IMPACT OF ASSET-LIABILITY MANAGEMENT ON BANK PROFITABILITY: EVIDENCE FROM PRIVATE COMMERCIAL BANKS IN ETHIOPIA

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Abstract

This study aimed to look at the impact of asset-liability management on the profitability of Ethiopian private commercial banks. A panel data approach was utilised to analyse time series data from 14 private commercial banks in Ethiopia between 2013 and 2022 using the statistical cost accounting (SCA) model. STATA 15 statistical software was used to evaluate the acquired secondary data using descriptive statistics, correlations, and multiple linear regressions to determine the nature of the relationship between bank profitability (ROA) and asset-liability management variables. According to the findings of Pearson correlation analysis, all asset types included in the study positively correlate with profitability (ROA). In contrast, all liability types negatively correlate with the banks' profitability (ROA). The random effect regression findings showed that all assets, particularly loans and advances, deposits in foreign banks, investments in security, and net fixed assets, positively affect profitability and vary across assets. Contrastingly, all liabilities, mainly savings deposits, demand deposits, fixed deposits, and other liabilities, negatively affect profitability and vary across liabilities. These findings give bank management useful insights by identifying the assets with the highest return on bank profitability and the cheapest source of funds from the liabilities. Overall, the study concludes asset-liability management deserves more focus to improve profitability.

1. Introduction

Developing a trustworthy, futuristic, and dynamic financial system is essential for every country's economic growth (Owusu & Alhassan, 2021; Ayadi et al., 2015). The banking sector acts as the principal financial intermediary for most African countries, which all have relatively underdeveloped and illiquid stock markets (Allen et al., 2011). Because Ethiopia is located in Africa and has no established stock markets, practically all transactions and activities that take place in the money and capital markets are handled by commercial banks. Thus, the influence of the country's financial sector on the economy is likely to be determined by the performance of its banks. Since banks invest with one another through the interbank market, the collapse of one can have a significant and detrimental effect on the rest of the economy. Asset-liability management (ALM) is the most notable factor affecting commercial banks' Profitability (Kosmidou, 2004). Daumont et al. (2004) also revealed that ineffective asset-liability management is one of the primary causes of failing banks. Abebe (2022) and Mahomed (2013) come to the same conclusion, which is that banks' asset-liability management directly impacts the institutions' performance. This includes the amount, structure, and maturity of the banks' assets and liabilities at any given time. Bank's asset-liability management is a strategic management approach that tries to maximize profitability, improve liquidity, and protect the organization from various financial risks (Owusu & Alhassan, 2021). It is the most fundamental aspect of financial management that banks control. According to Onaolapo & Adegoke (2020), asset-liability management is a cost-profit function that considers the bank's earnings, liquidity, and anticipated risk.

Despite the fact that asset-liability management has been studied from a number of contexts in developed economies (Chatterjee & Dutta, 2016; Kosmidou et al., 2004; Hester & Zoellner, 1966), empirical data from developing African economies like Ethiopia seem to be limited. Hence, the research findings undertaken in other countries may not be generalizable to Ethiopia because there are economy and policy differences. For this reason, it is crucial to study the impact that asset-liability management has on the Profitability of Ethiopian private commercial banks. Furthermore, prior research on asset-liability management and bank profitability in Ethiopia has largely neglected the effects of individual asset and liability variables on commercial bank's profitability and has instead focused on the determinants of bank financial performance using the CAMEL approach (Tibebe, 2020; Assfaw, 2018; Alemu & Aweke, 2017; Lelissa, 2014). Nonetheless, this

study explores the impact of individual asset and liability variables on the profitability of private commercial banks in Ethiopia.

Since the study is being done in a nation where commercial banks are the standard for financial services, and there is no stock market, the findings may be applicable to developing nations in similar circumstances. Additionally, the findings of this study might contribute to the existing body of literature on asset-liability management in Ethiopian banking institutions and other parts of the world. Furthermore, it might be of utmost significance for policymakers, the National Bank of Ethiopia to assess their policies, directives, and regulation following the research findings to guarantee that commercial banks manage their assets and liabilities to lessen financial risks. Finally, this research has the potential to educate bank executives, particularly those serving on the Asset and Liability Management Committee (ALCO), on how to balance their assets and liabilities best to ensure their institution's continued success.

2. Literature Review

According to Albrecher et al (2018), asset-liability management is the process of matching assets and obligations in terms of maturity and interest rate sensitivity to reduce exposure to interest rate and liquidity risks. All of these critical responsibilities are carried out following the asset-liability management committee's overall goal. Abebe (2022) studied a group of 106 Microfinance Institutions (MFIs) in sub-Saharan Africa over the years 2014 - 2018 using the statistical cost accounting (SCA) model to determine the relationship between financial performance and asset-liability management of the firms. The results showed that liabilities like deposits and borrowings strongly negatively affect financial performance. On the other hand, net loans and advances, other liabilities, and the size of the listed MFIs all have a substantial and positive relationship with the financial performance measured in terms of return on assets. The research concludes that asset-liability management must focus sufficiently on achieving optimal financial results.

Tee (2017) examined how asset-liability management affects the Profitability of Ghana's listed banks, and a random effect model was employed. As independent variables, the value of all assets and liabilities and the macroeconomic variables interest rate and GDP are used. In contrast, the return on asset (ROA) is a dependent variable. The outcome demonstrates that total assets

positively impact bank profitability, whereas total liabilities, namely savings and fixed-term deposits, negatively impact profitability. However, the macroeconomic factor of interest rate and GDP does not seem to have any visible effect on banks' profitability. The profitability of commercial banks was unaffected by interest rates. The study suggests that commercial banks improve their performance in lending and advancing money to consumers by raising public awareness to bring in more savings and fixed deposits.

Onaolapo and Adegoke (2020) used the random effects vector autoregressive model (VAR) and the SCA model on 14 Nigerian banks that accepted deposits from 2005 to 2018 to investigate the link between asset-liability management and the performance of money deposit institutions. The study found that loans and early repayments positively impact deposit banks' earnings, while nonperforming loans have a negative effect. The study also shows a positive relationship between demand deposits, borrowing, bank size (the moderate variable) and banks' return on assets.

Additionally, from 2007 to 2015, Owusu and Alhassan (2021) investigated the relationship between 12 local and 15 foreign banks' profitability measured by net interest income and the asset-liability management mix using the SCA and a fixed effect regression model in Ghana. According to the study, all returns on assets have statistically significant & positive effects, and all returns on liabilities have a negative & significant effect on the net interest income of high- and low-profit banks. The data also demonstrate that, excluding fixed assets, local banks earned significantly higher returns on all observable assets than overseas banks.

Njogo et al. (2014) applied the statistical cost accounting model to investigate the influence of asset-liability management on the performance of Nigerian commercial banks from 2008 - 2012. They discovered a high and favorable correlation between bank profitability and asset-liability management.

Ukpong & Olowokudejo (2021) researched the impact of asset-liability management on the profitability of 10 Nigerian life insurance businesses from 2008 to 2019. The regression results for fixed effect panel data using the statistical cost accounting model showed that assets have a positive and statistically significant relationship with profitability except for property and equipment. In contrast, some liabilities have a negative and significant relationship with

profitability.

From 2005 to 2013, Chatterjee and Dutta (2016) examined the relationship between profitability and the asset-liability mix in 20 private and 26 public sector banks in India. The research's panel data regression findings, which employed the statistical cost accounting model, show that low-profit banks generate higher rates of return on investments, fixed assets, and loans and advances than high-profit ones. Additionally, whereas public banks made money from all their assets, private banks made money by lending to other banks.

Using statistical cost accounting, Kosmidou et al. (2004) examined the relationship between profitability and asset-liability composition in 44 foreign and 36 domestic UK banks between 1996 and 2002. The data revealed that low-operating-profit banks had a higher return on loans, deposits, and investments but a lower return on fixed assets. Furthermore, they argued that improving bank performance in the UK banking system requires liability management more than asset management.

From 2008 to 2014, Shrestha (2015) examined asset-liability management's impact on the profitability of Nepal's seven largest commercial banks. According to the pooled OLS regression result, all assets positively impact commercial banks' profitability, including loans and advances, fixed assets, and other assets. In contrast, all liabilities, primarily deposits, negatively affected commercial banks' profitability. The study underlined that the rate of return on assets is positive and varies by asset type. The rate of cost on liabilities is negative and varies by liability type.

3. The Hypothesis of the Study

Assets generate earnings, whereas liabilities are the reasons for incurring costs in a bank's balance sheet (Owusu & Alhassan, 2021). In the banking literature, the statistical cost accounting model is commonly applied to evaluate the bank's asset-liability management (Abebe,2022; Onaolapo and Adegoke,2020; Ukpong & Olowokudejo, 2021; Owusu & Alhassan, 2021; Chatterjee and Dutta,2016; Njogo et al.,2014). This study also used this model to investigate how asset-liability management affects the profitability of Ethiopia's private commercial banks. The statistical cost accounting model approach is used in the banking sector to estimate the marginal rate of return and cost on bank portfolio items, to compare the rate of return on various loan categories, and to

examine the bank performance with the lapse of time (Owusu & Alhassan, 2021). According to Hester & Zoellner (1966), the fundamental principle of the statistical cost accounting model is that earning assets typically have a positive return rate and vary across different assets. In contrast, the rates of return for liabilities are typically negative and vary across different liabilities. Providing that this theoretical proposition is correct, the hypothesis of this study is outlined below.

H_1: Bank profitability and asset management have a positive and significant relationship.
H_2: Bank profitability and liability management have a negative and significant relationship.

4. METHODOLOGY

The data was collected from the audited annual financial statements of 14 private commercial banks' online portals and the National Bank of Ethiopia, covering the period from 2013 to 2023. According to the National Bank of Ethiopia, there are 18 private commercial banks registered in Ethiopia; however, only 14 private commercial banks were selected based on their year of establishment and the availability of data; the remaining commercial banks are not included in this analysis because their establishment year is too recent to provide 10 years of data. The analysis was carried out in the STATA Version 15 software using a panel data regression model. This is because panel data are often used to evaluate the time series of each entity within the same sector, which has a substantial cross-sectional structure.

5. Variables and measurement

Return on assets (ROA) was selected as the main proxy to measure bank profitability in the regression analysis because it is commonly employed to evaluate banks' profitability in banking literature (Abebe 2022; Tee, 2017; Onaolapo & Adegoke, 2020; Shrestha, 2015). The ROA is calculated by dividing net profit after tax by the average value of all assets. In a variety of research studies conducted in various countries (Kosmidou, 2004; Hester & Zoellner, 1966), assets were divided into different categories of independent variables, with the main criteria being maturity, the presence of a secondary market, the existence of federally guaranteed status, and collateral. However, commercial banks in Ethiopia do not operate in a secondary market and do not hold assets insured or guaranteed by the federal government. Therefore, considering an asset's maturity and collateral is the main step in decomposing it into its component factors.

On the contrary, since it is acceptable to assume that the banks' rate of cost on the bank's share capital and retained earnings, found on the right-hand side of the balance sheet, is zero, they were not included in the study (Kosmidou et al., 2004). The same can be said about the asset categories of cash on hand and reserve accounts with National Bank of Ethiopia which don't pay interest; instead, they are kept open to maintain the bank's liquidity and to satisfy legal obligations. To eliminate heteroscedasticity in the coefficient of estimates, average values for all asset-liability management variables are calculated by summing opening and ending book values and dividing by two. These values are then divided by the average total assets of the year to express them in ratios for the same period.

Therefore, taking into account these details, loans and advances (LAD), deposits in foreign banks (DFB), investments in securities (IS), and net fixed assets (FA) represent asset management variables in this study. Liability management, on the other hand, is represented by demand deposits (DD), savings deposits (SD), fixed deposits (FD), and other liabilities (OL).

Thus, the following model was used to analyze the relationship between profitability (ROA) and asset-liability management variables of the private commercial banks in Ethiopia during the study period.

$$\mathbf{ROA_{it} = \alpha_i + \beta_1 LAD_{it} + \beta_2 DFB_{it} + \beta_3 IS_{it} + \beta_4 FA_{it} + \beta_5 DD_{it} + \beta_6 SD_{it} + \beta_7 FD_{it} + \beta_8 OL_{it} + e_{it}}$$

Where;

ROA_{it} = Bank i's return on asset at year t

β_{1-4} = the rates of return on assets

β_{5-8} = the rate of cost on liabilities

it = i^{th} cross section in time period t

α_i = a constant term

e_{it} = error term

6. Results and Discussion

First, descriptive statistics were examined to provide an overview of the banking data relevant to this research. Second, correlation analysis reveals the association between profitability (ROA) and asset liability management variables. Thirdly, linear regression assumptions tests were conducted, mainly normality, multicollinearity, heteroskedasticity, and model specification tests. Finally, a regression analysis was conducted to examine the effect of asset liability management on the profitability of the selected banks.

6.1. Descriptive statistics

This section presents the summary statistics for all variables of the study.

Table 1: Descriptive statistics results

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	140	0.028	0.007	0.015	0.045
LAD	140	0.541	0.099	0.343	0.749
DFB	140	0.096	0.073	0.003	0.260
IS	140	0.205	0.053	0.084	0.307
FA	140	0.031	0.016	0.009	0.066
DD	140	0.231	0.055	0.097	0.354
SD	140	0.469	0.112	0.225	0.700
FD	140	0.101	0.061	0.018	0.237
OL	140	0.097	0.036	0.043	0.173

Source: "Researchers Survey" 2022

According to the data presented in the table above, there were a total of 140 observations gathered for each variable. Looking at the profitability of the Ethiopian private banks, the mean value of return on assets (ROA) for the selected banks from 2013 to 2022 is 2.8%. This means that these banks are earning a positive return on their assets. ROA ranges from a minimum of 1.5% to a maximum of 4.5%; hence, there are no wide variations in profitability among the banks during the study period.

Regarding the management of assets, the loan and advance (LAD) portfolio accounts for an average of 54.1% of the earning assets held by Ethiopian private banks. This indicates that loans and advances make up more than half of the assets held by the banks. This shows that the studied banks give high priority to lending activities. On the other hand, the spread and standard deviation (9.9 %) of the loan and advances portfolio shows higher variability than any other asset variables included in the study. The loans and advances are followed by the investment in securities (IS) portfolio (average 20.5 %) and deposit in foreign banks (DFB) (average 9.6%). The variable fixed assets (FA) reveal a mean value of 3.1%, with a standard deviation of 1.6 %. This could mean a relatively smaller portion of funds than other asset types were utilized to acquire fixed assets.

When it comes to the liabilities of the banks, savings deposits (SD) make up a significant portion (46.9% on average), followed by demand deposits (DD) with a mean of 23.1 % and fixed deposits (FD) with a mean of 10.1%, respectively. This suggests that most of the sample banks fund their assets via deposits in their savings accounts. This may be because commercial banks are financial intermediaries that follow a straightforward logic in which they receive deposits with short-term maturities from many individual depositors and provide loans with long-term maturities to a relatively small number of borrowers.

6.2. Correlation Analysis

The direction of the association between Ethiopian private commercial banks' asset-liability management and their overall profitability is shown in Table 2.

Table 2: Correlation Analysis results

| Variables	ROA	LAD	DFB	IS	FA	DD	SD	FD	OL
ROA	1	0.224	0.175	0.213	0.159	-0.275	-0.074	-0.107	-0.268

Source: "Researchers Survey" 2022

Table 2 shows the correlations between asset-liability management factors and the profitability of private commercial banks in Ethiopia. The study indicates that ROA is positively correlated with all the asset variables but negatively correlated with all liability variables

6.3.Test for Normality Assumption

To check the normality, the study used histogram and Jarque-Bera tests to confirm whether the residuals followed a normal distribution. The Jarque-Bera statistic should be insignificant, and the histogram should take on a bell shape if the residuals follow a normal distribution. The normality test results were shown in figure 1 and Table 3 below.

Figure 1: Histogram of Residuals
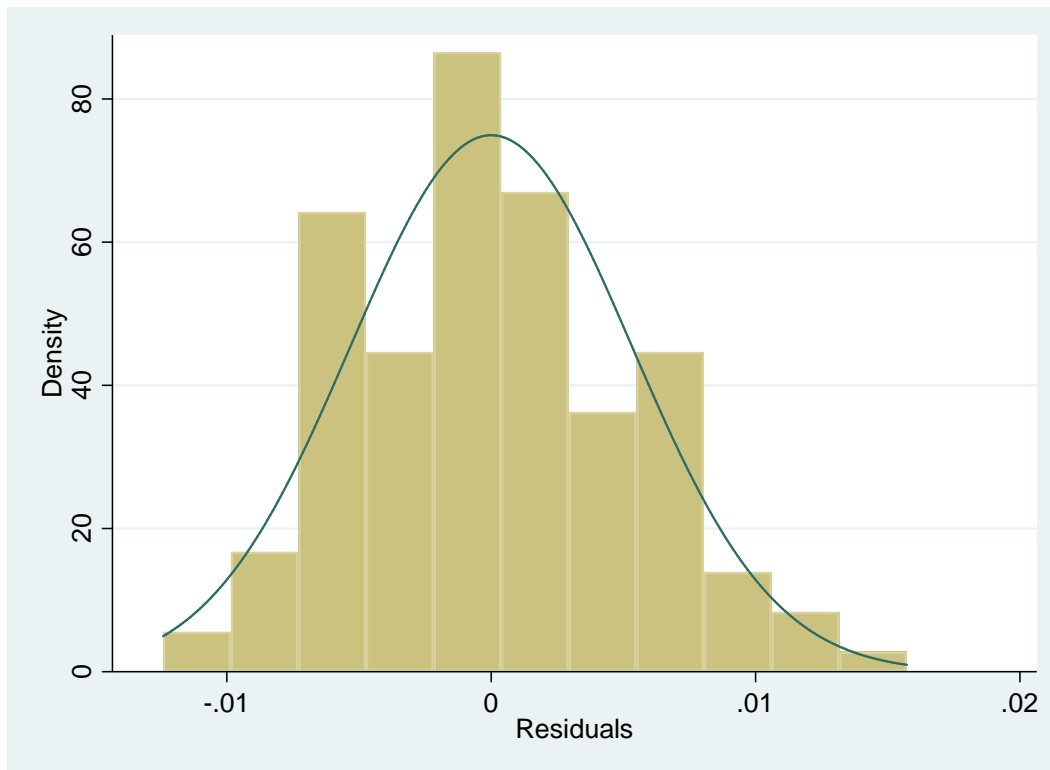
Source: "Researchers Survey" 2023

Table 3: Jarque-Bera Normality test

Jarque-Bera test for Ho: normality:	
Jarque-Bera normality test: 2.218	Chi (2) 0.3299

Source: "Researchers Survey" 2022

According to the study's findings, the residuals follow a normal distribution with a zero mean. As a result, the research failed to reject the null hypothesis that the study data had a normal distribution and could be analyzed using linear regression.

6.4. Multicollinearity Test

After confirming normality, the researchers used the variance inflation factor (VIF) to check for multicollinearity. According to Williams (2015), the presence of severe multicollinearity is indicated by a VIF value of variables that is larger than 10 or a tolerance value that is less than 0.10. Table 4 shows multicollinearity test results.

Table 4: VIF

	VIF	1/VIF
LAD	1.985	0.504
FA	1.839	0.544
IS	1.712	0.584
SD	1.661	0.602
DFB	1.251	0.8
OL	1.227	0.815
FD	1.184	0.844
DD	1.148	0.871
Mean VIF	**1.501**	

Source: "Researchers Survey" 2022

These findings are consistent with the assumptions made by the classical linear model, which states that there must be no significant multicollinearity in the independent variables for a regression analysis to be carried out.

6.5. Heteroskedasticity Test

To determine whether the variance of errors remains stable over time, the Breusch Pagan test (1979) was performed. The results of the tests, which can be shown in table 5 below, indicated that

the prob>chi^2 = 0.4627 value is larger than 0.05 cut point. Thus, the null hypothesis of constant variance or homoscedastic residuals was accepted, indicating no heteroskedasticity. This is consistent with the assumption made by the classical linear model, which states that the variance of error terms remains the same.

Table 5: Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity			
Ho:	Constant variance	chi2(1) =	0.54
Variables:	fitted values of ROA	Prob > chi2 =	0.4627

Source: "Researchers Survey" 2022

6.6.Model Specification Test

The model specification test was conducted using Hausman test to identify which of the panel estimator techniques: fixed-effect or random-effect model should be used for the study. The test results are presented in Table 6.

Hausman Test of Hypothesis

H_0: Random effect model is appropriate

H_1: Fixed effect model is appropriate

Table 6: Hausman (1978) specification test

	Coef.
Chi-square test value	2.681
P-value	0.953

Source: "Researchers Survey" 2022

The significance level (0.953) for the Hausman specification test is more than the threshold of 5 percent. As a consequence of this, the random effect model was a better fit than the fixed effect model for this inquiry.

6.7. Regression analysis

The random effect panel data regression results are shown in table 7 below. The overall F-Statistics which measure the fitness of the model had a $Prob > Chi^2$ of 0.000 which is less than 5 % threshold, meaning that the model is well fit.

Table 7: Regression results

RoA	Coef.	St.Err.	t-value	p-value	[95% Conf. Interval]		Sig
LAD	0.028	0.006	4.44	0.000	0.016	0.041	***
DFB	0.029	0.008	3.77	0.000	0.014	0.044	***
IS	0.024	0.011	2.25	0.025	0.003	0.044	**
FA	0.087	0.043	2.04	0.042	0.003	0.171	**
DD	-0.051	0.010	-5.11	0.000	-0.070	-0.031	***
SD	-0.016	0.006	-2.67	0.008	-0.027	-0.004	***
FD	-0.023	0.010	-2.41	0.016	-0.042	-0.004	**
OL	-0.039	0.014	-2.71	0.007	-0.067	-0.011	***
Constant	0.027	0.005	5.82	0.000	0.018	0.037	***
Mean dependent var	0.028		SD dependent var		0.007		
Overall r-squared	0.403		Number of obs		140		
Chi-square	109.384		Prob > chi2		0.000		
R-squared within	0.499		R-squared between		0.203		

*** p<.01, ** p<.05, * p<.1

Source: "Researchers Survey" 2022

Table 7 above shows that the P-value of all explanatory variables is less than 0.05. This indicates that all the asset-liability management variables determine the profitability (ROA) of the banks in a good way.

The findings of the random effect regression indicate that all returns on assets have statistically significant & positive effects on the profitability (ROA) of Ethiopian private commercial banks. This finding is consistent with the results of Owusu and Alhassan (2021), Chatterjee and Dutta (2016), and Shrestha (2015), who discovered that asset management had a statistically significant

& positive effect on the profitability of commercial banks. Except for the fixed assets, these findings are consistent with Ukpong and Olowokudejo's (2019) findings.

To be more precise, the result of the regression analysis between asset-liability management as measured by loans and advances (LAD) and bank profitability (ROA) is positive and substantially different from zero at a significance level of 5%. This suggests that if other independent variables are kept constant at their average values, the profitability of commercial banks, as measured by ROA, will increase by 2.8 percent when loans and advances increase by 1%. The findings in regarding the variable deposits in foreign banks (DFB) also show that for every one percent increase in a bank's deposits in a foreign bank, while keeping everything else the same, there is a resultant increase of 2.9 percent on the ROA in the same direction. This indicates that the profitability of Ethiopian private commercial banking is positively and significantly impacted by a rise in the volume of deposits held in banks located outside of Ethiopia. It was also shown that fixed assets (FA) have the highest rate of return (0.087) and a positive association with ROA among the bank assets. In contrast, investments in securities (IS) have the lowest rate of return with a coeffect of 0.024.

Regarding the banks' liabilities, negative rates of return and statistically significant coefficients are noticed for all liabilities included in the study. These findings are consistent with the statistical cost accounting (SCA) model, which assumes the rates of return on liabilities are negative and vary by liability types, as Hester and Zoellner (1966) proposed. Additionally, these results align with the outcomes of Abebe (2022), Tee (2017), Owusu & Alhassan (2021), Shrestha (2015), among others. However, demand deposits (DD) were found to be contrary to Onaolapo and Adegoke's (2020) findings, which suggested a positive relationship with bank's return on assets.

More specifically, the cost of maintaining a savings deposit (SD) is the least expensive option for the banks, followed by fixed deposits (FD) with a coefficient of -0.016 and -0.023, respectively. This lends credence to the idea that deposits continue to rank among the lowest-cost funding sources for financial institutions like banks. The coefficient of liability management as evaluated by demand deposit (DD) suggests that the profitability (ROA) of private commercial banks in Ethiopia will decline by 5.1 percentage points for every one percentage point rises in demand deposits. In light of this, it may be deduced that the interest expense paid for demand deposits

constitutes the primary component of the costs incurred by private commercial banks in Ethiopia. Therefore, at a significance level of 5 percent, the demand deposit of the sample banks over the time that was studied shows a negative and highly significant effect on the Profitability (ROA) of the banks. Put another way, the more their reliance on borrowed funds, the smaller the return on asset (ROA) will be for the banks. Other liabilities (OL), which include interbank borrowing, dividend payment, accounts payable, and long-term liabilities, were totaled together so that too many zero-value biases could be excluded from the model. The coefficient of other liabilities is negative (-0.039) and statistically significant at the 0.05 level, as shown in Table 7. This indicates that for every Ethiopian Birr (ETB) rise in other obligations, a return on asset decrease by 0.039 ETB can be anticipated, provided all other variables remain constant. Compared to all liabilities included in the study, demand deposits incur the highest expenses, followed by other liabilities in descending order of cost rate.

7. Conclusion and Suggestions

All of the expected rates of return on earning assets were significantly positive and varied across asset types, validating a central theory of SCA model. At the same time, liabilities were negative and varying across liabilities. This suggests that asset-liability management has a direct bearing on the overall performance of banks. During the study period, the findings revealed that saving deposits are the cheapest funding source, while fixed assets are among the highest-earning assets for the private commercial banks in Ethiopia. Regarding liability management, saving and demand deposits had the highest mean values of 46.9 and 25.1 percent, respectively. This suggests that most private commercial banks in Ethiopia are financed through savings and demand deposits during the study period. These banks have utilized the funds to supply loans and advances to their clients since loans and advances to customers have the highest mean value (54.1%) of all the assets considered in the study. From the use and source of funds perspective, fixed assets and other liabilities have lesser variability in standard deviations. In contrast, loans and advances, and fixed deposits have higher variability.

Based on the findings of the study, even though the rate of return on loans and advances is lower than that of fixed assets, it has a favourable and substantial impact on the profitability of private commercial banks in Ethiopia. As a result, the primary focus of banks should be on attracting high-

quality deposits and advancing loans, while managing the portfolio their assets for risk diversification and increased profitability. In addition, the banks should expand public awareness to attract more savings and fixed deposits to enhance their performance. This study was limited to private commercial Banks; therefore, future studies can consider including public banks and other variables excluded from this study.

COMPETING INTERESTS

The author has no competing interests to declare.

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