

## Unleashing the Power: Unraveling the Effects of Reserve Requirements on the Thriving Profits of Ethiopian Commercial Banks

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### Abstract

*This study examined the impact of reserve requirements on the profitability of Ethiopian commercial banks. The study utilized secondary data from the National Bank of Ethiopia's consolidated data and the banks' annual reports to ensure a comprehensive dataset. A quantitative research approach and an explanatory research design were employed using panel data from one state-owned bank and nine private commercial banks over an eight-year period. The target population consisted of sixteen private and one state-owned commercial banks operational from 2015 to 2022, with a sample of 10 banks selected through non-probability purposive sampling. The analysis utilizes descriptive statistics, correlation matrix, and panel data econometric modeling with STATA to investigate the relationships between variables. The findings demonstrated that reserve requirements had a significant negative impact on the profitability of Ethiopian commercial banks, as measured by both ROA and ROE. As reserve requirements increased, the banks experienced decreased returns on assets and equity, indicating a financial burden and reduced profitability. However, control variables such as credit risk, liquidity risk, and deposit fund did not significantly influence ROA or ROE, suggesting that variations in these factors did not have a significant impact on bank profitability in Ethiopia. On the other hand, the study found that bank size had a highly significant and positive effect on both ROA and ROE, indicating that larger banks tended to achieve higher returns, potentially benefiting from economies of scale or other advantages associated with their size. Furthermore, loan production had a statistically significant positive impact on ROE, suggesting that increased loan production led to higher returns on assets for commercial banks.*

**Key Words:** 1. Reserve Requirement 2. Return on Asset 3. Return on Equity 4. Profitability

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### 1. Introduction:

The banking sector plays a vital role in facilitating effective resource allocation within countries and acts as a backbone for economic growth and development (Frederick, 2015; Otuori, 2013). Commercial banks, in particular, provide a financial lifeline to investors by making funds available for borrowing and contribute to

deepening the country's financial foundation. Additionally, they engage in various activities such as money transfer and international banking services, further enhancing their role as financial intermediaries. The financial performance of banks holds paramount importance for a country's economic growth, as it rewards shareholders, encourages investment, and fosters economic development. Conversely, poor banking performance can lead to banking failures and crises, with disastrous consequences for economic growth (Frederick, 2015).

In a bank-based economy like Ethiopia, the financial sector, especially banks, acts as an engine that synergizes the economy by facilitating the circulation of financial resources and supporting the productive capacity of various sectors. Banks' proper functioning is crucial for economic development, and any failure or inefficiency in their operations can significantly hinder progress. The global financial crisis of 2007, 2008, and 2009 serves as evidence of how the failure of banks can trigger economic disasters, emphasizing the need for banks to operate in a safe and thorough manner to avoid a contagion of economic distress. Consequently, banks are among the most regulated sectors, regardless of a country's development level (Beck et al., 2006; Triki et al., 2017; Jomini, 2014).

In Ethiopia, commercial banks operate within a highly regulated industry, with all their activities guided by policies set forth by the National Bank of Ethiopia (NBE). The NBE issues various regulations and directives and undertakes monitoring and controlling activities to protect depositors and stabilize the macroeconomic conditions of the country. These regulations and supervisory measures aim to create a stable economic environment within the country (Temesgen, 2015).

One of the key policies employed by the NBE is the cash reserve requirement (CRR), which mandates that commercial banks keep a fraction of their total deposit liabilities as cash reserves with the central bank. This requirement sets a minimum fraction of customer deposits and notes that each commercial bank must hold as reserves instead of lending out. These reserves can be in the form of physical cash stored in a bank vault or deposits made with the central bank. The required reserve ratio can be utilized as a tool in monetary policy to influence borrowing, interest rates, and the amount of funds available for banks to make loans with (Gray, 2011; Ronitaille, 2011).

The reserve requirement serves to secure banks, their customers, shareholders, and the overall economy by providing stability and safeguards for all stakeholders (Glocker&Towbin, 2012). However, not all research studies have established a consensus on the impact of reserve requirements on the operational activities, liquidity, and financial performance of banks (Gray, 2011; Ma et al., 2011). Some studies have revealed that reserve requirements can influence banks' financial performance (Tewodros, 2017), while others have suggested that reserve requirements are responsible for poor financial performance in some banks worldwide (Ma et al., 2011; Ben Naceur&Kandil, 2009). Furthermore, reserve requirements may potentially hinder employment or necessitate the reduction of existing employees (King, 2010; Ben Naceur&Kandil, 2009).

Given the lack of clear-cut evidence regarding the effect of reserve requirements on banks' performance, there is a need for extensive research to ascertain the credibility of the reserve requirement set by central banks (Derina, 2011; Glocker&Towbin, 2012). The impact of reserve requirements on the profitability of Ethiopian commercial banks has received limited attention in previous studies. Additionally, while the perception exists among commercial banks and parts of the public that reserve requirements bring challenges and disadvantages, not all research studies support this notion. Therefore, conducting more research on this subject can shed light on the relevance and impact of reserve requirements on bank profitability.

In light of the above, this study aims to investigate the relationship between reserve requirements and the profitability of Ethiopian commercial banks. Specifically, it seeks to assess the impact of reserve requirements on the return on assets (ROA) and return on equity (ROE) of Ethiopian commercial banks. Additionally, the

study aims to analyze the causal relationship between reserve requirements and profitability, as well as to examine the potential moderating effects of bank-specific factors on this relationship.

## 1.2 Objective of the Study

The research has a general objective of identifying the impact of reserve requirements on the profitability of Ethiopian commercial banks.

### The specific objectives of the study are as follows:

- To assess the impact of reserve requirements on the return on assets (ROA) of Ethiopian commercial banks.
- To examine the impact of reserve requirements on the return on equity (ROE) of Ethiopian commercial banks.
- To investigate the causal relationship between reserve requirements and the profitability (ROA and ROE) of Ethiopian commercial banks.
- To analyze the extent to which reserve requirements affect the profitability (ROA and ROE) of Ethiopian commercial banks.
- To assess the potential confounding variables' effects of bank-specific factors, such as bank size, liquidity risk, credit risk, loan production, and deposit fund, on the relationship between reserve requirements and profitability (ROA and ROE) in Ethiopian commercial banks.

## 2. Literature Review

### 2.1 Theoretical Review

Reserve requirements are a regulatory tool utilized by central banks to control the amount of funds that commercial banks are required to hold as reserves against their deposit liabilities. These requirements stipulate the minimum proportion of a bank's deposit liabilities that must be maintained as reserves, which can comprise of vault cash or deposits held with the central bank (Shen, 2021).

The existence and functioning of many banking sectors are influenced by the reserve requirements set by the central bank (Robitaille, 2010). The central bank's reserve requirement serves as a crucial safeguard, providing assurance for the stability and operation of commercial banks. Research indicates that the majority of global banking sectors are regulated based on reserve requirements (Santos, 2000).

The central bank's reserve requirements play a vital role in mitigating bank runs and preventing the potential bankruptcy of commercial banks. They serve as a mechanism to regulate customer behavior and provide access to the discount window for interbank lending and borrowing, thus enhancing the overall stability of the banking system (Bianchi & Bigio, 2013; Bouwman, 2013; Glocker & Towbin, 2012).

Various theories have been employed to elucidate the relationship between reserve requirements and bank profitability. Two commonly applied theories are the trade-off theory and the commercial loan theory. The trade-off theory posits that banks face a trade-off between holding reserves and investing in income-generating assets to maximize profitability. On the other hand, the commercial loan theory emphasizes the role of reserves in facilitating lending activities, which directly affects bank profitability (Shen, 2021).

In this study, the theoretical foundation draws upon both the trade-off theory and the commercial loan theory to examine the impact of reserve requirements on the profitability of Ethiopian commercial banks. By exploring these theories, we can gain insights into the relationship between reserve requirements and bank profitability, shedding light on the mechanisms through which reserve requirements influence the financial performance of commercial banks.

### **2.1.1. Trade-Off Theory**

The trade-off theory of capital structure states that banks' objective is to attain an optimum degree of liquidity to balance the advantage and disadvantages of holding cash. It is believed to have been established by (Kraus & Litztenberger, 1973). The cost or disadvantage of holding cash revolves around a low rate of return because of tax burden and liquidity premium. The immediate survival of a firm is heavily dependent on its liquidity, while its long-term survival and growth is heavily dependent on its profitability. Hence, liquidity ensures short-term survival and profitability ensures long-term survival. Both are therefore important for any firm to survive.

This theory according to (Hanaffie, 2017) accentuates that companies keep an optimal degree of their liquidity level by trying to retain equilibrium between their profits and the price of keeping cash. He stressed that the primary point in trade-off theory is the proposition that corporate firms regulate the optimum level of their cash by defining the extent of their final cost significance and final profits from keeping cash. The highlight of the theory is that there must always be a trade-off between profitability and liquidity. The biggest criticism of the trade-off theory is that it predicts a positive relationship between earnings and advantage, contradictory to well-established empirical evidence (Moses et al., 2015). Another critic is that the foundation of the theory was based on the assumption of perfect knowledge in a perfect market. In addition, it failed to integrate the influence of taxes, agency cost, and cost of issuing new securities, apex bank regulation and financial ache of investment opportunities (Nguyen & Le, 2017). The relevance of this theory to the current study is that it explains the fact that corporations are usually financed with debt and partly with equity.

### **2.1.2. Commercial Loan Theory**

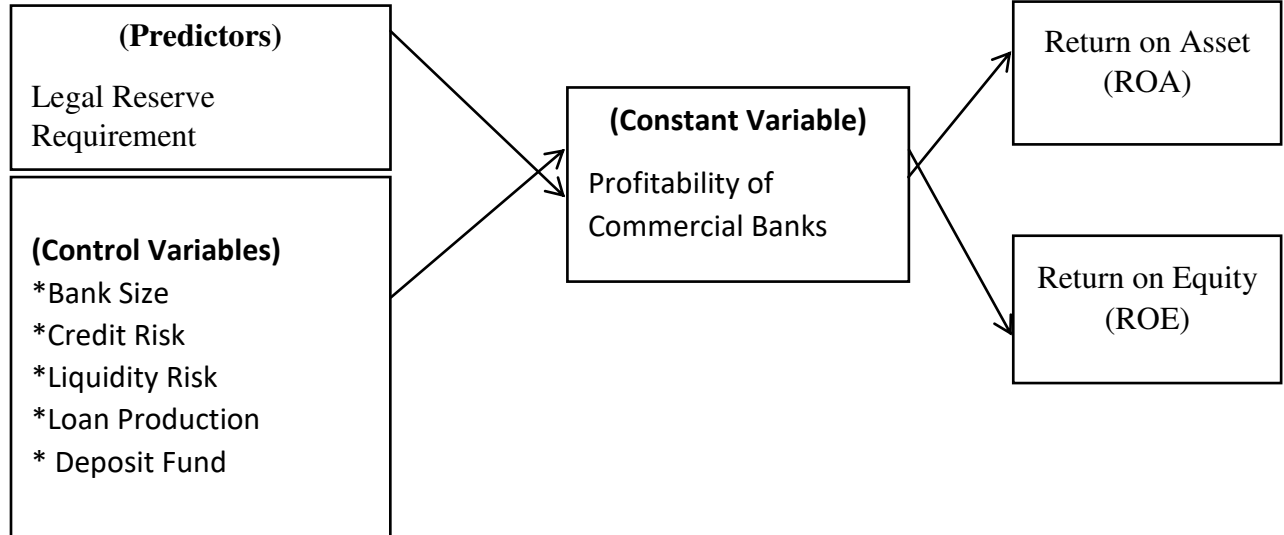
Commercial loan theory states that a commercial bank should advance only short-term self-liquidating loans to business firms. Implicitly, the theory upholds that banks should lend only on short-term, self-liquidating commercial documents. This is because a bank has liabilities or commitments payable on demand, and it would be unable to satisfy these responsibilities if its assets are inadequate or tied up for a lengthy period. Self-liquidating loans are those loans that are meant to fund the manufacturing and movement of commodities through the continuous levels of production, storage, transportation and distribution. Commercial loan theory is recognized to be the oldest theory on cash reserves and liquidity management. Commercial loan is a short-term, negotiable and self-liquidating instrument with little risk. It facilitates the capability of the borrower to make installments on a definite date when commodities are bought on credit. There are three notable benefits to short-term self-liquidating productive loans (Vincent & Gemechu, 2013). They achieve liquidity; therefore, they automatically liquidate themselves. In addition, since they become mature in the short-run, and are for productive ambitions, there is no fear of them transferring to bad debts. Lastly, such loans are high on productivity and provide revenues for the banks.

This theory holds weight in its doctrines and suppositions. However, it has some weaknesses and shortcomings. The weakness of this theory comes out from the failure to realize that the loans are made, based on the worth of the commodity, and not the commodity itself. In addition, the worth of the commodity is subject to diverse variations, based on the state of the economy (Obim et al., 2020). This theory has shortcomings such as inconsistency with the demand for economic development, exclusion of long-term loans, exclusion of stability of demand deposit that helps banks to undertake long term lending among others and much emphasis on the maturity of bank assets instead of marketability (Yusuf et al., 2019).

The relevance of this theory to the research are based on the fact it points to the reservation of cash through issuing of short-term loans to firms and obtaining cash from the central bank through the security of short-term loans. It brings to limelight the fact that having adequate cash reservations protect the liquidity of the bank, and increases profitability, which ultimately improves the economy. The theory makes an adequate comparison between liquidity and profitability of banks, stating that the liquidity of a bank is directly relate

to both the profitability and performance of the banks, as they have financial obligations and commitment to fulfill.

**Conceptual Framework**



Source: Adopted from Akinleye&Oluwadare, 2022 & Tewodros, 2017

**3. Research Methodology**

**3.1 Research Approach and Design**

The research study employed a quantitative methodology to investigate the research questions by collecting and analyzing quantitative data. Therefore, a quantitative approach was adopted to examine the impact of reserve requirements on the profitability of Ethiopian commercial banks, utilizing panel data analysis.

Explanatory research, such as this study, tries to clarify the causal connections between determinant variables and the profitability of Ethiopian commercial banks.

The explanatory research design, as highlighted by Kothari (2004), specifically focuses on analyzing cause-and-effect relationships between dependent and independent variables.

**3.2 Data Types and Sources**

For possible achievement of the objective of the paper the researcher used secondary data. In order to accurately assess the variables within the model, a comprehensive data set was gathered from NBE consolidated data and the banks’ annual reports. This entailed collecting such information as total deposits, loans and advances, total assets, net profit, shareholders’ equity, required cash reserves, loan provision, and liquid assets from each bank. All of this data was then meticulously examined for further study.

### 3.3 Population and Sampling Technique

#### Target Population

Target population of the study was commercial banks that were operational from 2015 to 2022. There are sixteen private and one state owned commercial banks in the mentioned period. Eight years panel data were encompassed for the study.

**Table 3.1 List of Banks and their establishment year**

No.	Name of Commercial Banks	Year of Establishment
1	Commercial Bank of Ethiopia	1942
2	Dashen Bank SC	1995
3	Awash Bank SC	1995
4	Bank of Abyssinia SC	1996
5	Wegagen Bank SC	1997
6	Hibret Bank SC	1998
7	NIB International Bank SC	1999
8	Cooperative Bank of Oromia SC	2004
9	Lion International Bank SC	2006
10	Oromia International Bank SC	2008
11	Zemen Bank SC	2008
12	Berhan Bank SC	2009
13	Bunna International Bank SC	2009
14	Debut Global Bank SC	2012
15	Abay Bank SC	2010
16	Enat Bank SC	2008
17	Addis International Bank SC	2010

#### Sample Design

The study selected a sample of 10 banks, consisting of one state-owned Commercial Bank of Ethiopia and 9 private commercial banks, namely Awash Bank S.C, Abyssinia Bank S.C, Dashen Bank S.C, Cooperative Bank of Oromia, United Bank S.C, Wegagen Bank S.C, NIB International Bank S.C, Oromia International Bank S.C, and Lion International Bank S.C. The selection of the banks was based on non-probability purposive sampling technique, which focuses on specific characteristics of a population of interest that can provide the most relevant information to answer the research questions, as described by (Mugenda, 2009).

According to the National Bank of Ethiopia's 2019/20 annual report, the selected nine private banks and one state-owned bank account for 87.2% of the market share in terms of total assets and capital. State-owned banks and private banks operate differently, and their financial performance differs significantly. In addition, the selected commercial banks were among the top banks as they hold the majority of the market share in terms of assets and capital. Including these banks into the performance of the significant players in the industry can provide an overview of the sector's overall profitability. Therefore, counting these banks in the study was considered sufficient to cover the majority of the market.

### 3.4 Methods of Data Analysis and Interpretation

The collected panel data was analyzed using descriptive statistics, correlations matrix and panel data econometric modeling since the data is collected over multiple time periods. The descriptive statistics was used to quantitatively describe the important features of the variables and to analyze the general trends of

the data from 2015 to 2022 based on the sector sample of 10 banks using statistical results mean, maximum minimum and standard deviations.

Additionally, the study applied panel data econometric modeling to assess the cause and effect relationship between variables. The Pearson correlation method was applied to know the relationship between independent variables and dependent variables. To change the collected data into useful information the analysis was helped by STATA. And so, to test the hypothesis of the study and to determine the relative importance of each independent variable in influencing profitability commercial banks in Ethiopia panel data econometric modeling was used.

### 3.5 Model Formulation and Specification

The researcher examined the impact of cash reserve requirement on the profitability of Ethiopian commercial banks using panel data econometric modeling. Control variables are included in the model to account for the potential impact of other factors that may affect the relationship between the independent variable (reserve requirement) and the dependent variable (profitability of Ethiopian commercial banks). The control variables are bank size, credit risk, liquidity risk, loan production, and deposit fund.

Including these control variables, the model can provide a more accurate and robust estimate of the relationship between reserve requirement and bank profitability, while also accounting for the potential impact of other relevant factors.

As a result, the panel data econometric model equation is:

#### Model 1

The first model measures profitability by return on assets (ROA).

The panel data econometric model was formulated as:

$$ROA_{it} = \beta_0 + \beta_1 CRR_{it} + \beta_2 BS_t + \beta_3 CR_{it} + \beta_4 LS_{it} + \beta_5 LP_{it} + \beta_6 DF_{it} + u_{it}$$

#### Model 2

The second model measures profitability by return on equity (ROE).

The panel data econometric model was formulated as:

$$ROE_{it} = \beta_0 + \beta_1 CRR_{it} + \beta_2 BS_t + \beta_3 CR_{it} + \beta_4 LS_{it} + \beta_5 LP_{it} + \beta_6 DF_{it} + u_{it}$$

Where:

ROA<sub>it</sub> is the return on assets of bank i at time t

ROE<sub>it</sub> is the return on equity of bank i at time t

CRR<sub>it</sub> is the reserve requirement of bank i at time t

BS<sub>it</sub> is the size of bank i at time t

CR<sub>it</sub> is the credit risk of bank i at time t

LR<sub>it</sub> is the liquidity risk of bank i at time t

LP<sub>it</sub> is the loan production of bank i at time t

DF<sub>it</sub> is the deposit fund of bank i at time t

β<sub>0</sub> is the intercept

β<sub>1</sub> to β<sub>6</sub> are the coefficients of the independent variables

u<sub>it</sub> is the error term



**Descriptions of model Variables and Working Hypothesis**

	Measure	Notation	Expected Sign
<b>Dependent Variable (Profitability)</b>			
Return on Asset	Net Income/Total Asset	ROA	
Return on Equity	Net Income/Share Holders' Equity	ROE	
<b>Independent Variable</b>			
Cash Reserve Requirement	Prescribed cash reserve ratio in the prior year	CRR	-
<b>Control Variables</b>			
Bank Size	Logarithm of Total Assets	BS	+
Credit Risk	Loan Loss Provision/Total Loan	CR	-
Liquidity Risk	Total Liquid Asset/Total Asset	LR	-
Loan Production	Total Loan & Advances/Total Asset	LP	+
Deposit Fund	Total Deposit/Total Asset	DF	+

**Hypotheses of the Study**

In line with the broad objective described above, the following hypotheses are formulated for investigation based on theories and past related empirical studies.

**H1:** Cash reserve requirement has negative and significant effect on return on asset.

**H2:** Cash reserve requirement has negative and significant effect on return on equity.

**4. Results**

**Descriptive Analysis**

**Data Analysis, Interpretation and Discussion of Results**

Variable		Mean	Std. Dev.	Min	Max	Observations
<b>ROA</b>	overall	0.025366	0.0359	0.003196	0.336321	N = 80
	between		0.015368	0.015722	0.067643	n = 10
	within		0.032765	-0.02136	0.294044	T = 8
<b>ROE</b>	overall	0.165711	0.076332	0.009351	0.371764	N = 80
	between		0.06489	0.016938	0.257823	n = 10
	within		0.044598	0.028419	0.279651	T = 8
<b>CRR</b>	overall	0.09	0.018142	0.05	0.1	N = 80
	between		0	0.09	0.09	n = 10
	within		0.018142	0.05	0.1	T = 8
<b>CR</b>	overall	0.57373	2.797444	0.002219	17.0302	N = 80
	between		1.705155	0.010386	5.425054	n = 10
	within		2.275033	-4.84353	12.17888	T = 8



<b>LR</b>	overall	0.337859	0.145734	0.000246	0.675482	N = 80
	between		0.117433	0.208099	0.634537	n = 10
	within		0.093113	0.074678	0.541398	T = 8
<b>BS</b>	overall	10.63675	0.508874	9.16924	12.05107	N = 80
	between		0.441712	10.21391	11.79139	n = 10
	within		0.284836	9.501739	11.20865	T = 8
<b>LP</b>	overall	0.540846	0.175506	0.000402	0.945365	N = 80
	between		0.131594	0.351521	0.819471	n = 10
	within		0.122556	0.173157	0.823171	T = 8
<b>DF</b>	overall	0.775754	0.064781	0.488785	0.865583	N = 80
	between		0.049303	0.695202	0.820011	n = 10
	within		0.04451	0.569338	0.872763	T = 8

**(Source: Own survey, 2023)**

Return on Assets (ROA), the overall mean is found to be 0.0253656 with a standard deviation of 0.0358999. This indicates that, on average, the assets generate a modest return. The minimum observed value is 0.0031956, suggesting instances of relatively low returns, while the maximum value of 0.3363214 indicates instances of higher returns. The analysis includes a total of 80 observations.

Moving on to the Return on Equity (ROE), the overall mean is calculated as 0.1657106, with a standard deviation of 0.0763321. This signifies a moderate level of return on equity. The minimum observed value is 0.0093508; indicating lower returns, while the maximum value of 0.3717635 points to higher returns. Examining the Cash Reserve Requirement (CRR), the overall mean is determined as 0.09, with a standard deviation of 0.0181415. This suggests a relatively consistent cash reserve requirement across the dataset. The minimum and maximum values are found to be 0.05 and 0.1, respectively.

Turning to Credit Risk (CR), the overall mean is calculated as 0.5737301, with a substantial standard deviation of 2.797444. This signifies varying levels of credit risk within the dataset. The minimum observed value is 0.0022188, while the maximum value is 17.0302. Regarding Liquidity Risk (LR), the overall mean is found to be 0.3378591, with a standard deviation of 0.1457344. This indicates a moderate level of liquidity risk present in the dataset. The minimum and maximum values observed are 0.0002456 and 0.6754823, respectively.

Examining Bank Size (BS), the overall mean is determined as 10.63675, with a standard deviation of 0.508874. This suggests a relatively consistent bank size across the dataset. The minimum observed value is 9.16924, while the maximum value is 12.05107. Moving on to Loan Production (LP), the overall mean is calculated as 0.5408457, with a standard deviation of 0.1755064. This indicates a moderate level of loan production within the dataset. The minimum and maximum values observed are 0.0004016 and 0.9453653, respectively.

Finally, considering Deposit Funds (DF), the overall mean is found to be 0.7757543, with a standard deviation of 0.0647806. This indicates a relatively stable level of deposit funds across the dataset. The minimum observed value is 0.4887851, while the maximum value is 0.8655829.

## Inferential Analysis

### Correlation Analysis among Variables

**Table 4.2: Pearson Correlation Coefficient Table**

	ROA	ROE	CRR	CR	LR	BS	DF	LP
ROA	1.0000							
ROE	0.3651	1.0000						
CRR	-0.5513	-0.6353	1.0000					
CR	-0.4152	-0.4167	-0.1498	1.0000				
LR	-0.1458	-0.3447	-0.1773	-0.2419	1.0000			
BS	-0.3538	-0.4906	0.3654	-0.1205	0.3562	1.0000		
DF	-0.4969	-0.3102	0.1887	0.4189	-0.6198	0.2895	1.0000	
LP	-0.0684	-0.1305	0.3256	-0.6086	-0.4535	-0.0384	-0.4875	1.0000

(Source: Own survey, 2023)

The correlation analysis conducted in this research study reveals valuable insights into the relationships between the profitability measures of Return on Assets (ROA) and Return on Equity (ROE) and the selected independent variables, namely credit risk, liquidity risk, bank size, deposit fund, and loan production.

ROA shows a negative correlation with cash reserve requirement (CRR) and credit risk (CR) with coefficients of approximately -0.5513 and -0.4152, respectively. This implies that as the cash reserve requirement or credit risk increases, ROA tends to decrease. In other words, higher cash reserve requirements and higher credit risk negatively affect the profitability of assets.

Additionally, ROA has a negative correlation with liquidity risk (LR) and bank size (BS) with coefficients of approximately -0.1458 and -0.3538, respectively. This suggests that as liquidity risk and bank size increase, ROA tends to decrease. Higher liquidity risk and larger bank size is related with reduced asset profitability.

On the other hand, ROA shows a weak positive correlation with deposit fund (DF) and loan production (LP) with coefficients of approximately 0.1887 and -0.0684, respectively. This indicates that as deposit funds increase, ROA tends to slight increase, whereas higher loan production has a minimal negative impact on ROA.

Moving on to ROE, shows a negative correlation with cash reserve requirement (CRR) and credit risk (CR) with coefficients of approximately -0.6353 and -0.4167, respectively This implies that higher cash reserve requirements and higher credit risk are associated with lower equity profitability.

Moreover, ROE has a negative correlation with liquidity risk (LR), bank size (BS), and deposit fund (DF) with coefficients of approximately -0.3447, -0.4906, and -0.3102, respectively. This indicates that as liquidity risk, bank size, and deposit funds increase, ROE tends to decrease. Higher liquidity risk, larger bank size, and increased deposit funds have a negative impact on equity profitability.

Lastly, ROE exhibits a weak negative correlation with loan production (LP) with a coefficient of approximately -0.1305. This implies that higher loan production has a minimal negative impact on equity profitability.

**Hausman Test [Random Effect (FE) Vs. Fixed Effect (FE) Models]**

The research applied the Hausman test to the panel data analysis to determine the appropriate choice between the fixed effect (FE) and random effect (RE) models. According to Hausman (1978), the test is based on the concept of the difference in estimated coefficients between the two models. It examines whether the difference is systematic or random. If the difference is systematic, it suggests that the random effects assumption is violated, and the fixed effects model should be used.

The application of the Hausman test ensures that our panel data analysis accounts for potential endogeneity issues and provides reliable and robust estimates for our research findings."

**Table 4.3: Hausman Test for Model 1**

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CRR	.3006441	.1363345	.1643096	.
CR	.0022991	-.0016711	.0039703	.001026
LR	-.0761409	-.0501389	-.0260019	.0066397
BS	-.0783085	-.0196843	-.0586242	.0164962
LP	.0863703	-.0457809	.1321512	.0332069
DF	-.1851646	-.2963393	.1111747	.0579368

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)' [(V\_b-V\_B)^(-1)] (b-B)  
 = 18.42  
 Prob>chi2 = 0.0053

For the first model, Return on Asset (ROA), the test statistic is chi-squared [chi2 (6)] with 6 degrees of freedom, which measures the discrepancy between the coefficients of the two models. The p-value (Prob>chi2) is 0.0053, indicating that the difference in coefficients between the fixed effects and random effects models is statistically significant at 5% levels of significance.

Based on these results, we reject the null hypothesis that the difference in coefficients is not systematic, suggesting that the random effects model is inconsistent. Therefore, the fixed effects model was considered more appropriate.

**Table4.4: Hausman Test for Model 2**

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt (diag (V_b-V_B)) S.E.
CRR	.0299089	.1777964	-.1478875	.0999232
CR	-.006299	-.0041524	-.0021466	.0014616
LR	-.0356211	-.0537554	.0181343	.0156819
BS	.0127308	-.0295775	.0423084	.0225603
LP	-.1631763	-.0879644	-.0752119	.0445626
DF	.0133001	.1209655	-.1076654	.0764245

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)' [(V\_b-V\_B)^(-1)] (b-B)  
 = 3.88  
 Prob>chi2 = 0.6934

Regarding the second model, return on equity (ROE), the test statistic is chi-squared [chi2 (6)] with 6 degrees of freedom, which measures the discrepancy between the coefficients of the two models.

The p-value (P>chi2) is 0.6934, indicating that the difference in coefficients between the fixed effects and random effects models is not statistically significant at 5% levels of significance. Hence, we fail to reject the null hypothesis that the difference in coefficients is not systematic, suggesting that both the fixed effects and random effects models are consistent.

By failing to reject the null hypothesis of no systematic difference in coefficients, it implies that the individual-specific effects captured in the random effects model do not have a significant impact on the estimated coefficients. This suggests that the random effects model adequately accounts for the individual-specific heterogeneity in the data.

Hence, the researcher applied fixed effect model since random effects model offers certain advantages such as efficiency and generalizability. It allows for more efficient estimation compared to the fixed effects model, providing more precise estimates of the coefficients. Additionally, the random effects model allows for generalization beyond the specific panel of individuals included in the analysis, providing insights into the average relationships between the variables of interest in the broader population.

## Results of the Regression Analysis

### Model one

**Table 4.5: Regression Analysis for Model 1**

#### Model 1

$$ROA = \beta_0 + \beta_1CRR_{it} + \beta_2CR_{it} + \beta_3LR_{it} + \beta_4BS_{it} + \beta_5LP_{it} + \beta_6DF_{it} + \mu_{it}$$

$$ROA = .952 - 0.300CRR - 0.002CR - 0.076LR + 0.078BS + 0.086LP - 0.185DF + \mu_{it}$$

<b>Fixed-effects (within) regression</b>			<b>Number of obs = 80</b>	
<b>Group variable: Bank1</b>			<b>Number of groups = 10</b>	
<b>Adjusted R-sq:</b>				
<b>Overall = 0.4254</b>			<b>F(6,64) = 9.51</b>	
<b>corr(u_i, Xb) = -0.8598</b>			<b>Prob&gt; F = 0.0000</b>	
<b>ROA</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>t</b>	<b>P&gt;t</b>
<b>CRR</b>	-.01364	.01010	-1.35	0.018
<b>CR</b>	-.00229	.002148	-1.07	0.290
<b>LR</b>	-.01614	.007507	-2.15	0.036
<b>BS</b>	.00830	.002085	3.98	0.000
<b>LP</b>	.03637	.021145	1.72	0.090
<b>DF</b>	.18516	.089939	2.06	0.044
<b>_cons</b>	.95259	.154508	6.17	0.000

The fixed-effects (within) regression analysis was conducted using a dataset consisting of 80 observations from 10 different groups, identified by the variable "Bank1."

The overall R-squared value for the model was 0.4254, indicating that approximately 42.54% of the total variation in the return on Asset can be explained by the independent variables.

The F-test with a value of 9.51 was used to test the joint significance of the coefficients in the model. The associated p-value was found to be 0.0000, providing strong evidence against the null hypothesis of no joint significance. **Thus, we can conclude that the group of coefficients as a whole is statistically significant in explaining the variation in the dependent variable.**

The coefficient for the cash reserve requirement (CRR) is -0.01364, with a standard error of .01010. The t-statistic is -1.35, and the associated p-value is 0.018, indicating that CRR has a statistically significant impact on the dependent variable at a 5% significance level.

**So, the alternative hypothesis (H1) that there is significant relationship between reserve requirement and return on asset was accepted.**

**Model Two**

**Table 4.6: Regression Analysis for Model 2**

**Model 2**

$$ROE = \beta_0 + \beta_1CRR_{it} + \beta_2CR_{it} + \beta_3LR_{it} + \beta_4BS_{it} + \beta_5LP_{it} + \beta_6DF_{it} + \mu_i$$

$$ROE = .952 - 0.300CRR - 0.002CR - 0.076LR + 0.078BS + 0.086LP - 0.185DF + \mu_i$$

<b>Random-effects GLS regression</b>			<b>Number of obs = 80</b>	
<b>Group variable: Bank1</b>			<b>Number of groups = 10</b>	
<b>R-sq:</b>				
<b>Overall = 0.4967</b>				
<b>corr(u_i, X) = 0 (assumed)</b>				
<b>ROE</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt;z</b>
<b>CRR</b>	-.0177	.0386	-0.46	0.049
<b>CR</b>	-.0041	.0036	-1.15	0.251
<b>LR</b>	-.0537	.0624	-0.86	0.389
<b>BS</b>	.0295	.0276	1.07	0.028
<b>LP</b>	.0179	.0161	1.11	0.026
<b>DF</b>	.1209	.1440	0.84	0.401
<b>_cons</b>	.4385	.2280	1.92	0.054

The random-effects generalized least squares (GLS) regression analysis was performed using a dataset comprising 80 observations from 10 different groups identified by the variable "Bank1." The overall R-squared value, which measures the proportion of the variation in the dependent variable (ROE) explained by the independent variables shows 0.4967. This suggests that approximately 49.67% of the variability in ROE can be accounted for by the independent variables.

The Wald chi-square test with 6 degrees of freedom was employed to test the joint significance of the coefficients in the model. The test statistic yielded a value of 4.40, and the associated p-value is 0.0227. Since the p-value is less than the typical significance level of 0.05, we can conclude that there is evidence of joint significance among the coefficients.

- Cash reserve requirement (CRR) has a coefficient of -0.0177 with a standard error of 0.386. The corresponding z-statistic is -0.46, and the associated p-value is 0.049. This suggests that CRR has a marginally significant negative effect on ROE at a 5% significance level.

**Thus, the alternative hypothesis (H2) that there is significant relationship between reserve requirement and return on equity is accepted.**

In summary, based on the findings of the research, reserve requirement has a significant negative impact on the profitability of Ethiopian commercial banks, as measured by both Return on Asset (ROA) and Return on Equity (ROE). As the reserve requirement increases, the returns on asset and equity of the banks tend to decrease. This suggests that a higher reserve requirement places a financial burden on the banks, reducing their profitability.

The study also examined the effects of several control variables on bank profitability. It was found that credit risk, liquidity risk, and deposit fund do not have a statistically significant impact on either ROA or ROE. This implies that variations in credit risk, liquidity risk, or deposit fund levels do not significantly influence the profitability of commercial banks in Ethiopia.

However, bank size was found to have a highly significant and positive impact on both ROA and ROE. This indicates that larger banks tend to achieve higher returns, potentially benefiting from economies of scale or other advantages associated with their size. Additionally, loan production was found to have a statistically significant positive effect on ROE, suggesting that higher loan production leads to increased returns on assets for commercial banks.

### **Discussion of the Regression Results**

The study tried to explore the impact of reserve requirement on the profitability of Ethiopian commercial banks. The analysis was 8 years data collected from 10 different banks on a dataset of 80 observations. Five control variables that could potentially influence the dependent variables but are not the primary focus of the analysis namely bank size, liquidity risk, credit risk, loan production and deposit fund have been included in the model. The direction and magnitude of the relationships between the independent variables and dependent variables varied depending on the measure of profitability used.

### **Relation of Cash Reserve Requirement (CRR) with Return on Asset (ROA)**

The study revealed that Reserve requirement has statistically significant and negative relation with ROA. The coefficient -0.01364 indicates a 1% increase in cash reserve requirement will lead to 1.36% decrease in return on asset.

When the Reserve Requirement is increased, the ROA of a bank decrease significantly, a consequence that can be far-reaching and have major impacts.

The finding of this research is consistent with previous studies that have found reserve requirement to be a constraint on bank profitability Akinleye&Oludawore, (2022), Jimenez et al., (2014), Gemechu, (2016),

Tewodros, (2016), Addisu, (2017) and Fatima & Samreen, (2015). In contrary to the above studies, this finding is in opposite to that of (Eden, 2014), Onoh, (2017), Akanbi & Ajagbe, (2012), Uremadu, (2012) and Olukoyo, (2011) conclusions that argued reserve requirement has insignificant impact on return on asset.

### **Relation of Cash Reserve Requirement (CRR) with Return on Equity (ROE)**

The coefficient for the cash reserve requirement (CRR) in the regression analysis of return on equity (ROE) is -0.0177 with P-value of 0.049. This shows that the relationship is statistically significant at a 5% level of significance and a 1% increase in cash reserve requirement would cause to 1.77% decrease in return on equity. This finding suggests that higher reserve requirements imposed by regulatory authorities have a detrimental effect on the profitability of banks and their ability to generate returns for shareholders.

These findings align with previous research on the impact of reserve requirements on bank profitability and return on equity. For example, a study by Akinleye & Oludawore, (2022), Fatima & Samreen, (2015), Maddaloni & Peydro, (2011), and Oganda et al, (2018) on reserve requirements and bank stability found that higher reserve requirements tend to reduce bank profitability, including the return on equity. In contrary, the finding of this study is in opposite to that of Uremadu, (2012), Eden, (2014) and Onoh, (2017).

### **Conclusion**

Based on the findings of this study, it can be concluded that reserve requirements have a significant negative impact on the profitability of Ethiopian commercial banks. As the reserve requirement increases, the returns on assets (ROA) and return on equity (ROE) of the banks tend to decrease, indicating a financial burden on the banks and reducing their profitability. This suggests that reserve requirements impose constraints on the banks' ability to generate profits.

Furthermore, the study found that credit risk, liquidity risk, and deposit fund levels do not have a statistically significant impact on the profitability of commercial banks in Ethiopia. This implies that variations in these factors do not significantly influence the profitability of the banks. However, bank size was found to have a highly significant and positive impact on both ROA and ROE. This indicates that larger banks tend to achieve higher returns, potentially benefiting from economies of scale or other advantages associated with their size.

Additionally, loan production was found to have a statistically significant positive effect on ROE, suggesting that higher loan production leads to increased returns on assets for commercial banks. These findings highlight the importance of considering reserve requirements and other factors such as bank size and loan production in assessing the profitability of Ethiopian commercial banks. Policymakers and stakeholders in the banking sector should take into account the potential negative impact of reserve requirements on bank profitability and consider measures to mitigate this effect. Additionally, efforts to promote the growth and expansion of banks, particularly in terms of size and loan production, may contribute to enhancing profitability in the Ethiopian banking sector.



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