

# The Impact of Digital Banking on the Performance of Commercial Banks in Vietnam by Using the CAMELS Ratio Framework

Hoang Trinh Xuan <sup>a,\*</sup>, Khanh Thai Hong Thuy<sup>b</sup> & Lan Nguyen Mai<sup>c</sup>  
<sup>a,b,c</sup>*Finance and Accounting, Nguyen Tat Thanh University, Ho Chi Minh City*  
<sup>\*</sup>txhoang@ntt.edu.vn

**Abstract:** Vietnam has 31 banks, in which there are more than 27 banks with audited annual published financial statements. Up to the present time (2023), there have been 06 banks converted on the banking application into digital banking, the remaining banks are still electronic banks (E-Banking). The financial ratios in this study including: Capital Adequacy, Asset Quality, Management Efficiency, Earnings, Liquidity, and Market Risk Sensitivity which are collectively known as CAMELS rates and digital banking adoption. This study aims to evaluate the performance of the banking sector and the impact of digital transformation on the performance of commercial banks in Vietnam in terms of Efficiency and empirical significance in terms of Panel regression mode. Therefore, pooled data of 28 the banks operating in Vietnam from 2007 to 2022 have been employed. Methods used in the study are the panel data regression methods including fixed effect model, random effect model then use Hausman test, autocorrelation test to select the best model. The results of this model are intended to help banks identify the factors that affect their performance and devise strategies to apply digital banking that are appropriate for their banks.

**Keywords:** CAMELS model, digital banking, listed commercial banks, Vietnam

## 1. Introduction

Bank profits usually come from two main sources: credit activities and other financial service activities. Credit activities in recent years accounted for a large proportion of the bank's profits, mainly lending to real estate, or using real estate as collateral. However, from 2020 until now, the cooling of the real estate market has caused real estate prices to decrease, thereby affecting credit activities. Some previous real estate mortgage loans are gradually becoming into bad debt because the market value of the real estate is falling below the credit balance. This requires that banks, instead of focusing on credit activities as before, need to gradually switch to other financial services (Alnemer, 2022; Dang, 2022). Electronic banking applications (E-banking) and Digital banking are two key customer service methods in financial services because of the popularity and convenience of smartphones (Nguyen, 2020). Up to the time of the study (2023), out of 31 joint stock commercial banks in Vietnam, six banks have converted from E-banking to Digital Banking. Up to the time of the study (2023), out of 31 joint stock commercial banks in Vietnam, 6 banks have converted from E-banking to Digital Banking, in which the digital transformation bank is as early as 2017. The nearest digital conversion bank is in 2022.

The CAMEL framework was issued by the Uniform Financial Institutions Rating System (UFIRS) and was approved by the Federal Financial Examination Council (FFIEC) in 1979. As revised by UFIRS in 1997, this framework added a sixth element and is now known as CAMELS. The CAMELS framework includes six essential components to assess a bank's financial health: Capital Adequacy (C), Asset Quality (A), Management Efficiency (M), Earnings (E), Liquidity (L) and Market Risk Sensitivity (S). The ratings of these six components are based on a scale of 1 to 5. Where the highest rating of 1 indicates the best performance, best risk management has been implemented and therefore the lowest level of monitoring

concern. The lowest is a rating of five, which represents the worst performance, inadequate risk management has been implemented and therefore requires the highest level of monitoring attention.

The purpose of this study is to analyze the performance of banks using the CAMELS ratio framework and the bank's transition to digital banking. The results of this study are intended to help banks identify the factors affecting their performance and devise a digital banking application strategy that is suitable for their banks.

## **2. Literature Review**

### *2.1 Performance of Commercial Banks*

When banks effectively use resources in meeting their goals and manage to generate more revenue than they cost, they generate profits. When banks use resources efficiently to meet their goals and management generates more revenue than costs, they generate profits. In studies, profitability is used to evaluate the performance of banks. The most common performance measures of Banks are ROCE - rate of return on capital employed, NIM - net profit margin (Gul et al., 2011; Kumar & Malhotra, 2017). There are also two commonly used metrics, ROA, and ROE (Hibba Saeed et al., 2019; Hewaidy et al., 2020)

### *2.2 Capital Adequacy*

Capital adequacy is a source of capital that is expected to maintain the stability of banking operations. At the same time, Capital adequacy maintains and increases customers' confidence in the event of risks such as credit risk, market risk and liquidity risk. This expected capital will absorb possible bank losses (UFIRS,1997; Dang, 2011). Capital Adequacy is measured by the ratio of total equity to total loans (Muhmad and Hashim, 2015), total regulatory capital on risk weighted assets (Hewaidy et al., 2020) and equity to total assets (Hibba Saeed et al., 2019; Magoma et al., 2022)

*H1: There is a significant relationship between capital adequacy (CA) and bank performance.*

### *2.3 Asset Quality*

In the banking sector, asset quality refers to the assessment of the credit risk of any asset. One of the most important asset classes is the loan portfolio. These are the biggest risks that banks face is the risk of loan loss arising from overdue loans. This requires the bank to have provisions for possible losses. These losses will be erased from the capital and reduce the bank's operational efficiency. To assess the impact of Asset Quality on bank's performances, two commonly used ratios are non-performing loans on Total Loans (Al Zaidanin, 2020; Hibba Saeed et al., 2019) and Provisions for Loan Losses on Total Loans (Hewaidy et al., 2020; Muhmad & Hashim, 2015).

*H2: There is a significant relationship between asset quality (AQ) and bank performance.*

### *2.4 Management Efficiency*

Effective management aims to ensure the bank's stable, safe, and efficient operation. Management efficiency is the ability of the board of directors, the bank's leaders, to identify and measure risk management at a bank with the aim of reducing risk and increasing the bank's operational efficiency.

Management efficiency can be measured in terms of total earnings per employee, operating profit per employee (Hewaiddy et al., 2020) or a ratio of total loans to total deposits (Gautam, 2020).

*H3: There is a significant relationship between management efficiency (MQ) and bank performance.*

## 2.5 Earning Quality

The Earnings quality depends on the effectiveness of the bank's asset and liability management. An increase in earnings quality will increase the confidence of depositors, creditors, investors, and the public. Earnings quality is usually measured by NIM -net interest margin, the ratio of net interest to total assets. (Muhmad & Hashim, 2015) and the ratio of operating expenses to income (Hewaiddy et al., 2020).

*H4: There is a significant relationship between earning quality (EQ) and bank performance.*

## 2.6 Liquidity

Liquidity is understood as the assurance that cash or assets can be easily converted into cash to meet the needs of paying current and future financial obligations. Liquidity risk is a bad thing that no bank or business wants to happen, because in that situation the bank's cost of capital will be higher, thereby reducing the operational efficiency of the organization. Abundant cash and cash equivalents will help the bank perform better payment activities, thereby contributing to increased income from non-interest activities. Therefore, liquidity is also a criterion to evaluate the bank's performance. To measure this criterion, there are several ratios such as cash to customer deposits (Muhmad and Hashim, 2015), cash to total assets (Kumar & Malhotra, 2017; Magoma et al., 2022).

*H5: There is a significant relationship between liquidity (LIQ) and bank performance.*

## 2.7 Sensitivity to Market Risk

This is the sixth factor in the CAMELS model, reflecting how changes in interest rates and stock prices can affect the capital and income of the bank. Although bank performance is affected by price changes and financial market fluctuations, many studies have been omitted from the CAMELS framework because of difficulties in accounting and financial measurement. Therefore, in the study of Roman and Sargu (2013), is decided as the size of the bank and is calculated by the ratio of that bank's assets to the total assets of the banking sector.

*H6: There is a significant relationship between sensitivity to market risk (SR) and bank performance.*

## 2.8 Digital Banking

The digital banking system can perform all the services that traditional banks can perform without customers needing to go to the bank. Meanwhile, E-banking is understood as an expanded service including money transfer and account balance management. Digital banking benefits customers and enables banks to deliver more financial products quickly and reduce transaction costs. Thus, saving the cost of providing services to customers and increasing the bank's operational efficiency (Alnemer, 2022).

H7: *There is a significant relationship between digital banking and bank performance.*

### 3. Data and Methodology

#### 3.1 Sample and Data

The data in this study is collected from 28 banks out of 31 joint stock commercial banks in Vietnam and those that have published their audited annual financial statements for the period 2007 to 2022 (16 year). However, among these banks, there are banks that were established after 2007 and there are some banks that have not published their audited financial statements for 2022. Therefore, the data of this study includes 438 observations. and is unbalanced panel data.

Estimation methods: Pool OLS, Fixed Effect Model, and Random Effect Model. Model error checking included: (i) Test of multicollinearity: VIF coefficient used to test; (ii) Variance test; and (iii) Autocorrelation test: Using Wooldridge test to check correlation phenomenon. If the model defects occur, the handling measures are applied: For the case of multicollinearity, remove the variables with the possibility of multicollinearity; for the phenomenon of variance and autocorrelation, make corrections by FGLS estimation method to overcome this phenomenon.

#### 3.2 The Regression Model

To estimate the relationship between the six components of CAMELS and the impact of digital banking transformation on the performance of the banking industry according to the following regression equation:

$$ROA_{it} = a_0 + \beta_1 CA_{it} + \beta_2 AQ_{it} + \beta_3 MQ_{it} + \beta_4 EQ_{it} + \beta_5 LIQ_{it} + \beta_6 SR_{it} + \beta_7 Digitalbanking_{it} + e_{it} \quad (1)$$

$$ROE_{it} = a_0 + \beta_1 CA_{it} + \beta_2 AQ_{it} + \beta_3 MQ_{it} + \beta_4 EQ_{it} + \beta_5 LIQ_{it} + \beta_6 SR_{it} + \beta_7 Digitalbanking_{it} + e_{it} \quad (2)$$

$$e_{it} = v_i + u_{it}$$

Table 1. *Definition and Measurement of Variables*

Definition	Variable	Measurement
Bank performance	ROA	Profit after tax / total assets
	ROE	Profit after tax/owner's equity
Capital Adequacy	CA	Total Equity / Total Assets
Asset Quality	AQ	Provision ratio for loan loss / (Customer loans + Interbank loans)
Management Efficiency	MQ1	Operating expenses/total assets ratio
	MQ2	Net income/Total loan
Liquidity	LIQ	cash/customer deposit
Earning quality	EQ	Net interest income/total assets

Sensitivity to market risk	SR	Size of bank's Assets = Bank assets/total assets of the banking sector.
Digital Banking	Digital Banking	is a dummy variable that takes the value = 1 for banks that have converted to digital banking, = 0 for the remaining banks

Researchers will apply by estimating the squared method of POOL - OLS method, fixed effect (FEM) and random effect (REM) on Stata 15 software. In FEM,  $v_i$  is the estimated parameter, which represents unobserved factors that vary between subjects but do not change over time. While REM,  $u_{it}$  is assumed to be random,  $u_{it}$  represents unobservable factors that vary between subjects but change over time. If the FEM and REM models suffer from phenomena such as Heteroskedasticity or autocorrelation, the Researchers will apply the estimation method is generalized least squares (GLS).

## 4. Results

### 4.1 Characteristics of Research Sample

According to Table 2, dependent variables are two variables ROA, ROE has 438 observations with mean values of 1% and 11%, respectively, with the lowest return range of 0%, the largest being 6% for the variable ROA belonging to the variable ROA. about Lien Viet in 2008 and the biggest ROE belonged to TPBanks at 82% in 2011.

Table 2. Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	438	1%	1%	0%	6%
ROE	438	11%	8%	0%	82%
CA	438	10%	7%	4%	81%
AQ	438	1%	1%	0%	4%
MQ1	438	2%	1%	-2%	5%
MQ2	438	6%	3%	0%	44%
LIQ	438	2%	3%	0%	26%
EQ	438	3%	1%	-1%	8%
SR	438	4%	5%	0%	25%

The Capital Adequacy (CA) is calculated as a ratio of equity to Total assets with an average value of 10%, The Asset Quality (AQ) is calculated as the ratio of provision for loan loss to total loans to customers and deposits/interbank loans, because not only on customer credit balance, this ratio should has an average value of 1% and is less than the required reserve ratio for the reserve requirement that the central bank requires for the amount of loans to customers.

Management Efficiency (MQ), which is expressed as 02 variables MQ1 (Operating Cost Ratio to Total Assets) with an average value of 2% and variable MQ2 (net income/total loan) with an average value of 6%. Although MQ1 and MQ2 have the same assessment of management efficiency, they are different in nature because MQ1 evaluates the cost ratio, while MQ2 evaluates the income ratio.

Earning quality (EQ) is calculated as net interest income on total assets with an average value of 3%. The Liquidity variable (LIQ) is calculated as a ratio of cash to total customer deposits with an average value of

2%. Sensitivity to market risk (SR) is an assessment of bank size calculated as the ratio of each bank's assets to the total assets of the banks in the sample each year with an average value of 4% and a maximum of 4%. 25%.

## 4.2 Regression Results

Before entering the regression model, we will evaluate the pairwise correlation of the variables and the VIF coefficients of the variables to avoid multicollinearity in the model. Table 3 below shows the degree of similarity of each variable. pairs and VIFs of the variables.

Table 3. *Correlation Matrix*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	VIF
(1) ROA	1.000										-
(2) ROE	0.741	1.000									1.52
(3) CA	0.336	-0.203	1.000								1.92
(4) AQ	-0.140	0.017	-0.302	1.000							1.66
(5) MQ1	0.174	0.126	0.131	0.128	1.000						1.24
(6) MQ2	0.545	0.204	0.554	-0.122	0.206	1.000					2.06
(7) EQ	0.549	0.352	0.233	0.152	0.420	0.542	1.000				1.91
(8) LIQ	0.151	0.100	0.101	-0.172	-0.008	0.058	-0.012	1.000			1.06
(9) SR	-0.001	0.268	-0.317	0.516	0.021	-0.074	0.126	-0.026	1.000		1.59
(10) Digital Banking	0.243	0.211	-0.016	0.150	0.052	0.118	0.205	-0.082	-0.003	1.000	1.13

After analyzing the correlation matrix and VIF. The researcher runs regression for two models ROA (1) and ROE model (2), respectively, and performs tests such as: variance change Heteroskedasticity test, VIF, autocorrelation (Autocorrelation in panel data test) according to the estimation methods POOL -OLS, Fixed Effect (FEM), Random Effect (REM). Results obtained are as follows:

ROA (1) model: All the VIF coefficients of the independent variable are less than 2, this shows that the model does not have multicollinearity. The Hausman test between FEM and REM methods shows the results of the model. FEM method has better estimation results because  $\chi^2 = 15.86$  and  $p\text{-value} = 4.4\%$ . The variables in the model have not detected autocorrelation (Autocorrelation in panel data) because  $F(1,27) = 3.77$  and  $P\text{-value} = 6.72\%$ . In addition, all estimation methods show that the model suffers from Heteroskedasticity.

ROE (2) model: All the VIF coefficients of the independent variable are less than 2, this shows that the model does not have multicollinearity. The Hausman test between FEM and REM methods shows the results of the model. FEM method has better estimation results because  $\chi^2 = 16.2$  and  $p\text{-value} = 3.43\%$ . The variables in the model have not detected autocorrelation (Autocorrelation in panel data) because  $F(1,27) = 2,964$  and  $P\text{-value} = 9.66\%$ . In addition, all estimation methods show that the model suffers from heteroskedasticity.

Both the ROA model (1) and the ROE model (2) show that the FEM estimation method is a reliable estimator. However, both regression models have heteroskedasticity when estimating FEM and do not suffer from autocorrelation. Therefore, the researcher uses FGLS estimation method to overcome this phenomenon. FEM and FLGS estimation results are presented in Table 4.

According to the regression results in Table 4, it helps us to assess the impact of the factors in the CAMELS model and the digital transformation on the performance of the joint stock commercial bank in Vietnam.

Table 4. Regression Results

	FEM		FGLS	
	ROA	ROE	ROA	ROE
CA	0.0175**	-0.325***	0.00783	-0.427***
AQ	-0.291***	-3.358***	-0.174***	-2.579***
MQ1	-0.0164	0.644	-0.224***	-1.706***
MQ2	0.0250*	0.141	0.0717***	0.782***
EQ	0.253***	1.959***	0.270***	2.047***
LIQ	0.0288**	0.274*	0.0283***	0.213***
SR	0.00303	0.598*	0.00952*	0.431***
Digitalbanking	0.00413**	0.0321*	0.00619***	0.0476***
_cons	0.00173	0.0729***	0.000665	0.0696***
Observation	438	438	438	438
R <sup>2</sup> adj.	43.50%	31.12%	46.04%	34.41%
Heteroskedasticity test (chi2)	1398.53***	724.41***	-	-
Serial Correlation	No	No	-	-

\* significant at the 5% level, \*\* significant at the 1% level, \*\*\* significant at the 0.1% level

Capital Adequacy (CA) has a negative effect on ROE ( $\beta = -0.427$ ) and no effect on ROA. This shows that equity is an important factor contributing to ensure stable operation of the bank. However, if banks do not know how to take advantage of large equity capital to promote their role in credit intermediaries to mobilize deposits and payments to create an advantage in market share in the industry, this is also a minus point. At the same time, the results of the regression equation also confirm the hypothesis:

*H1: There is a significant relationship between Capital Adequacy (CA) and bank performance.*

Asset Quality (AQ) as measured by Loan Loss Provision Ratio on Loans to Customers and Interbank Loans/Deposits has a negative effect on ROE ( $\beta = -2.58$ ) and ROA ( $\beta = -0.17$ ). If the bank continues to expand loans without paying attention to the quality of the credit, it will increase the bad debt, which will also increase the loan loss provision. Therefore, banks need to gradually shift to seek profit in other financial and payment services that will contribute to the quality of asset utilization. Regression results also accept hypothesis:

*H2: There is a significant relationship between Asset Quality (AQ) and bank performance.*

Management Efficiency (MQ), MQ1 is the ratio of operating expenses that has a negative impact on ROE ( $\beta = -1.7$ ) and ROA ( $\beta = -0.22$ ). Meanwhile, MQ2 is the ratio of income that has a positive effect. with ROE ( $\beta = 0.78$ ) and ROA ( $\beta = 0.07$ ). Banks need to actively transform digitally to cut operating costs as well as increase income, which will increase ROA and ROE. This result also accepts the hypothesis.

*H3: There is a significant relationship between Management Efficiency (MQ) and bank performance.*

Earning quality (EQ) as measured by net interest income on total assets has a significant impact on ROE ( $\beta = 2.04$ ) and ROA ( $\beta = 0.27$ ). This shows that the efficiency of Vietnamese banks over the period. 2007 – 2022 still largely depends only on credit activities but still has not focused on developing other financial activities outside of credit activities. With the Beta coefficient in the results, the hypothesis is also accepted.

*H4: There is a significant relationship between Earning quality (EQ) and bank performance.*

Liquidity (LIQ) measured as the ratio of cash to total customer deposits has a positive effect with both ROE ( $\beta = 0.21$ ) and ROA ( $\beta = 0.03$ ). This shows that cash contributes to efficiency increase. performance of the bank because when this amount of money is not involved in lending activities, cash will participate in other financial services of the bank. This result proves the hypothesis.

*H5: There is a significant relationship between Liquidity (LIQ) and bank performance.*

Sensitivity to market risk (SR) is an assessment of bank size calculated by the ratio of each bank's assets to the total assets of the banks in the sample by year. SR represents the size and market share of the bank. goods have a positive impact on ROA and ROE. The results of the regression equation (table 4) also accept the hypothesis.

*H6: There is a significant relationship between Sensitivity to market risk (SR) and bank performance.*

Digital Banking has a positive effect on ROA and ROE with more than 99% reliability, indicating that the application of Digital banking has the effect of increasing the bank's operational efficiency. The results of the regression equation also accept the hypothesis.

*H7: There is a significant relationship between Digital Banking and bank performance.*

## **5. Conclusion**

This study has confirmed the impact of 06 CAMELS Framework factors on the performance of Vietnamese joint stock commercial banks, including: Capital Adequacy (CA), Asset Quality (AQ), Management Efficiency (MQ), Earnings (EQ), Liquidity (LIQ) and Market Risk Sensitivity (SR). Thereby also assessing the impact of the application of digital banking on the performance of joint stock commercial banks in Vietnam. In addition, the results of the coefficients in the regression equation also show that, in the period 2007 - 2022, the performance of Vietnamese joint stock commercial banks largely depends on credit activities. Because the EQ is quite large, it is measured by net interest income on total assets.

Liquidity coefficient (LIQ) has a positive effect on ROA, this result is contrary to the study in Malaysia by Muhmad & Hashim (2015). However, this shows that Vietnamese joint stock commercial banks have gradually moved. to service activities such as payment services for individuals and organizations such as payment for electricity and water bills, shopping, money for buying tickets for means of transport, etc., have contributed to operational efficiency.

Asset Quality (AQ) as measured by Loan Loss Provision Ratio on Customer Loans and Interbank Loans/Deposits has a negative effect on ROE and ROA. This result is similar to the study in Kuwait. by Hewaidy and Kayed (2020). It also shows that joint-stock commercial banks in Vietnam should not be



excessively widening their credit lines at present because this will lead to loss provision. loans increased. Instead, banks gradually shifted to other service activities besides the traditional credit segment.

Moreover, Digital Banking has a positive effect on ROA and ROE with more than 99% confidence. Although the number of observations in the sample is quite modest, only 25 observations out of 438 of 06 banks have digitally converted. Out of a total of 28 joint stock commercial banks, it has been shown that the application of Digital banking has the effect of increasing the bank's operational efficiency. As reckon the E-banking is just an additional product that helps customers transfer money and manage accounts. Meanwhile, Digital Banking can perform all transactions like a traditional counter on the internet. This allows digital banking to have the potential to provide payment services or financial services and financial management beyond what e-wallets or E-Banking can provide as investment management services.

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