

Beyond ICT capability, competitive advantage obtained from strong market power is another crucial determinant of bank profitability. Market power, typically measured by the Lerner index, represents a bank's ability to price its products and services above marginal cost. The Lerner index is defined as the ratio of the difference between price and marginal cost to price, with higher values indicating stronger market power and competitive advantage [13]. Empirical evidence suggests that banks with greater market power tend to earn higher profits by reducing competition and maintaining wider interest margins [14]-[16].

However, this relationship becomes more complex when ICT is adopted. The interaction between ICT and market power represents a theoretically ambiguous yet important dimension of bank performance. The existing literature outlines two competing mechanisms: the reinforcement argument and the mitigation argument.

The reinforcement argument states that ICT strengthens the competitive advantages of banks with substantial market power. Banks possessing stronger market positions typically have greater financial resources and capacity, allowing them to invest more heavily in advanced ICT infrastructure. Such investments - ranging from AI-driven data analytics to personalized digital financial products - enable these banks to strengthen customer experiences, increase switching costs, and reinforce their market dominance. Evidence from Vives and Ye [17] supports this viewpoint, showing that technologically advanced banks tend to achieve superior market performance. Similarly, Ansari and Sen Gupta [18] find that in India, ICT investments interact with market share (a proxy for market power) to enhance profitability among foreign banks, suggesting a reinforcing effect of technology and market dominance.

Conversely, the mitigation hypothesis argues that ICT erodes market power by reducing information asymmetry, lowering customer switching costs, and facilitating market entry by new competitors. Digitalization increases transparency, enabling customers to easily compare financial products and prices across institutions through online tools and platforms. As a result, the ability of dominant banks to sustain large interest spreads diminishes. Asongu, Le roux and Biekpe [19] provide supporting evidence from Africa, showing that ICT adoption interacts with information-sharing systems to reduce market concentration. Likewise, Koont [20] documents that digitalization decreases market concentration and reduces average markups in deposit and loan markets, suggesting that ICT may ultimately foster competition rather than reinforce dominance.

Despite these insights, empirical evidence on the ICT - market power interaction in emerging economies remains limited, particularly in rapidly digitizing markets such as Vietnam. This study addresses this research gap by analyzing the simultaneous effects of ICT capability, market power (proxied by the Lerner index), and their interaction on bank profitability. Using panel data from 31 Vietnamese commercial banks over the 2006-2022 period, the study aims to test the following hypotheses:

H1: *ICT has a positive effect on bank profitability.*

H2: *Bank competitive advantage from market power has a positive effect on bank profitability.*

H3a: *The interaction between ICT and market power positively affects bank profitability.*

H3b: *The interaction between ICT and market power negatively affects bank profitability.*

3. Research methodology

3.1. Research model and data

To test the research hypotheses, the author employs a panel data regression approach with the following model specification:

$$\boldsymbol{PROF_{it} = \gamma_i + \theta ICT_{it} + \mu LERNER_{i,t} + \sigma ICT_{i,t} * LERNER_{i,t} + \rho CONTROL_{i,t} + \vartheta_{it}}$$

Where:

- $PROF_{it}$ denotes bank profitability (measured by Return on asset ROA and Return on Equity ROE) of bank i in year t;

- ICT_{it} represents the bank's information and communication technology capability of bank i in year t. ICT index was collected from Vietnam ICT Index reports published annually by the Ministry of Information and Communications. This index reflects the capability of financial institutions in applying and developing information and communication technology. It comprises four main components: (i) ICT infrastructure, (ii) ICT human resources, (iii) internal ICT applications, and (iv) online services. In this study, the authors employ the composite ICT index as a comprehensive measure of the overall ICT capability of commercial banks.

- $LERNER_{it}$ captures the competitive advantage from market power of bank i in year t. LERNER index is measured by the formular "$LERNER_{it} = (P_{it} – MC_{it})/P_{it}$" in which P is output calculated as total income divided by total asset and MC is the marginal cost of banks [21]-[24].

- $(ICT \times LERNER)_{it}$ is the interaction term that reflects the joint effect of ICT and market power. To mitigate potential multicollinearity arising from the inclusion of the interaction term, ICT and LERNER index were mean-centered prior to constructing the product term. Mean centering involves subtracting the sample mean from each observation, which reduces non-essential multicollinearity between the main effects and their interaction without altering the coefficient or statistical significance of the interaction term itself [25], [26]. The lag of this interaction is also included in the model to test the potential long-term impact of this joint effect.

- The vector $CONTROL_{it}$ denotes control variables including bank size (SIZE), capital adequacy (ETA), asset growth (TA_GROWTH), and macroeconomic variable inflation (CPI).

The study utilizes data from 31 Vietnamese commercial banks over the period 2006-2022. Financial data for commercial banks were extracted from the FiinPro database, while macroeconomic variables were collected from the World Bank database. Since the ICT data published by the Ministry of Information and Communications are not available for all years, and some banks lack complete ICT information throughout the entire study period, the dataset used in this study is unbalanced data. In addition, as the regression model includes lagged variables, the final sample consists of 221 bank–year observations.

3.2. Research method

Research model was estimated using two commonly applied panel data techniques: the Fixed-Effect Model (FEM) and the Random-Effect Model (REM). After estimating both models, the Hausman test was conducted, and the results indicated that the FEM specification is more appropriate for this study. We believe that the assumptions of FEM model fit our bank-level dataset, as unobserved bank-specific features such as market share and reputation are likely to remain stable over time but may correlate with the explanatory variables [27], [28].

To address potential econometric issues frequently encountered in panel data regressions, including autocorrelation and heteroskedasticity, the study employs robust standard errors clustered at the bank level [29]. This approach ensures consistent and efficient estimation of standard errors, improving the reliability of the result.

4. Research result

4.1. Descriptive statistics and Correlation matrix

Table 1 presents the descriptive statistics of the variables used in the model, while Table 2 reports the correlation matrix among these variables. The results show that all pairwise correlation coefficients among the explanatory variables are below 0.7, indicating no serious multicollinearity problem in the model. Furthermore, the Variance Inflation Factor (VIF) values for all independent variables, as well as the mean VIF, are below 5, confirming the absence of multicollinearity issues [30].

Table 1. *Descriptive statistics*

Variable	Mean	Std. dev.	Min	Max
ROA	0.010575	0.00752	0.00010	0.04570
LERNER	0.15597	0.11536	-0.19133	0.46936
ICT	0.52923	0.11793	0.15810	0.84000
TA_GROWTH	0.29971	0.39726	-0.37261	3.58123
SIZE	32.26540	1.44803	27.38751	35.29051
ETA	0.09515	0.05141	0.03800	0.38225
CPI	0.20370	0.30404	0.00630	0.91569

Table 2. *Correlation Matrix*

	ROA	LERNER	ICT	TA_ GROWTH	SIZE	ETA	CPI
ROA	1						
LERNER	0.653	1					
ICT	0.2453	0.2884	1				
TA_ GROWTH	0.4095	0.0617	0.0878	1			
SIZE	-0.1176	0.388	0.2355	-0.4749	1		
ETA	0.4424	0.0698	-0.1669	0.4119	-0.6404	1	
CPI	0.3362	0.057	0.1685	0.4883	-0.4547	0.2832	1

4.2. Main result

The regression result of research model is illustrated in Table 3, in which the dependent variables in column 1 and 2 are ROA and ROE respectively.

Table 3. *Regression result*

	ROA	ROE
ICT	**0.009****	**0.062***
	(0.003)	(0.037)
LERNER	**0.029*****	**0.257*****
	(0.006)	(0.052)
ICT_LERNER	-0.005	**-0.499***
	(0.030)	(0.294)
L.ICT_LERNER	**-0.037****	**-0.731*****
	(0.016)	(0.224)
TA_GROWTH	0.003*	0.031**
	(0.002)	(0.011)
SIZE	0.002*	0.022**
	(0.001)	(0.009)
ETA	0.041**	-0.170
	(0.017)	(0.113)
CPI	0.006***	0.081***
	(0.001)	(0.019)
_cons	-0.061*	-0.682**
	(0.033)	(0.296)
R^2	0.493	0.360
N	221	221

Robust standard errors in parentheses (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$)

The regression results indicate that ICT capability has a positive and statistically significant impact on the profitability of commercial banks, measured by both ROA and ROE. This finding is consistent with prior studies conducted in Vietnam and internationally, which emphasize the crucial role of ICT in enhancing bank profitability [1] - [3]. The underlying mechanism can be explained by the fact that ICT helps to increase revenue through product innovation [31], reduces operating costs [32], and broadens customer reach through numerous digital channels and better customer analysis [33]. Banks with stronger ICT capability are generally more efficient, better at managing risks, and more innovative in product and service delivery, which jointly contribute to higher profitability.

Similarly, the positive and highly significant coefficient of LERNER index in both models suggests that banks with greater market power - those able to price above

marginal cost - tend to achieve higher profitability. It can be explained that market power enables large banks to maintain stable customer bases, control costs, and sustain higher interest spreads. This result aligns with previous empirical evidence by Koetter et al. [16] and Fernández et al. [15], who demonstrated that market power enhances profitability by enabling banks to sustain interest margins and mitigate competitive pressure.

However, the interaction term (ICT×LERNER) carries a negative sign in the ROE model, implying that while ICT and market power independently enhance profitability, their joint effect may reduce marginal returns, particularly for banks with strong market positions. This can be explained through two mechanisms. First, in large banks with strong market power, ICT investments are often directed toward high implementation cost to maintain existing systems rather than motivating innovation, which reduces their marginal efficiency. This finding is consistent with Maudos & Fernández [34], who found that the benefits of ICT adoption are maximized under moderate competition, while in more concentrated markets, technology tends to act as a fixed cost rather than a strategic advantage. Second, ICT promotes transparency and intensifies competition, thereby eroding the profit advantage previously derived from market power. In the digitalization era, the information asymmetry that once favored dominant banks diminishes, narrowing their profitability gap with smaller competitors.

Notably, the lagged interaction term (L.ICT×LERNER) also exhibits a negative and significant effect in both models, indicating that the adverse impact of the ICT-market power combination persists over time rather than temporary. This long-term negative impact implies that the erosion of competitive advantages from market power continues over time as the ICT enhances market transparency and reduces monopoly in banking industry in the long run.

Among the control variables, total asset growth (TA_GROWTH) and bank size (SIZE) positively affect both ROA and ROE, while capital ratio (ETA) is significantly positive for ROA only. Inflation (CPI) shows a strong positive relationship with both profitability measures, suggesting that banks may benefit from higher spreads in inflationary environments.

Overall, the findings suggest that while ICT investment and competitive advantage from market power independently enhance bank profitability, the joint effect of ICT capability and competitive advantage is negative for commercial banks. In other words, ICT weakens the benefits derived from market power and market power reduces the marginal impact of ICT on bank profitability, especially in the long term.

5. Discussion and Implications

The study findings provide empirical evidence that both ICT capability and market power serve as positive drivers of bank profitability; however, their interaction exerts a dampening effect on bank performance. In other words, ICT tends to reduce the influence of market power on profitability, while market power, in turn, diminishes the marginal effectiveness of ICT investments, particularly among large, dominant banks. Specifically, when a bank already holds a strong market position, excessive investment in technology may not yield proportionate gains in efficiency or profitability. This observation aligns with the theoretical framework of the "technology saturation effect" proposed by Kohli and Grover [35], which suggests that the benefits of ICT are maximized when driven by competitive innovation rather than the maintenance of monopolistic advantages. The negative joint impact of ICT and market power can also be explained through the reduction of information asymmetry: as ICT promotes greater transparency and market openness, the relative advantage of dominant banks is eroded. This phenomenon is often observed in emerging markets undergoing rapid digital transformation.

From a policy perspective, the findings of this study provide several important policy implications for both commercial banks and regulatory authorities. First, while ICT enhances profitability, the long-term negative interaction between ICT and market power suggests that banks should develop long-term ICT strategies focused on adaptability and innovation, rather than short-term infrastructure expansion. In particular, large banks should integrate ICT advancement with innovation management instead of adopting digital tools merely to follow industry trends. This prevents ICT investment from becoming a fixed cost that negatively affects profitability in the long run. Second, regulatory authorities, such as the State Bank of Vietnam, should foster fair competition and expand the digital banking environment, ensuring that technological progress enhances efficiency rather than reinforcing market dominance. Moreover, financial technology policies should emphasize support for small and medium-sized banks in their digital transformation process, as ICT tends to have a stronger marginal effect on profitability in this group. Promoting healthy competition - by enabling smaller banks to access digital infrastructure and shared technology platforms - can help maximize the systemic benefits of ICT while preventing market concentration. At the same time, policymakers should closely monitor the long-term effects of digital transformation on the structure of the Vietnamese banking sector to propose timely adjustments in monetary and financial policies.

Overall, this study contributes to the growing literature on the relationship between technological investment and financial performance in the context of Vietnamese commercial banks. It also extends the empirical understanding of the interaction between ICT capability and competitive advantage, an area that remains underexplored in emerging markets.

Despite its contributions, several limitations should be acknowledged. ICT data are not fully available, particularly for smaller banks, which may limit the representativeness of the sample. Moreover, the study does not examine the potential existence of ICT absorptive capacity thresholds, technological dependence, or cybersecurity risks, which may affect bank performance if

not properly managed. These issues reveal meaningful directions for future studies.

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