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BANK RESERVE REQUIREMENT, DIGITALIZATION, AND PROFITABILITY IN INDONESIA BANKING INDUSTRY

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Abstract

The study investigates the impacts of central banks' policies along with the effects of digitalization and macroeconomics on the profitability of Indonesian banks using dynamic panel data from the period 2010–2022. The System Generalized Method of Moments (GMM) analysis reveals that profitability of the past significantly influences present performance due to the presence of strong profit persistence among the banks. The analysis finds that the reserve requirements lower profitability while digitalization raises profitability, thus reflecting the necessity of financial innovations. The analysis reveals that banks that have a higher ratio of capital adequacy ratio (CAR) and loan-to-deposit ratio (LDR) have improved profitability levels that reflect the necessity of strong financial fundamentals. The research shows that exchange rate (ER) depreciation leads to reduced profitability but moderate inflation levels have a positive effect on profitability. The research demonstrates that balanced monetary policy together with digital transformation and stable macroeconomic conditions create essential conditions for bank performance. The study recommends that governments should support digital infrastructure development while exercising careful monetary tightening and improve their foreign exchange risk management systems. The research demonstrates how policy and technology work together to affect financial sector performance.

Keywords: *Reserve Requirement, Digitalization, Return on Asset, Banks, Panel GMM.*

JEL Classifications: *E20, E44, E58*

1. Introduction

The role of the banking industry is crucial towards ensuring financial stability, underpinning economic development, and the effective allocation of resources Anwar et al., 2024). The banking industry has rolled through substantial structural as well as regulatory changes over the two decades past, reacting towards both domestic evolution and international finance trends (Ventouri, 2018). As one of the tools of the central bank's monetary policy measures, the reserve requirement rate represents the preeminent instrument for the management of liquidity and for discipline within the industry (Fagatelli, 2024; Pham et al., 2021)Through the compulsion on banks to keep a level of deposits as a reserve, the central bank imposes discipline on credit supply and ability of banks to take on risks that again could have implications for the profitability of banks. While the central bank thus gains a great deal of leverage over the supply of credit as well as over the inclination of banks towards taking risks, the central banks' ability to take decisions on the level of the reserve ratio without any advice from any panel of experts on central banks mandates a fresh look at the role of the central banks (Anestiawati et al., 2025; Horváth, 2023).

While profitability remains a fundamental indicator of a bank's performance, it also depends on a multifaceted interaction among macroeconomic, operational, and regulative factors (Cobbinah et al., 2024; Shubita, 2024). The twin challenges of ensuring regulatory compliance, especially regarding reserve requirements, and driving innovation through digitalization both pose opportunities and challenges for banks (Bueno et al., 2024; Murinde et al., 2022). Previous empirical literature considered these factors in isolation. There remains relatively sparse literature addressing these two jointly as factors of bank profitability and more specifically within the Indonesian context. The present study seeks to determine the impact of the reserve requirements and digitalization on the profitability of banks in Indonesia. Using panel data analysis on a comprehensive sample of Indonesian

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commercial banks, this work aims to provide empirical evidence on the efficacy of regulative tools and the strategic implications of digitalization towards improving the financial performance of banks.

The driving motivation for this work is the deepening challenge of harmonizing regulatory compliance and innovation for Indonesian banks. Banks have the mandate of meeting central-bank-imposed reserve requirements while facing the challenge of navigating a fast-changing digital economy (Lee et al., 2021; Tong & Jiayou, 2021). Reserve requirements aim at ensuring liquidity and stability of finances while at the same time limiting banks' capacity for credit expansion and profit-making (Eltweri et al., 2024; Gaur et al., 2022). Alternatively, according to Bueno et al. (2024) the digitalization of operations promises enhanced profitability through enhanced operational efficiency and customer interaction, while its true impact remains unclear, at least in emerging markets such as Indonesia where scales of digital take-up, infrastructure adequacy, and readiness vary considerably among institutions. While the two forces of regulatory control and digital innovation are of profound significance for the economy, they have traditionally been left under examination by literature. That leaves a clear problem for research: the absence of catalytical empirical work that analyses jointly the respective impacts of reserve requirements and digital transformation on the profitability of Indonesian banks. Bridging this gap becomes imperative for ascertaining the degree to which these dynamics represent complementary or mutually opposing forces and the ways banks may set about bringing the regulations within synchrony of advancement.

Even as the spotlight grows on the profitability of banks, a clear area of research remains on what drives the combined impact of regulatory needs and digitalization on financial performance across developing economies such as Indonesia. Most previous studies have centred on the impact of the reserve requirement as a means of monetary policy on the efficiency of banks (Bitar, 2022; Afanasyeva & Korovin, 2020; Fungáčová, 2016; Mimir et al., 2013) as well as the effect digitalization on the efficiency of banks (Xie & Wang, 2023; Do et al., 2022; Mavlutova et al., 2022). Prior studies examined these two drivers systematically and how they interact and amplify or undermine the profitability of banks. Furthermore, most of the literature exists within advanced economies with complex and established financial systems and advanced digital infrastructure and thus its applicability to the Indonesian banking industry based on diverse digital competencies and transitioning regulations is doubtful. The absence of a holistic examination leaves policymakers and practitioners without a proven body of evidence-based insights on how the compliance of regulations should meet digital-based innovative strategies towards sustainable profitability. To fill this void is crucial for constructing a refined and realistic picture of bank behaviour under the impacts of the regulatory and technology forces.

This work makes a number of significant contributions over the standard literature. Firstly, while prior work has largely tested the individual impact of reserve requirements or digitalization on the performance of banks independently, this work contributes a new empirical design by examining the simultaneous interaction between the two variables on the profitability of banks within the Indonesian context. The integrated view permits the deeper consideration of the interaction between regulatory limitation and tech advancement on finance. Secondly, the work uses a comprehensive panel dataset over a broad sample of Indonesian banks over a considerable time period that permits the strong examination of short-run dynamics as well as long-run impacts by the inclusion of lagged measures of profitability. Thirdly, the work offers methodological originality by employing both the application of Pooled Ordinary Least Squares (POLS) as well as Fixed Effects (FE) estimators that permit the identification of fixed bank-specific factors that may have an impact on profitability. Lastly, the work provides context-relevant insights pertaining to emerging economy finances such as Indonesia where the structures of regulation and the digital landscape are changing dynamically though differently from advanced countries. Thus, the work not only fills a significant void empirically but also provides policy insights for policymakers and regulators as well as bank managers on how to craft strategies that weigh compliance and advancement for long-term profitability.

The GMM estimation results confirm that previous profitability has a positive impact on current bank profitability which supports performance persistence in Indonesia's banking industry. The research shows that higher RR create a positive and statistically significant effect which contradicts conventional beliefs by indicating that strict reserve requirements strengthen bank financial stability through better liquidity and risk management. The positive effect of digitalization on profitability exists but it lacks statistical significance which means technological progress improves service quality and operational efficiency yet its short-term impact on industry profitability remains limited. The (ER) maintains its negative relationship with ROA which demonstrates that depreciation in exchange rate negatively affect bank performance. The control variables CAR, LDR and inflation do not show any consistent or robust effects. The GMM results demonstrate that bank profitability in Indonesia heavily depends on regulatory compliance particularly reserve requirements while showing digital transformation financial benefits emerge over time based on various environmental conditions.

2. Literature Review

The investigation requires a well-defined theoretical framework to establish the mechanisms which explain how reserve requirements and digitalization influence bank profitability. The research uses bank intermediation theory (Boyd and Prescott, 1986) and dynamic capabilities theory (Teece et al., 1997) to establish a systematic framework of relationships between regulatory mechanisms and financial innovation and bank profitability. The bank intermediation theory explains how banks function as financial intermediaries by converting short-term liabilities into long-

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term assets while their profitability depends on regulatory instruments including reserve requirements which impact their liquidity and lending capacity (Son et al., 2023; Mia 2023; Garr & Awadzie, 2021). Higher reserve requirements function as profit constraints because they decrease the funds banks can use for income-generating operations (Taib Khan, 2025). From a stability-enhancing viewpoint reserve requirements contribute to financial soundness which might lead to better profitability in the future (Mustafa, 2024). The study implements the dynamic capabilities theory to analyse how organizations manage their internal and external competences through integration and building and reconfiguration to adapt to environmental changes. Banks that successfully adapt technological advancements into their operations through digitalization can improve service delivery while reducing transaction costs and developing new revenue streams. The dynamic capabilities view supports that properly managed innovation creates competitive advantages which lead to long-term profitability. Digital transformation functions as a strategic capability which differs between institutions and produces varying effects on regulatory pressures (Martínez-Peláez et al., 2023).

This research combines two theoretical perspectives to create a dual-lens framework which links regulatory compliance with technological adaptation to bank profitability. The approach provides a detailed understanding of how banks leverage regulatory requirements and digital innovation differently based on their internal efficiency and strategic responsiveness. The framework enables researchers to create more sophisticated hypotheses and strengthen their interpretation of empirical results. The integrated perspective addresses a major research limitation by uniting regulatory and technological factors into a unified framework which strengthens theoretical development. The study deepens analytical analysis of the manuscript while establishing its potential to make substantial contributions to banking research and financial innovation studies.

Research has extensively analysed bank profitability determinants through examination of monetary factors and technological elements and macroeconomic conditions and institutional frameworks. The research combines empirical results into four main themes which include monetary policy and reserve requirements alongside digitalization and macroeconomic variables and bank-specific characteristics. The relationship between monetary policy and bank profitability receives extensive empirical analysis especially in emerging markets because reserve requirements serve as a key regulatory tool for liquidity management. Research evidence shows that reserve requirements produce negative effects on profitability levels. The research conducted by Abid and Lodhi (2015) demonstrates that Pakistani banks face reduced lending capacity when the cash reserve ratio increases thus limiting their revenue generation potential. Mia et al. (2023) show through their analysis of Bangladeshi banks that reserve requirements negatively affect ROA while demonstrating how mandatory liquidity requirements limit profitability. Some research indicates that monetary policy produces complex outcomes. The short-term reduction in profits from reserve requirements leads to better financial discipline and reduced risk-taking which supports long-term stability. The existing literature about monetary policy instruments shows inconsistent results. Al-Harbi (2019) explains that monetary policy expansion leads to increased lending and broader interest margins but sustained low interest rates can squeeze banking margins especially in advanced financial systems thus reducing profitability. The research demonstrates that monetary policy functions as both an enabling factor and a limiting factor for bank profitability based on the specific macro-financial environment and policy implementation methods.

The banking industry now uses digitalization as a major profitability determinant because financial institutions implement digital technologies to improve their service delivery and operational efficiency. The adoption of digital transformation leads to increased profitability through cost reduction and market expansion and the creation of additional revenue streams according to empirical evidence. The research by Huang (2023) demonstrates that Chinese state-owned commercial banks achieve better profitability through digital banking adoption because it enables them to reach more customers and reduce operational costs. The research conducted by Dao (2020) demonstrates that Southeast Asian banks experience better performance results because of digital transformation which leads to improved ROA and ROE metrics. Digitalization produces benefits which do not distribute uniformly across all entities. The high costs of digital transformation and integration difficulties faced by smaller banks and banks in regions with underdeveloped digital infrastructure can reduce their short-term digital adoption benefits. The literature lacks comprehensive analysis of how digitalization affects profitability alongside monetary policy and regulatory requirements especially in emerging markets such as Indonesia.

Bank profitability is significantly affected by macroeconomic variables which include GDP growth and inflation rates and exchange rates. The majority of research shows that economic growth creates a positive relationship with bank performance because strong GDP growth leads to increased credit demand and reduced default risk and better financial intermediation. The research by Batten and Vo (2019) demonstrates that GDP together with inflation rates create positive effects on bank profitability within the Vietnamese banking sector. Kiganda (2014) discovered equivalent results for Kenyan banking institutions. The research by Azzabi and Lahrichi (2023) demonstrates that positive macroeconomic conditions boost banking profit margins throughout emerging markets. However, this relationship is not uniform. Rolle et al. (2020) discovered that GDP has a negative relationship with ROA when analyzing Pakistan because economic growth leads banks to expand credit into riskier sectors which lowers their profitability. The study by Islam (2023) about UK banks demonstrates that GDP growth has negative effects but inflation and interest rates show no significant impact on bank performance thus demonstrating differences between

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developed economies and emerging markets. Exchange rate volatility proves to be a negative factor which appears consistently in research findings.

Internal bank-specific characteristics function as the main factors which explain why different institutions achieve varying levels of profitability. CAR stands as a key positive predictor of profitability among the internal bank-specific characteristics. The research of Batten and Vo (2019), and Mohanty and Krishnankutty (2018) demonstrates that banks with sufficient capital perform better because they maintain better shock resistance and improved credit risk management capabilities. The combination of operational inefficiency with excessive bank size leads to decreased profitability. The research by Batten and Vo (2019) together with Mohanty and Krishnankutty (2018) demonstrates that bigger bank size together with higher cost ratios and lower productivity levels result in negative ROA effects which indicate scale-related operational inflexibility. The traditional interpretation of LDR as an indicator of intermediation activity produces conflicting results in research studies. Ebenezer et al. (2019) links higher LDR to better performance but other studies indicate that high LDR may indicate credit overextension which leads to increased risk exposure and reduced profits. The risk profile together with diversification approaches of banks play an important role in their operations. Zaiane and Moussa (2021) demonstrate that asset quality together with diversification enhance profitability but liquidity constraints and management inefficiency decrease performance when studying MENA banks during crisis periods.

The empirical research demonstrates both similar and different results. The evidence shows that capital adequacy together with GDP growth supports profitability but reserve requirements and liquidity constraints and operational inefficiency create obstacles. Digitalization emerges as a transformative power which produces inconsistent results that depend on specific circumstances. The research expands existing knowledge by studying how monetary policy reserve requirements and digitalization influence bank profitability in Indonesia which represents an emerging market that faces both regulatory changes and fast digital transformation. The research seeks to address a fundamental empirical deficiency which examines how financial sector performance responds to regulatory changes and technological innovations.

3. Data dan Methodology

3.1 Data

The research examines the impact of monetary policy together with digitalization and CAR and LDR and exchange rates and inflation on bank profitability using a panel dataset of selected countries over a specified time period. The study uses ROA as indicator to measure bank profitability because they represent both operational efficiency and financial performance. The analysis includes reserve requirement alongside digitalization indicators and standard bank-specific and macroeconomic controls which include CAR and LDR and exchange rates and inflation. The data covers the period from 2012Q1 to 2022Q4.

Table 1. Descriptive Statistic

Variable	Abbreviation	Mean	Std Dev.	Min.	Max.
Return of Asset	ROA	1.0799	2.1943	-29.1900	10.4600
Central Bank Reserve Requirement	RR	6.7692	1.7530	3.0000	9.0000
Digitalization Index	DIG	4.9877	0.8730	3.7500	6.3727
Capital Adequacy Ratio	CAR	24.7736	17.2415	8.6096	215.500
Loan to Deposit Ratio	LDR	87.4578	3.4276	28.7900	248.4100
Exchange Rate	ER	13,600	1,853	9,315	16,374
Inflation	INF	3.8706	1.7837	1.2005	7.8717

3.2 Econometrics Methodology

The research applies System GMM estimator from Arellano and Bover (1995) and Blundell and Bond (1998) to handle both bank profitability dynamics and standard panel data issues including endogeneity and omitted variables and heterogeneity. The approach shows its advantage when analysing panels containing numerous observations across time but short time duration because it outperforms standard estimators including fixed effects and pooled OLS. System GMM proves useful because it uses internal instruments including lagged levels and first differences of regressors to control endogeneity and simultaneously estimate in situations with simultaneity and reverse causality. The use of moment conditions in both levels and differences within System GMM increases the estimator's efficiency especially when analysing persistent variables including profitability. The use of lagged dependent variables in the model is both methodologically correct and empirically justifiable since bank performance responds to previous outcomes and macroeconomic and policy shocks through dynamic adjustments. The Hansen J-test for overidentifying restrictions evaluates instrument

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validity and the Arellano-Bond test examines serial correlation in differenced residuals. A properly defined GMM model should both reject second-order serial correlation and accept first-order autocorrelation. The number of instruments needs to be limited relative to cross-sectional units because excessive instrument proliferation leads to weak test power and overfitting according to best practices in empirical research. The research approach enables an exhaustive examination of monetary policy effects combined with digital innovation and bank fundamentals together with macroeconomic factors on bank profitability. The selected methodology provides both robust and policy-relevant insights into bank performance determinants across developing financial systems through its ability to handle dynamic behaviour and structural heterogeneity and endogeneity.

4. Results and Discussion

4.1 POLS Estimation

Table 3. POLS estimation results

Variable	Dependent variable : ROA		
	Model 1	Model 2	Model 3
ROA (-1)	0.7786*** (0.0137)	0.7796*** (0.0137)	0.7786*** (0.0137)
RR	0.0409* (0.0219)		0.0374 (0.0232)
DIG		0.0798 (0.0756)	0.0714 (0.0801)
CAR	0.0012 (0.0018)	0.0010 (0.0018)	0.0011 (0.0018)
LDR	-0.0014 (0.0009)	-0.0013 (0.0009)	-0.0013 (0.0009)
ER	-0.5776** (0.2402)	-0.8531** (0.3858)	0.7235* (0.3940)
INF	-0.0151 (0.0236)	0.0249 (0.0228)	-0.0070 (0.0303)
R^2	0.6240	0.6236	0.6241
No. of Cross-section	41	41	41
No. of Observation	2,091	2,091	2,091

Note: Symbols * is Prob. < 10%, ** is Prob. < 5%, and *** is Prob. < 1%.

The lagged value of ROA shows a positive relationship with the current profitability of banks across all three model specifications. The coefficient is approximately 0.7786 and the significance is at the 1% level, which means that the persistence of bank profitability is very high. This means that banks that have performed well in the previous period are likely to continue with the same performance level due to internal factors such as management efficiency, customer base or strategic position. This persistence means that past financial performance is a key determinant of the current financial position. RR variable has a positive effect on bank profitability in Models 1 and 3, with the coefficient being statistically significant at the 10% level in Model 1. This could mean that an increase in reserve requirements could lead to slightly better profitability, which could be due to better liquidity management or less risk-taking. However, the lack of significance of RR in Model 3 could indicate that the effect of reserve requirements on profitability is not robust and that the relationship between the two may be context dependent or influenced by other factors. The Digitalization is included in Models 2 and 3 and in both cases it has a positive but not statistically significant relationship with ROA. This could suggest that digital transformation might have a positive effect on profitability – maybe through better operational efficiency, customer outreach, or service delivery – but the evidence is not strong enough to confirm this. The lack of statistical significance may be due to the need for more precise digitalization measures or a longer period of time to observe its effects. CAR has a small and not statistically significant positive effect on ROA in all models. This could mean that banks that are well capitalized are considered safer but higher capital buffers do not necessarily translate into higher profitability in the short run. The results indicate that capital adequacy is more of a risk management tool than a direct profit generator. LDR has a negative coefficient in all models but the effect is not statistically significant. This could be because banks that lend more relative to deposits may be less profitable, possibly because they are more exposed to risk or have less liquidity. However, the lack of significance may indicate that this relationship is not strong enough to make any conclusions in the context of the data used. ER is negative and significant with respect to ROA in Models 1 and 2, which means that lower efficiency (higher costs) leads to lower profitability. Interestingly, in Model 3, the sign of the ER is reversed and is positive, but only marginally significant. This could be due to model specification changes or interaction effects and suggests the need for further research to establish the relationship between exchange rate and profitability. Finally, Inflation has different signs in the models and is not statistically significant in any of them. This could mean that inflation, at least within the range observed in the data, does not have a clear or direct impact on bank profitability. The mixed results could be due to the fact that macroeconomic dynamics are complex and the effect of inflation can be different based on monetary policy, interest rates, and the inflation expectations of banks and borrowers. Overall, the models show that past profitability is the most important predictor of current ROA, while the explanatory power of policy-related and macroeconomic variables is relatively low. The R-squared values of approximately 0.624 for all models indicate a moderate fit, which means that the variables included explain a large portion of the variation in bank profitability, but a large part of it is internal and historical.

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4.2 Fixed Effect Estimation

Table 4. Fixed Effect Estimation Results

Variable	Dependent variable : ROA		
	Model 1	Model 2	Model 3
ROA (-1)	0.6205*** (0.0173)	0.6228*** (0.0173)	0.6205 (0.0173)
RR	0.0526** (0.0211)		0.0495** (0.0224)
DIG		0.0889 (0.0733)	0.0327 (0.0775)
CAR	0.0022 (0.0023)	0.0020 (0.0023)	0.0021 (0.0023)
LDR	-0.0010 (0.0010)	-0.0009 (0.0010)	-0.0009 (0.0010)
ER	-0.9289*** (0.2330)	-1.2261*** (0.3737)	-1.0563*** (0.3812)
INF	-0.0027 (0.0228)	0.0472** (0.0221)	0.0049 (0.0292)
R^2	0.4291	0.4278	0.4291
No. of Cross-section	41	41	41
No. of Observation	2,091	2,091	2,091

Note: Symbols * is Prob. < 10%, ** is Prob. < 5%, and *** is Prob. < 1%.

The fixed effects estimation results demonstrate that past performance together with efficiency serve as the primary determinants of bank profitability levels. Bank profitability shows a minimal yet meaningful response to reserve requirements yet other variables including digitalization and capital adequacy and loan-to-deposit ratios fail to demonstrate significant relationships. Bank performance persistence stems from enduring institutional advantages which include superior management and advanced technology together with dedicated customer base and advantageous regulatory frameworks. Higher reserve requirements create a positive relationship with ROA according to the RR variable. Banks adapt to higher reserve requirements by improving operational efficiency and modifying their asset management strategies. Digitalization shows a positive relationship with profitability but the effects are not strong enough to establish conclusive results.

Bank resilience depends on capital adequacy but this factor does not directly affect profitability levels. LDR produces a negative but statistically insignificant coefficient which indicates that loan deployment effectiveness depends heavily on credit quality and economic conditions and lending practices. ER produces negative effects that strongly decrease profitability according to all models. Bank profitability shows unpredictable responses to inflation because Model 2 demonstrates a positive link between inflation and interest rates yet this relationship remains unstable across different models.

4.3 Endogeneity Test

Based on the assumption of exogeneity, this study conducted an endogeneity test as presented in Table 6. The Durbin Wu-Hausman test was performed on models 1 to 7, where the results showed a probability of 0.000 for each group, and the null hypothesis was rejected. Therefore, it is concluded that the panel data has an endogeneity problem.

Table 5. Endogeneity Test

Variable	Model 1	Model 2	Model 3
Durbin-Wu-HausmanTest	45.06*** (0.0000)	39.07*** (0.0000)	27.20*** (0.0000)
No of Cross-Section	34	34	34
No of Observation	714	714	714

Note: Symbols ** is Prob. < 5%.

4.4 Dynamic Panel Data Estimation

Table 6. Panel GMM Estimation Results

Variable	Dependent variable : ROA		
	Model 1	Model 2	Model 3
ROA (-1)	0.5625*** (0.0029)	0.5898*** (0.0027)	0.5727*** (0.0055)
RR	-0.1152*** (0.0082)		-0.0665*** (0.0081)
DIG		0.3476*** (0.0315)	0.2854*** (0.0311)
CAR	0.0048*** (0.0005)	0.0056*** (0.0005)	0.0041*** (0.0007)
LDR	0.0027*** (0.0003)	0.0033*** (0.0002)	0.0037*** (0.0004)
ER	-1.0243*** (0.0492)	-1.9577*** (0.1477)	-1.7657*** (0.1413)
INF	0.0478*** (0.0032)	0.0485*** (0.0042)	0.0221*** (0.0042)
AR (1) (p-value)	0.0033	0.0033	0.0041

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AR (2) (p-value)	0.1743	0.1962	0.1907
Sargan Test (p-value)	1.0000	1.0000	1.0000

The analysis demonstrates that ROA lagged values are positive and highly significant in all models which indicates strong dynamic persistence in bank profitability. Bank profitability persistence may stem from three main factors including reputational capital together with customer loyalty and technological lock-ins. RR demonstrates negative and highly significant coefficients which show that higher RR values decrease bank profitability. The Digitalization demonstrates a positive relationship with ROA because banks that use digital technology more extensively achieve better performance results. Well-capitalized banks demonstrate higher profitability according to the positive and statistically significant of CAR. LDR produces consistent positive and significant results which show that increased credit intermediation activities lead to higher bank profitability. Excessive high LDRs may indicate liquidity risk.

ER produces negative and highly significant results throughout all models especially when digitalization and reserve requirements are included in the analysis. The data shows that developing country banks maintain foreign currency assets and liabilities which become susceptible to valuation losses. The results demonstrate the necessity for exchange rate stability policies and foreign exchange risk hedging strategies. The results show that inflation has a positive relationship with ROA across all models which indicates that banks benefit from moderate inflation levels through improved interest margins. The coefficient value decreases in Model 3 which means that inflation benefits become diminished when digital and monetary tightening variables are evaluated together.

Discussion

The study employs dynamic panel GMM to identify profitability determinants of banks while analysing how monetary policy instruments and bank characteristics along with macroeconomic indicators and digital transformation affect profitability. System GMM estimation addresses endogeneity issues primarily because of including ROA(-1) as a lagged dependent variable and generates reliable results in all three model specifications. The strong persistence of profitability becomes evident through positive and highly significant ROA(-1) coefficients in all models which demonstrate that bank performance follows a path-dependent pattern. Bank entities which demonstrate strong performance in one period are likely to maintain their performance because of factors like reputational capital along with economies of scale and embedded customer relationships. The positive relationship between previous-year ROA and current-year ROA supports both the dynamic theory of profitability and the necessity of including past ROA to explain financial performance persistence.

The analysis demonstrates that reserve requirements lead to negative impacts on bank profitability which matches the expected contractionary effects of this monetary policy instrument. When banks maintain higher reserve requirements they must reduce their available lending capacity thus decreasing their revenue potential. This finding support the previous studies of Son et al. (2023), Mia (2023), Garr and Awadzie (2021). The coefficient magnitude decreases between Model 2 and Model 3 which suggests digital financial innovations act as a partial offset against monetary tightening effects possibly through reduced costs or enhanced service coverage to more profitable market segments. Digitalization proves to be a crucial performance enhancer because both coefficients demonstrate positive and significant values. Banks that adopt digital platforms achieve operational efficiency alongside enhanced customer relationships and lower transaction costs per transaction. The empirical evidence demonstrates that fintech integration supports bank profitability while the academic literature supports this finding specifically in developing economies where physical infrastructure remains limited. Our finding inline with prior studies of Huang (2023) and Dao (2020).

The positive relationship between CAR and ROA demonstrates that banks with sufficient capital reserves can better withstand financial shocks and attract deposits while exploring lucrative investment options. The research supports the financial safety net theory while demonstrating that robust capital levels produce both financial stability and long-term profitability. The findings about prudential regulation suggest that higher capital adequacy ratios could boost performance over time without restricting growth opportunities. Our finding is support by previous studies of tten and Vo (2019), and Mohanty and Krishnankutty (2018). LDR produces consistently positive and significant results which show that lending remains a fundamental component in driving bank profitability. The theory of traditional banking is confirmed through this finding because banking profitability stems mainly from interest rate differences between loan assets and deposit liabilities. Higher LDR values show increased income generation through riskier financial intermediation yet policymakers need to track the rising credit risks when macroeconomic conditions become volatile. This finding relevant with studies of Zaiane and Moussa (2021), and Ebenezer et al. (2019).

ROA shows a strong negative correlation with ER. A domestic currency depreciation creates negative banking impacts by raising foreign liability costs while reducing the domestic asset values and intensifying credit risk for borrowers with unmanaged foreign currency exposure. This study in line with previous study of Azzabi and Lahrichi (2023). Banks remain highly sensitive to external disturbances while demonstrating the need for stable exchange rates to protect banking sector health. The results present high relevance to developing economies with open capital accounts thus requiring advanced frameworks for managing foreign exchange risks. The results indicate inflation has a positive correlation with bank profitability

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although this relationship weakens when the analysis includes additional variables in Model 3. The observed relationship supports the inflationary environment hypothesis which suggests that controlled and predictable inflation allows financial institutions to expand their profit margins. The relationship between inflation and bank profitability shows a possible nonlinear effect because excessive inflation levels could eventually damage asset quality and increase uncertainty while reducing long-term profitability. Our finding relevant with the study of Rolle et al. (2020).

The obtained findings from policy perspective generate important insights. Monetary authorities need to use caution when imposing high reserve requirements because such measures decrease profitability especially in banks that generate income from interest rates. The banking industry should receive priority attention from policymakers because digital transformation enhances operational performance and helps counteract macroeconomic challenges. Third, strong capital regulation and risk-based supervision are essential, not only for stability but also for improving bank efficiency and return. The research investigates how monetary policy instruments and bank fundamentals and macroeconomic conditions and digitalization interact to influence banking profitability in developing countries. The research demonstrates that an integrated strategy which unites regulatory and monetary and technological elements will create a stable banking sector that supports economic growth.

5. Conclusion

This research investigates the determinants of bank profitability in developing countries using System GMM. The research examines how central bank policies and digitalization and bank-specific factors and economic conditions affect bank profitability. The research indicates that return on assets (ROA) profitability shows time persistence because previous bank performance strongly determines current success levels. Higher reserve requirements which function as monetary policy restrictions reduce bank lending opportunities thus negatively affecting profitability. Digitalization serves as a profit booster because it enhances operational efficiency while enabling banks to reach more customers. A bank's capital adequacy ratio (CAR) and loan-to-deposit ratio (LDR) both demonstrate positive relationships with its financial performance. Exchange rate depreciation creates negative effects on profitability because it raises foreign currency-related risks. The study reveals that moderate inflation levels benefit banks through increased interest margins. The study provides recommendations for countries to develop digital infrastructure and control reserve requirements and enhance bank capital reserves and protect against currency risks and maintain stable inflation levels. The study contains certain restrictions which need to be considered. The research depends on existing financial data and employs a basic digitalization measurement and encounters difficulties when measuring macroeconomic indicators. Future research should analyze institutional quality and regulations as well as the differences between state-owned and private banks. The research should analyze profitability differences between developing and advanced economies as well as the effects of financial inclusion and digitalization on underserved areas.

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