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MANAGEMENT EFFICIENCY IN ASSET UTILIZATION OF CAMBODIA'S BANKING INDUSTRY

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ABSTRACT

This paper investigates the extent to which the major bank-specific factors, i.e., loan growth (LG), non-performing loans (NPL), liquidity (LQ), and capital growth (CAG), explain profitability among Cambodian commercial banks using return on assets (ROA). A paned ARDL model is used with the Pooled Mean Group (PMG) and Dynamic Fixed Effects (DFE) estimations to capture long-run equilibrium relationships as well as short-run dynamics among these variables. The substantially negative error-correction terms (ECTs) for the models indicate a stable cointegrating relationship between ROA and the independent variables. The empirical evidence suggests that loan growth is potentially the most significant driver of long-run profitability. The positive and highly significant LG coefficients of both PMG and DFE suggest that those banks that conduct economies of strong credit expansion would ultimately lead to a higher ROA. Since the short-run impact of LG is negative, this could be due to the up-front costs of credit screening, monitoring, and provisioning required before new loans can start earning income. NPL, as a measure of credit risk, has a significant negative effect on profitability in the short run, indicating that increasing bad assets deteriorates interest income and leads to more provisions for loan loss. Although the long-run impact of NPLs is less pronounced among estimators, PMG outcomes suggest there is a weak guiding-down effect. Liquidity has a highly negative long-run effect in the PMG, indicating that holding low-yield liquid assets leads to lower returns, but no short-run effect. Capital appreciation is generally good for profits, but surprisingly the DFE model does not show this, and PMG only finds considerably weaker gains in the long run.

KEYWORDS: Return On Asset; Loan Growth; Non-Performing Loan; Liquidity; Capital Growth; Panel ARDL Model; PMG, DFE.

1. INTRODUCTION

Commercial banks are a key player in the emerging financial market of Cambodia. Running under a dual-track system with the National Bank of Cambodia (NBC) at its helm, the sector has rapidly expanded in terms of size, complexity, and competition since the early 2000s. The banking sector included 58 commercial banks, and along with specialized banks as well as microfinance institutions, the former held a majority of assets and credit to the economy up until December 2023 (National Bank of Cambodia, 2024). During this period, credit has grown rapidly and increased substantially in size relative to the size of the economy, which may have implications for asset quality, risk management, and efficiency of bank asset allocation.

Banks in Cambodia are thus also subject to high levels of financial depth and foreign presence despite often being referred to as "overbanked" and highly dollarized, with the largest proportion of deposits appearing in US dollars across banks' balance sheets (Ahmed & Runggcharoenkitkul, 2014). Dollarization, either in the form of hysteresis or confidence effects due to past volatility, influences bank funding structure, liquidity management, and interest rate determination (Odajima & Aiba, 2019). In the light of this situation, it is important to understand how commercial banks use their assets efficiently and manage risk accordingly to remain profitable so that financial stability can be achieved and inclusive economic development can be supported.

Recent empirical studies on the banking industry in Cambodia have begun to piece together a coherent narrative regarding what drives commercial bank profitability, albeit taking different data, models, and profitability measure approaches. One of the few systematic studies is conducted by Lim and Barnett (2020), which examines panel data over 2012–2017 employing both fixed and random effects with return on asset (ROA) as the dependent variable. The authors report that bank-specific factors seem more important than macro variables. A high equity-to-asset ratio and low operating expenditure (i.e., costs) have a positive impact on profitability, but a high non-performing loans (NPLs)-to-loan ratio harms in terms of ROA. In contrast, Gross Domestic Product (GDP) growth and inflation are not significant when bank characteristics are controlled for, implying that management and balance sheet structure are more important than the macro environment in Cambodian banks.

The balance-sheet composition is revisited in Lim et al. (2025), who emphasize the combination of liquidity and profitability for 22 banks in 2011–2022. They employ pooled Ordinary Least Square (OLS), fixed effects (FE), random effects (RE), and one-step GMM (Generalized Method of Moments), and they consistently report that higher liquidity ratios dampen profitability, confirming the opportunity cost associated with holding low-yield liquid assets. Nevertheless, net interest margin and reduced operating expenses are far more strongly related to profits, while macroeconomic variables like money supply and inflation matter less.

All these studies share some common profitability drivers for Cambodian commercial banks, such as loan size and net interest margin on the positive side and NPLs, high operational expenses, and excess liquid assets on the negative side, with equity and deposit funding stabilizing their profit-making impact. The general literature indicates that, in Cambodia's rapidly expanding yet competitive banking industry, the banks that achieve improved performance are those able to increase credit and diversify income without undermining asset quality or cost efficiency.

Despite using static models (pooled OLS, FE, and RE) and a dynamic model (one-step GMM), however, those models are unable to measure the short- and long-run dynamic relationship between a bank's profitability and its determinant, especially a measurement of the speed at which the profit model adjusts toward equilibrium due to a short-run shock, which the current research considered to be a research gap. In order to investigate in depth to assess factors determining commercial banks' ROA, a panel ARDL (autoregressive distributed lags) model is applied.

The organizational structure of the study has been classified into five sections. This section is defined to be the first section. The literature review is presented in section two, followed by section three, research methodology. Moreover, the empirical results and conclusion of the study are provided in sections four and five, respectively.

2. LITERATURE REVIEW

Through studies surveyed, a connection with the relationship between bank lending and profitability has been extensively explored, which has shown that credit expansion can have positive and negative effects on profitability depending upon credit quality, credit linkages prevailing in the market, and risk situations. All of the studies have in common a concern to analyze the internal determinants of bank profitability, with an emphasis on how loan ratios — whether measured as loan intensity, loans-to-asset

ratio, or market-wide expansion of loans—determine ROA across banking systems.

Sufian (2009) investigates Malaysian commercial banks by applying a fixed-effects regression model to annual bank-level data from the period 2000-2004. The findings of this study indicate that loan intensity has a negative and statistically significant impact on ROA, indicating that in periods of economic turbulence, higher exposure does not only involve a greater credit risk but also comes with the cost of profitability as well. The study also demonstrates that a loan increase does not inherently result in profit enhancement unless favorable economic conditions for quality lending exist. Applying the above perspective to emerging economies, Al-Harbi (2019) utilizes a fixed-effects OLS model by considering 686 traditional banks present in 52 OIC members. The findings of the study further reveal that credit impairs return on assets and may justify such claims that when loan demand or the credit management system is weak, aggressive lending can bring about a higher cost of funds and a class of non-performing loans.

Roy et al. (2019) further obtain a more subtle pattern using Indian bank-level data and two-stage least squares (2SLS): loan growth enhances profitability due to income-generating assets. However, they also indicate profitability and liquidity go in opposite directions: increased lending can depress liquidity unless it's accompanied by capital buffers. Nguyen and Vu (2025) apply panel methods to study Vietnamese banks (FEM, REM, and FGLS). They observe that the loan-to-deposit ratio has a positive but weak link with ROA. Conversely, we obtain a strong and positive impact of lending on NIM, which confirms that loans contribute to increasing margins regardless of always improving profitability. These analyses reveal that loan supply affects profitability through channels that increase revenues as well as risk. Expansion in lending increases margins and potential returns, but if the new lending is characterized by either poor credit quality, an economy-wide slowdown, or high NPLs, such effects can override gains with depressed ROA.

Banks are at the heart of economic development because they provide the money needed for companies, governments, and families to increase their activity. The banks' ability to mobilize money from where it is idle and unwanted to where it is wanted and needed sustains the effective working of market-based economies. They stimulate investment and the overall economic growth by mobilizing deposits and providing crediting facilities (Vrotslavskyy & Dropa, 2024). As intermediaries that bring together those units that have excess funds and those units with financing needs, banks also contribute to preserving financial stability and the foundation of long-term development (Gözkonan et al., 2024). Banking systems influence development globally but are particularly important in developing countries such as Cambodia, where capital markets are underdeveloped and the strong role of banks is at the heart of trade finance and economic progress (Vrotslavskyy & Dropa, 2024).

Balancing between profit and liquidity that guarantees the stability and sustainable development of banks. Profits assist in long-run growth, and liquidity is required to meet short-term obligations (interest on the debt) without causing distress. This trade-off between income from lending and exposure to liquidity risk is intrinsically difficult to manage (Bianchi & Bigio, 2022). Empirical findings indicate the way by which banks handle liquidity has a significant impact on their performance, as several indicators of liquidity influence major profitability measures like return on assets (ROA) and return on equity (ROE) (Ajayi & Lawal, 2021; Thinh et al., 2022). This connection is particularly relevant for developing and emerging counties, where banks are working with the need to grow quickly and within a shallow financial system. Therefore, these associations should be carefully assessed by policymakers and bank executives in order to strengthen the resilience of the banking sector, improve the effectiveness of operations, and play their role for economic growth (Abbas et al., 2023; El-Chaarani et al., 2023).

Despite all existing work, there are important blind zones that remain unanswered, in particular those works oriented towards the study of banks' evolution over time and their comparison among nations that limit our knowledge on how liquidity and profitability play out in different economies (Rodriguez et al., 2014). This constraint holds true in the context of Cambodia, where capital markets are still underdeveloped and few have analyzed how the domestic macroeconomic environment and legal systems affect the link between liquidity and profitability. To close these gaps, it would help to deepen understanding about country- and sector-level dynamics, which may be invaluable for designing better financial management interventions—especially in small economies such as Cambodia (Rodriguez et al., 2024; Qaysi & BenMabrouk, 2024).

Static panel methods, namely pooled OLS, fixed effects (FE), and random effects (RE) models, are

employed frequently in empirical banking studies to examine the determinants of bank performance and profitability. Pooled OLS often serves as a starting point for cross-sectional estimation: for instance, it forms the basis of studies on the profitability impact of digitalization on Indian banks (Lolemo & Pandya, 2023) and earnings in Bangladesh (Gazi et al., 2024) and Kenyan Shariah-compliant banks (Oseko et al., 2024). When the concern is to control for unobserved, time-invariant firm characteristics, as in the U.S. regional bank analysis (Umeorah et al., 2024) and Chinese city commercial bank analysis (Jigeer 2:15 PM??Koroleva, 2023), FE estimators are preferred. On the other hand, RE models are used when bank-specific effects are assumed random and independent of the regressors, as has been the case for research into Islamic rural banks in Indonesia (Sudarsono et al., 2024).

Dynamic panel data methods are essential for analyzing data that are observed over time for a large number of units, since they allow for modeling changing relationships between variables while correcting for unobserved heterogeneity and endogeneity. These models are commonly used in econometrics to address causal inference when both time varying and entity-specific effects of covariates matter and have shown a flexible adaptation to different data structures and dependence patterns (Helske & Tikka, 2024). Among these tools, the generalized method of moments (GMM) is one of them that focuses on endogeneity and provides consistent estimates when standard approaches fail (Carrasco & Nayihouba, 2024). GMM has become, thus, commonplace in empirical finance—for example, research into Pakistani banks demonstrating that capital adequacy can improve profitability and increased liquidity risk may dilute returns due to the magnification of default risk (Rahman et al., 2020).

In research on global banking, capital adequacy repeatedly turns out to be an important determinant of profitability. Although studies focus on interdependence between capital and the performance of banks under various banking regulations, this relationship is not tested using different methodological frameworks and different banking regimes, but their results indicate that the capital adequacy promotes or restricts ROA depending upon regulatory climates, risk environment, and type of capital. Lee et al. (2013) study U.S. regional banks employing GMM in evaluating bank-specific, industry, and macroeconomic effects on profitability. Their findings suggest that solvency (the equity-to-assets ratio) significantly enhances ROA, reduces the bankruptcy risk, and cuts down funding costs for banks, in line with the conventional wisdom that well-capitalized institutions better cushion shocks and are more efficient. This positive relationship between capital and profitability provides a point of comparison with the emerging-market cases. Building upon this observation, Siddik et al. (2017) study Bangladeshi banks via dynamic panel GMM and also conclude that capital adequacy has a positive and significant impact on ROA. The authors find that high levels of capitalized capital allow for good lending to be practiced, and thus better interest earnings are possible, supporting stability-based theories of capital. Their results provide support for the view that, especially in emerging countries with greater credit risk, capital buffers improve profitability.

Yao et al. (2018), applying system-GMM on Pakistani banks, report similar evidence; solvency, proxied by the equity-to-asset ratio, is among the most significant factors that drive firms' profitability, and well-capitalized banks have lower costs of funds and credit risk varieties. More importantly, their analysis indicates that ROA is lower in a situation of low credit quality, evidencing an interplay between capital and asset quality as profitability drivers. Pham et al. (2022) analyze capital structure in the Vietnamese commercial banks and employ the OLS pattern, the RE/FE pattern, and the FGLS and GMM models. Notably, they discover that customer deposits (as a source of low-cost capital) have a negative influence on ROA, but non-deposit liabilities contribute positively to profitability. Unlike prior research focusing on the effects of equity capital, this paper stresses how various funding types impact profit efficiency—in line with capital's influence on ROA depending strongly on how that is sourced and allocated. Alkhazali et al. (2024) refine the discussion by studying 819 emerging-market banks in the period of the COVID-19 crisis. They employ OLS fixed effects and show via regression analysis that in successful OLS estimations quality of capital (Tier 1 and total regulatory) increases ROA during crisis periods to a large extent, whereas among simple equity-to-asset ratios it does not. Their findings reveal that it is the quality, rather than quantity, of capital that explains resilience and profitability in crises. Farooq et al. (2025) adopt system-GMM for Islamic and conventional GCC banks and reach the opposite result: higher Tier 1, total regulatory capital, and equity-to-asset ratios decrease ROE (and hence indirectly ROA), particularly in Islamic banks. This implies that there

are decreasing returns to surplus capital when regulatory buffers are in excess beyond the operational requirements. These works have uncovered a complex association: capital on average improves ROA, since banks with sufficient and shareholder-value-maximizing capital can reduce risk, while excessive and inefficient capital allocation has the potential to erode profitability, especially in highly regulated or deposit-dependent banking systems.

An increasing body of empirical work has pointed to non-performing loans as a lead cause of the profitability of banks. Although it is directed at different banking systems, the studies reviewed agree on one aspect: it is that a higher level of NPL ratio has a negative impact on profitability, specifically ROA. Kwashie et al. (2022) open this story by analyzing 15 Ghanaian banks for the period of 2013–2018 and apply a random-effects panel regression to investigate credit risk impact on financial performance. Their findings indicate a negative association between NPLs and ROA as well as economic value added, with the drop in profitability being justified by an increase in provisioning expenses and a decline in interest income. Their regression results show that even a moderate elevation of NPLs will have a pronounced impairment upon the asset-based returns, laying a foundation for the nexus between an increase in credit risk and loss of profitability. Following this thread, Buchory (2024) analyzes Indonesian Bank BJB by using the data from the quarter from 2014 until 2022 with multiple linear regression. These results reinforce the previous evidence: NPLs have a significant negative impact on ROA (coefficient of –0.270). This serves to highlight that credit impairment leads directly to bank income, and from the Indonesian example, we can see how a low NPL ratio still results in a material depression of profit when asset size is substantial.

In the Western Balkans, Shkodra et al. (2024), through a system-GMM dynamic panel model, constitutes a relevant methodological extension. Their findings indicate that NPLs have a significant negative effect on ROA in the baseline and extended models, verifying an unfavorable impact even after considering capital adequacy, efficiency of operations, and liquidity. Their scatter diagram of ROA–NPL also depicts the negative correlation and confirms the evidence from econometrics. In related work, Kalkan (2025) seconded all reports through robust least-squares regression for 15 Turkish banks over 2003–2020. In his analysis, NPLs is a very important negative predictor of ROA; –0.00589 is the coefficient value for this variable. This literature provides further insight, incorporating macroeconomic factors and ownership concentration to demonstrate that the NPL-profitability relationship is robust to inflation, GDP growth, and even corporate governance. While not focused specifically on NPLs, Alkhazali et al. (2024) present an important complementary observation: capital strength interacts with NPLs and affects profitability. Their study of 819 emerging-market banks during COVID-19 reveals that banks entering crises with low NPLs and reserves exhibit higher ROA, showing that asset quality has a moderating effect on profitability in a distress. The stronger capital effects for banks with healthier pre-crisis NPL ratios therefore associate credit performance to the resistance in profit during downturns. Taken together, this body of work tells a compelling story. Throughout Africa, Asia, Europe, and Turkey, NPLs consistently depress bank profit performance no matter how the model is estimated (OLS regression analysis, random-effects regression analysis, GMM regression analysis, or robust regression analysis), time period, or economic structure. Overall, the evidence indicates that adverse loans decrease earnings by decreasing interest income and increasing loan-loss reserves, leading to a degradation of banks' asset quality as measured by ROA. Taken as a whole, this integrated research highlights the strategic role of rigorous credit-risk management and early-warning models in concern for the preservation of bank profit.

3. METHODOLOGY

In order to evaluate the efficiency of asset utilization of commercial banks in Cambodia, this research applies the Panel ARDL (p,l,m,n,q) model, which has the following form. It is worth highlighting that the independent variables incorporated in the model include return on asset (ROA), loan growth (LG), non-performing loan (NPL), liquidity (LQ), and capital growth (CAG). All variables presented in model (1) are expressed in percentage.

$$ROA_{it} = \alpha_i + \sum_{j=1}^{p} \phi_j ROA_{i,t-j} + \sum_{j=0}^{l} \beta_j LG_{i,t-j} + \sum_{j=0}^{m} \gamma_j NPL_{i,t-j} + \sum_{j=0}^{n} \delta_j LQ_{i,t-j} + \sum_{j=0}^{q} \theta_j CAG_{i,t-j} + \varepsilon_{it} \qquad i = 1, \dots, N\ (Banks), t = 1, \dots, T\ (Years)$$

Where p is the number of lags of ROA (the autoregressive part), l, m, n, and q are the lag lengths for LG, NPL, LQ, and CAG (distributed lag parts),

α_i captures unit-specific fixed effects, and ε_it is the error term. In addition, the general form of error correction model (ECM) of Panel ARDL model, the integration between long and short-run analysis of ROA and its determinants, is present in model (2) as follow.

$$\Delta ROA_{it} = \mu_i + \lambda_i\big(ROA_{i,t-1} + \psi_1 LG_{i,t-1} + \psi_2 NPL_{i,t-1} + \psi_3 LQ_{i,t-1} + \psi_4 CAG_{i,t-1}\big) + \sum_{j=1}^{p-1} \omega_j \Delta ROA_{i,t-j} + \sum_{j=0}^{l-1} \vartheta_j \Delta LG_{i,t-j} + \sum_{j=0}^{m-1} \tau_j \Delta NPL_{i,t-j} + \sum_{j=0}^{n-1} \varrho_j \Delta LQ_{i,t-j} + \sum_{j=0}^{q-1} \xi_j \Delta CAG_{i,t-j} + \epsilon_{it} \quad (2)$$

Where λ_i is a speed of adjustment which expect to have a negative sign and statistically significant. In the long-run equation of the short-run dynamic of model (2), the ψ_1,ψ_2,ψ_3 and ψ_4 are coefficients LG, NPL, LQ, and CAG, respectively. Moreover, the coefficients of 〖ΔROA〗_(i,t-j) are ω_j, the coefficients of 〖ΔLG〗_(i,t-j) are ϑ_j, the coefficients of 〖ΔNPL〗_(i,t-j) are τ_j, the coefficients of 〖ΔLQ〗_(i,t-j) are ϱ_j, the coefficients of 〖ΔCAG〗_(i,t-j) are ξ_j, and the ϵ_it indicates the residual term of the short-run dynamic model, where Δ measures the change.

The study period accounted for 13 years (T) from 2011 to 2023. Since this research uses balanced-panel data, any commercial banks that have missing data or have entered into the market after 2011 will be omitted from the study.

After screening the collected data, which was extracted from the National Bank of Cambodia's website, a total of 23 commercial banks, or cross-sections (N), were found to have a complete data set. A combination of 13 years of time series and 23 cross-sections generates panel data, which consists of a sample size of 299 observations.

4. EMPIRICAL RESULTS

The analysis of the data has been initiated with descriptive statistics, including mean (average), standard deviation, minimum, and maximum values. The next process is the interpretation of the correlation matrix to assess the correlation among independent variables. Prior to proceeding with the estimation of the Panel ARDL model, it is necessary to perform the Pedroni test for panel cointegration. It is worth highlighting that a rejection of the null hypothesis of the test indicated that all variables in the study have a long-run relationship, or they are co-integrated.

Descriptive analysis derived from Table 1, constructed from 299 bank-year observations, offers a portrait of banking industry performance and risk profile in Cambodia. The average ROA is 2.79 percent, which shows that banks make a small but positive profit on their assets in general. Nevertheless, the high standard deviation of 7.30 and the wide range between –7.92 and 64.23 implicate that profitability is widely dispersed among banks and times, with some of them being loss-making rather than making extremely high returns. This heterogeneity leads to profitability differences as illustrated, which are not uniform and may result from differences in business model, risk management, and market position.

Loan growth (LG) is on average 20.77 percent with a standard deviation of 23.48, indicating that, overall, bank lending is expanding very rapidly, but at the same time, differences are pronounced across banks. A minimum of -55.11 percent implies that some banks closely and dramatically shrink their loan portfolios, while a maximum number of 115.72 percent confirms how rapidly others lent money over the same period. The NPL rate is 3.01 percent; differences range from 0 to 19.40 percent. Moreover, even though the mean indicates that, on average, asset quality is relatively healthy, with 3.46 for dispersion (standard deviation) and a high maximum value further demonstrating that groups of banks are dealing with real credit-risk issues.

The average value of liquidity (LQ) is 37.52 percent with a standard deviation of 13.87, and the sample ranges from 12.25 to 79.87 percent. This is a sign that most banks have a comfortable liquidity buffer, as some maintain low levels of liquidity and others at very conservative levels. Lastly, capital growth (CAG) is at 22.21%, almost implying that banks are continuously strengthening their capital position.

The lowest and the highest values are 0 percent and 78.29 percent, respectively, revealing that there is significant heterogeneity in capital accumulation rate among institutions with a standard deviation of 11.33. All of these aggregates suggest that the banking sector, while on average profitable and growing, is quite diverse in profitability levels, riskiness exposures, and balance sheet strategies across banks.

Table 1: Summary Statistics.

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
ROA	299	2.79	7.30	-7.92	64.23
LG	299	20.77	23.48	-55.11	115.72
NPL	299	3.01	3.46	0.00	19.40
LQ	299	37.52	13.87	12.25	79.87
CAG	299	22.21	11.33	0.00	78.29

The correlation matrix in Table 2 displays the pairwise associations among the explanatory variables included to describe the performance of banks, which are loan growth, non-performing loans, liquidity, and capital growth. All of these coefficients are moderate in magnitude (all less than .30 in absolute value) and should therefore not give concern to serious multicollinearity problems when performing the follow-up regression analysis.

The correlation between loan growth and NPL is moderately negative (–0.2617), indicating that higher borrowing must be associated with lower levels of non-performing loans, on average. Such a pattern is consistent with the view that growing banks either are facing more propitious credit conditions or have in place better risk-screening technologies that lead to higher-quality assets. LG is also negatively associated with liquidity (–0.1662), indicating that as lenders grow larger, their loan portfolios tend to shrink their liquidity reserves, the greater the liquidating effect for more loans being offered and transformed from the available funds. LG is also not correlated with capital growth; in fact, it has a very weak negative correlation (-0.0856), which suggests that the trade-off between aggressive loan expansion and the speed at which banks shore up their capital base may be small.

NPL shows very little correlation with liquidity and capital growth, at –0.04 and 0.0233, respectively. These near-zero values suggest that changes in credit risk as proxied by the NPL ratio were mostly unrelated to banks' liquidity and capital growth in this sample. That is, banks with greater NPLs do not systematically have more or less liquidity, and they inconsistently increase capital at similar rates to those with lower ratios.

The correlation between liquidity and capital growth is positive but weak (0.2055). This implies that banks with higher capitalization also have higher levels of liquidity. Under such a relationship, the more cautious balance sheet stance would consider larger liquidity buffers for better-capitalized banks. Overall, this correlation structure suggests that the explanatory variables measure different aspects of banks' behavior (growth, risk, and prudence) without being highly redundant with each other and can be used in a regression model that explains ROA.

Table 2: Correlation Matrix.

Variable	LG	NPL	LQ	CAG
LG	1			
NPL	-0.2617	1		
LQ	-0.1662	-0.04	1	
CAG	-0.0856	0.0233	0.2055	1

The Pedroni panel cointegration test indicated in Table 3 checks whether an array of non-stationary variables share a common long-term relationship among cross-sectional units, in this case 23 panels over 12 periods. The null hypothesis is represented by the absence of cointegration between the variables, whereas all panels are assumed to be cointegrated under the alternative hypothesis. The specification allows the cointegrating vector and autoregressive parameter to be panel-specific, contains panel means but not a deterministic time trend, and controls for serial correlation and heteroskedasticity using a Bartlett kernel with Newey–West bandwidth and one lag.

Three in-dimension test statistics are provided: the Modified Phillips–Perron t-statistic, the Phillips–Perron t-statistic, and the Augmented Dickey–Fuller (ADF) t-statistic. All three reject the null of no cointegration at standard levels of significance. The statistic for Modified Phillips–Perron is 4.6517 (p-value = 0.0000), for Phillips–Perron it is –3.1930 (p-value = 0.0007), and for ADF it is –4.1109 (p-value = 0.0000). Since all the p-values are far less than 1 percent, there is strong and consistent evidence that the variables are cointegrated.

As a whole, these results suggest that the variables in the model do adjust jointly in the long run and tend to converge towards a common equilibrium relationship across 23 panels, even though deviations exist in the short run. This does not probably justify resorting to the later panel cointegration estimators, which is an ECM framework to investigate long-run effects of loan growth, NPLs, liquidity, or capital build-up on bank performance within a panel context.

Table 3: Pedroni Test for Cointegration.

Test	Statistic	p-value
Modified Phillips–Perron t	4.652	0.000
Phillips–Perron t	-3.193	0.001
Augmented Dickey–Fuller t	-4.111	0.000

The estimates in Table 4 are from panel-ARDL using Pooled Mean Group (PMG) and Dynamic Fixed Effects (DFE) estimators. Therefore, the dependent variable in this context is the change in return on assets (ΔROA). The long-run (LR) block indicates what the final impact of loan growth, non-performing loans, liquidity, and capital growth on

banks' profitability is, while the short-run one reveals how changes in those variables are transmitted to profits and at what rate adjustment occurs back to equilibrium via the Error-Correction Term (ECT). The PMG estimation starts with the assumption that long-run coefficients are common across banks but using different short-run dynamic and error variances, while DFE further restricts that short-run relationship parameters are also common across panels.

4.1. Long-Run Relationships

As suggested in Table 4, loan growth has a positive and statistically significant long-run coefficient of 0.037 ($p < 0.01$) under the PMG estimator. This means that other things being equal, a loan growth of 1% will cause an effect on ROA of around 0.037 percentage points in the long run. In short, the faster lending banks do show afterwards they are more profitable at entering that loan. This result is in line with empirical research for emerging markets that religious credit growth with higher profitability as the loan growth increases interest-earning assets and net interest margins (Athanasoglou et al., 2008). The estimate of the DFE further indicates an appreciably positive and significant coefficient associated with LG (0.069, $p < 0.01$), thus highlighting that loan growth is a significant long-run determinant of bank profitability.

For NPL, the PMG long-run coefficient is also negative (−0.023), although statistically insignificant. It indicates that after making decisions towards the bank-specific dynamics and adjustments, the long-run effect of credit risk on ROA is feeble in this sample. Instead, the DFE estimates also evidence a positive NPL (0.432, $p < 0.01$) ratio coefficient that is counterintuitive and contrasts with most of the literature, where the higher an NPL ratio, the less profitable firms will be, as problem loans dampen interest income and diminish provisioning costs (Blackburne & Frank, 2007). It could be the case that the difference between PMG and DFE results could reflect the stronger assumption about homogeneity in parameter restrictions that DFE imposes; if banks vary a lot in terms of (the magnitude with which) credit risk transforms into profits, pooling short-run versus long-run parameters may result in biased or incorrect coefficients. In this case, the trivial PMG coefficient and clearly negative short-run effects indicate that increasing NPLs has a negative effect on profitability in the short to medium run; any spurious positive DFE relationship should be interpreted with caution.

The long-run coefficient on liquidity is negative and statistically significant in PMG (−0.018, $p < .01$). This suggests that a higher liquid asset position, relative to total assets, is negatively related to long-run ROA. The finding is consistent with the theoretical trade-off in banking by which safety-enhancing liquidity results not only from a higher share of liquid deposits in banks' account structure but also from costs associated with reserve holding (Hasanov et al., 2018). The DFE coefficient for LQ is positive and insignificant (0.053) as well, which further confirms that the PMG specification, estimated with heterogeneous short-run dynamics, provides a more reasonable long-run estimate.

In terms of capital growth (CAG), PMG reports a negative long-run coefficient, but the effect is small and statistically insignificant (0.013); whilst DFE also reports a positive point estimate (0.098), which is significant at the 5% level. The DFE finding is consistent with numerous profitability investigations that have found banks with higher capital levels to be more profitable, as a strong capital base lowers funding costs and allows for prompt exploitation of profitable lending opportunities (Kohlscheen et al., 2018). Nevertheless, the insignificance of the PMG specification indicates that the impact on ROA from capital growth might not be very strong in this sample once we allow for heterogeneity in adjustment and short-run dynamics. In general, the long-run pattern across estimators is that loan growth and (to a lesser extent) capital growth are conducive to higher profitability, high liquidity takes a toll on ROA values, and the expected negative effect of NPLs is not robustly identified in the payoff matrix of the estimated long-run parameters.

4.2. Short-Run Dynamics And Error Correction

The Error-Correction Term (ECT) is statistically significant with a negative sign in the two models (−0.413 for PMG and −0.586 for DFE, $p < 0.01$). This establishes that there exists a stable relationship between long-run ROA and its determinants: if ROA deviates from the LG, NPL, LQ, and CAG implied long-run path, it moves back towards equilibrium in time. Quantitatively, the PMG estimate suggests that after one time period, about 41% of any disequilibrium is removed, while the DFE estimate reports an even more rapid adjustment (about 59%) per period. Large rates of adjustments of these magnitudes are common in panel ARDL studies and suggest that bank profitability reacts relatively speedily to shocks and returns to the long-run equilibrium level.

Regarding the short-run coefficients, ΔLG has a negative and significant effect on ΔROA in both models (−0.011 in PMG and −0.029 in DFE, $p < 0.01$). This implies that when we experience a rapid expansion in lending, profitability is initially decreased as new lending generates up-front screening, monitoring, and provisioning costs before it generates stable interest income. The long-term positive coefficient on LG, on the other hand, suggests that this investment in loan growth eventually creates a return and profitability increases after new loans become seasoned. In the short term, ΔNPL are found to have highly significant negative effects in both specifications (−0.344 for PMG and −0.621 for DFE, $p < 0.01$). This is consistent with theory and has been empirically documented: a reduction in the quality of assets directly reduces interest income and necessitates larger provisions for loan losses, thereby resulting in diminished current earnings. The large size of these coefficients implies that profit growth is very sensitive to short-run fluctuations in credit risk.

The short-run change in liquidity, ΔLQ, is not statistically different from zero for both models, indicating that temporary changes to liquidity management do not affect the period's profitability. This might suggest that banks are applying their liquidity management practices and smoothing short-term liquidity shocks in the interbank market or in central bank facilities. In the case of capital growth (ΔCAG), the PMG model obtains a positive coefficient that is small but significant at the 10% level (0.060), while DFE picks out an insignificant impact (0.047). Given the modest evidence of a short-run effect, it appears that capital measures impact profitability primarily in the long term via balance sheet strength rather than short-term profits. Collectively, the PMG and DFE results suggest that loan growth is also a key long-run driver of bank profitability, despite the fact that aggressive lending may have temporarily suppressed ROA in a short-term analysis. NPL clearly affects profitability negatively in the short run, and theory implies a negative long-run effect, even though it is not very robust across all of the estimators in this sample. Lower liquidity ratios decrease profitability in the long run; they show an effect of opportunity cost since low-yielding liquid assets are kept. The growth of capital tends to help profitability increase, but its strength and significance depend on the estimator.

Methodologically, the finding that all ECTs are negative and statistically significant confirms the presence of a cointegrating relation in our model and justifies panel ARDL with PMG and DFE estimation. Consistent with Pesaran et al.'s (1999) proposition, the PMG model, being more flexible in terms of permitting cross-sectional varying short-run dynamics across banks, has found favor amongst empirical researchers when it is unclear whether the adjustment paths for cross-sectional units are different. In this framework, the findings of the PMG model describe a banking sector in which ROA in the long run is explained by sustainable loan growth and competitive capital management, but with short-run impacts acting through loan growth against asset quality on profitability, emphasizing the significance of sound credit risk management and conservative lending policies.

Table 4: PMG and DEF Results.

Model	ΔROA	PMG	DEF
		Coefficient	Coefficient
LR			
	LG	0.037***	0.069***
		[7.17]	[3.12]
	NPL	-0.023	0.432***
		[-0.89]	[2.95]
	LQ	-0.018***	0.053
		[-2.64]	[1.31]
	CAG	0.013	0.098**
		[1.08]	[2.11]
SR			
	ECT	-0.413***	-0.586***
		[-5.13]	[-9.05]
	ΔLG	-0.011***	-0.029***
		[-3.23]	[-3.44]
	ΔNPL	-0.344***	-0.621***
		[-2.64]	[-6.76]
	ΔLQ	0.013	0.000
		[0.42]	[0.01]
	ΔCAG	0.060*	0.047
		[1.93]	[1.34]
	Constant	1.988	-2.223**
		[1.27]	[-2.09]

Note: z-tests are in bracket and ***, **, * indicate statistically significant at 1%, 5%, and 10%, respectively.

5. CONCLUSION

The empirical findings from the panel ARDL model paint a consistent picture of how bank-specific characteristics influence profitability over time. The large and negative error-correction terms (ECT) for both the PMG and DFE specifications indicate that there is a stable long-run relationship among return on assets (ROA), loan growth (LG), non-performing loans (NPL), liquidity (LQ), and capital growth (CAG).

The findings indicate that loan expansion is the primary long-run determinant of profitability. The also positive and highly significant coefficient of LG in PMG and DFE estimations suggests that those banks that are more aggressively expanding their

credit portfolio end up reporting higher ROA. Meanwhile, the short-run coefficients of ΔLG are negative, indicating that initial sharp increases in lending lead to lower earnings, which is caused by screening effort, monitoring cost, and risk provision via loan decisions lagging behind new income generation.

Credit risk, as proxied by NPLs, has a negative and highly significant short-run effect, with ΔNPL being statistically significant in both equations. Moreover, it is very much in line with the evidence that falling asset quality cuts interest income and compels banks to provision more for loan losses, which squeezes current profit. It is less clear the long-run impact of NPLs, which, if anything, is confirmed to be negative, although not statistically significant, in the PMG and surprisingly positive in DFE. Since a DFE model implies stronger homogeneity in the errors than PMG and that theory and short-run effects point solidly to harmful impacts of NPLs, the PMG result is more reliable; under this view, an indication above one for the coefficient corresponds to deterioration in performance rather than support for profit mark-up from problem loans.

The liquidity has a significant negative impact on ROA in the long run for PMG, which suggests that when firms hold more lower-yield liquid assets than their total assets, it will cause decreased profitability. Surprisingly, short-run variation of liquidity, however, does not have a significant effect on ROA. This result implies that banks are able to redistribute temporary liquidity shocks over different periods through the interbank market and central bank lending mechanism.

Capital growth is conducive to profitability, although its influence is different according to the estimator. According to the DFE estimates, CAG has a positive significant long-run effect on ROA, which is in line with research that argues for better capitalized banks having lower costs of funding and being able to exploit lucrative lending options more efficiently. With the PMG specification, on the other hand, we find that although both the estimated long-run coefficient and its t-statistic are positive, i.e., statistically weak, the short-run effect is limited in magnitude. Our finding implies that capital's role is primarily to support profitability through an expanded balance sheet over time, not through near-term profits.

In conclusion, these results describe a banking system with sustainable loan growth and decent capital at the heart of profitability, which remains exposed to asset quality shocks in the near term. Too large liquidity buffers reduce long-run ROA, and the adjustment speeds described by the error-correction terms suggest that deviations from equilibrium are corrected at a faster pace.

REFERENCES

Abbas, F., Ali, S., & Ahmad, M. (2023). Does economic growth affect the relationship between banks' capital, liquidity, and profitability: empirical evidence from emerging economies. Journal of Economic and Administrative Sciences, 39(2), 366-381. https://doi.org/10.1108/JEAS-03-2021-0056

Ahmed, F., & Runggcharoenkitkul, P. (2014). Cambodia's banking sector: Are more banks always better? Cambodia, Entering a New Phase of Growth, Washington, DC: IMF, 51-61.

Ajayi, J. A., & Lawal, Q. A. (2021). Effect of liquidity management on banks' profitability. Business & Management Compass, 2, 220-237. https://doi.org/10.36997/IJUEV2021.65.2.220

Al-Harbi, A. (2019). The determinants of conventional banks' profitability in developing and underdeveloped OIC countries. Journal of Economics, Finance and Administrative Science, 24(47), 4-28.

Alkhazali, O., Helmi, M. H., Mirzaei, A., & Saad, M. (2024). The impact of capital on bank profitability during the COVID-19 pandemic. Global Finance Journal, 62, 100994.

Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific, and macroeconomic determinants of bank profitability. Journal of International Financial Markets, Institutions and Money, 18(2), 121–136.

Bianchi, J., & Bigio, S. (2022). Banks, liquidity management, and monetary policy. Econometrica, 90(1), 391-454. https://doi.org/10.3982/ecta16599

Blackburne, E. F., III, & Frank, M. W. (2007). Estimation of nonstationary heterogeneous panels. Journal of Econometric Methods, 7(2), 191–213.

Buchory, H. A. (2024). Analyzing the Impact of Cost of Funds and Non-Performing Loans on Bank Profitability: A Case Study of Bank BJB in Indonesia. International Journal of Finance & Banking Studies, 13(3), 54-59.

Carrasco, M., & Nayihouba, A. (2024). Regularized estimation of dynamic panel models. Econometric Theory, 40(2), 360-418. https://doi.org/10.1017/s0266466622000469

El-Chaarani, H., Abraham, R., & Azzi, G. (2023). The Role of Liquidity Creation in Managing the COVID-19

Banking Crisis in Selected MENA Countries. International Journal of Financial Studies, 11(1), 39. https://doi.org/10.3390/ijfs11010039

Farooq, M. O., Miah, M. D., Kabir, M. N., & Hassan, M. K. (2025). The impact of banks' capital buffer on equity return: evidence from Islamic and conventional banks of GCC countries. Journal of Islamic Accounting and Business Research, 16(1), 188-217.

Gazi, M. A. I., Karim, R., Senathirajah, A. R. b. S., Ullah, A. K. M. M., Afrin, K. H., & Nahiduzzaman, M. (2024). Bank-Specific and Macroeconomic Determinants of Profitability of Islamic Shariah-Based Banks: Evidence from New Economic Horizon Using Panel Data. Economies, 12(3), 66. https://doi.org/10.3390/economies12030066

Gözkonan, Ü. H., Hatipoğlu, İ. Y., & Straupaite-Simonavice, S. (2024). A HOLISTIC APPROACH TO THE BANKING SECTOR: PERFORMANCE AND EFFICIENCY ANALYSIS OF TURKISH BANKS USING CoCoSo AND DEA METHODS. Management/Vadyba (16487974), 40(2). https://doi.org/10.38104/vadyba.2024.2.08

Hasanov, F. J., Bayramli, N., & Al-Musehel, N. (2018). Bank-specific and macroeconomic determinants of bank profitability: Evidence from an oil-dependent economy. International Journal of Financial Studies, 6(3), 78.

Helske, J., & Tikka, S. (2024). Estimating causal effects from panel data with dynamic multivariate panel models. Advances in Life Course Research, 60, 100617. https://doi.org/10.1016/j.alcr.2024.100617

Jigeer, S., & Koroleva, E. (2023). The determinants of profitability in the city commercial banks: The case of China. Risks, 11(3), 53. https://doi.org/10.3390/risks11030053

Kalkan, G. (2025). The Impact of Non-Performing Loans on Bank Profitability: Evidence from Türkiye. Pub. Governance, Admin. & Fin. L. Rev., 10, 121.

Kohlscheen, E., Murcia, A., & Contreras, J. (2018). Determinants of bank profitability in emerging markets. BIS Working Papers, 686.

Kwashie, A. A., Baidoo, S. T., & Ayesu, E. K. (2022). Investigating the impact of credit risk on the financial performance of commercial banks in Ghana. Cogent Economics & Finance, 10(1), 2109281.

Lee, C. C., & Hsieh, M. F. (2013). The impact of bank capital on profitability and risk in Asian banking. Journal of International Money and Finance, 32, 251-281.

Lim, S., & Barnett, C. (2019). Commercial banks' profitability determinants in Cambodia: Fixed effect and random effect. Journal of Accounting, Finance, Economics and Social Sciences, 8, 231–243.

Lim, S., Flores, E., & Barnett, C. (2025). The impact of increased liquidity on profitability: Insights from Cambodian commercial banks. Banks and Bank Systems, 20(2), 38–50. https://doi.org/10.21511/bbs.20(2).2025.04

Lolemo, S., & Pandya, H. (2023). THE IMPACT OF DIGITIZATION ON THE PROFITABILITY OF SELECTED INDIAN BANKS: A POOLED OLS MODEL APPROACH. International Journal of Management Public Policy and Research, 2(3), 1-9. https://doi.org/10.55829/ijmpr.v2i3.167

National Bank of Cambodia. (2024). Annual report 2024. NBC.

Nguyen, N. B., & Vu, N. Y. (2025). Factors influencing the profitability of Vietnamese commercial banks during the 2013-2024 period. Edelweiss Applied Science and Technology, 9(2), 1648-1658.

Odajima, K., & Aiba, D. (2019). Dollarization in Cambodia: A review of recent empirical findings from a nationwide survey. Asian Studies, 65(1), 24-44.

Oseko, D., Ng'eno, E., & Mose, N. (2024). Bank-specific and Macroeconomic Determinants of Commercial Banks' Profitability in Kenya. Asian Journal of Economics, Business and Accounting, 24(10), 368–378. https://doi.org/10.9734/ajeba/2024/v24i101534

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American Statistical Association, 94(446), 621–634.

Pham, N. H., Hoang, T. M., & Pham, N. T. H. (2022). The impact of capital structure on bank profitability: evidence from Vietnam. Cogent Business & Management, 9(1), 2096263.

Qaysi, M. J. R. A., & BenMabrouk, H. (2024). THE IMPACT OF BALANCING LIQUIDITY AND PROFITABILITY ON EVALUATING AND IMPROVING FINANCIAL PERFORMANCE IN IRAQI COMMERCIAL BANKS. International Journal of Professional Business Review, 9(11), e04721. https://doi.org/10.26668/businessreview/2024.v9i11.4721

Rahman, H. U., Yousaf, M. W., & Tabassum, N. (2020). Bank-specific and macroeconomic determinants of profitability: A revisit of the Pakistani banking sector under the dynamic panel data approach.

International Journal of Financial Studies, 8(3), 42. https://doi.org/10.3390/ijfs8030042

Rodriguez, V. H. P., Aguilar, H. E. V., Delgado, F. M. C., Santa Cruz, L. D. C. S., Benavides, A. M. V., Salazar, C. A. H., ... & Suyón, A. A. (2024). Challenges in the Relationship between Liquidity and Profitability: Perspectives from a Literature Review. Revista de Gestão Social e Ambiental, 18(1), 1-17. https://doi.org/10.24857/rgsa.v18n1-084

Roy, S., Misra, A. K., Padhan, P. C., & Rahman, M. R. (2019). Interrelationship among liquidity, regulatory capital, and profitability—A study on Indian banks. Cogent Economics & Finance, 7(1), 1664845.

Shkodra, J., Anastasiou, D., & Kallandranis, C. (2024). The impact of non-performing loans on commercial bank profitability: Evidence from the Western Balkans. Financial and Credit Activity: Problems of Theory and Practice, 3(56), 49–58. https://doi.org/10.55643/fcaptp.3.56.2024.4355

Siddik, M. N. A., Kabiraj, S., & Joghee, S. (2017). Impacts of capital structure on performance of banks in a developing economy: Evidence from Bangladesh. International Journal of Financial Studies, 5(2), 13.

Sudarsono, H., Anto, M. H., & Perdana, A. (2024). Financial Risk Determinants in Islamic Rural Banks: Static and Dynamic Models. Jurnal Ekonomi Pembangunan, 22(01), 54-72. https://doi.org/10.22219/jep.v22i01.33404

Sufian, F. (2009). Factors influencing bank profitability in a developing economy: Empirical evidence from Malaysia. Global Business Review, 10(2), 225-241.

Thinh, T., Thuy, L., & Tuan, D. (2022). The impact of liquidity on profitability—evidence of Vietnamese listed commercial banks. Banks and Bank Systems, 17(1), 94-103. https://doi.org/10.21511/bbs.17(1).2022.08

Umeorah, S. C., Adelaja, A. O., Ayodele, O. F., Abikoye, B. E., & Azubuike, N. A. (2024). Impact of Select Variables on Tangible Book Value Multiple of U.S. Regional Banks. Journal of Economics, Management and Trade, 30(11), 33–49. https://doi.org/10.9734/jemt/2024/v30i111251

Vrotslavskyy, D., & Dropa, Y. (2024). THE ROLE OF THE BANKING SYSTEM IN PROVIDING FINANCIAL RESOURCES FOR THE DEVELOPMENT OF THE ECONOMY. Grail of Science, (40), 177–179. https://doi.org/10.36074/grail-of-science.07.06.2024.021

Yao, H., Haris, M., & Tariq, G. (2018). Profitability determinants of financial institutions: evidence from banks in Pakistan. International Journal of Financial Studies, 6(2), 53.