INNOVATIONS

The impact of size, age, leverage and capital on profitability of commercial banks in Ethiopia: A panel FMOLS analysis

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Abstract: Quantitative data was gathered from 17 banks in Ethiopia for a period of 8 years from 2013 to 2020, and analyzed using panel unit root for stationarity check, co-integration test for a long-run relationship, Fully Modified OLS model, and Granger Causality for identifying the causal variable and direction of causality. The finding of the study analyzed by the FMOLS model showed the banks Size and the banks Age significantly influence ROA and ROE but the banks' Age influence negatively. Meaning a bank with a high bank Size was performed better than a lower bank Size but an older bank was performed lower in terms of ROA and ROE. However, both banks Leverage and Capital had an insignificant impact on banks' performance. The unidirectional Granger Causality was running from banks Size, Age, Leverage, and Capital to ROA. Moreover, unidirectional causality also was running from ROE to the banks' Age and from the Leverage to ROE.

Keywords: 1. Size 2. Age 3. Leverage 4. Capital 5.profitability 6. Unit root 7. Co-integration 8. Fully Modified Ordinary Least Square 9.Granger causality 10.Commercial banks 11. Ethiopia

1. Introduction

The commercial banks in Ethiopia have a long history to stand in the current position. For this study, all 17 commercial banks available in Ethiopia were included. The profitability of the banks has been assessed and measured by different factors in various literature (Gul, 2011), such as Return on Assets (ROA), return on Equity (ROE), Net Interest Margin, Return on Capital Employed, Gross Margin (GM) and likes. These factors are further affected by various factors such as (Sulub, 2014), (Akben-Selcuk, 2016), (Majumdar, 1997) ages, size, leverage, and capital of a bank.

The Ages of the banks have started to count from the date they were established to the end of this study period 2020. The minimum and maximum Ages of the banks are 8 years (Enat bank) and 58 years (Commercial Bank of Ethiopia (CBE)) respectively. However, except CBE, the remaining banks' Age are ranged between 8 to 27 years.

The bank Size is measured in terms of the total asset of the respective banks as of the statement of position prepared at the end date of the financial period of the country. The minimum and maximum at the end of the study period, are 6.49 billion (Addis bank) and 813 billion (CBE) respectively but the average of all banks Size is 80.5 billion. The discrepancies of Ages and Sizes among the banks are so high especially between CBE and other remaining banks.

Leverage is defined as the ability to enhance the profitability of the firm by utilizing debt financing in the capital structure. However, if in a condition of an unfavorable market and poor management the cost of debt is detrimental to the profitability of the firm. The average minimum, maximum and average leverage ratios at the study period are 0.051 (Enat bank), 22.89(CBE), and 6.64 respectively.

Capital is another factor that affects the profitability of a bank which encompasses the owners' fund, retained earnings, and reserves of a bank. If a bank holds a proper amount of capital or optimum ratio of equity to an asset, then it enjoys with ample profit it generates but the question is how do we know the proper amount of this ratio to a specific firm? Due to this problem and the two extremes are also harmful to banks' profitability. If a bank holds a surplus or deficit of capital, then its losses benefit earned from an opportunity of investment. If this ratio approaches one means there is a firm which operating its business only by shareholders' funds and losing the opportunity of additional investment from external financing. If the ratio approaches zero, meaning a firm running a business from only external financing. As result firms face a problem of liquidity. This ratio by its nature ranges from zero to one all-inclusive since Asset is the sum of Debt and Equity.

2. Literature Review

2.1 Theory

In the study conducted by (Majumdar, 1997), the Age and Size of banks affect the performance positively as well as negatively in many ways. Banks with older age are more experienced (Haryati, Burhany, & Suhartanto, 2019) and high reputation (Alshehri, 2016), so they perform better than less experienced younger banks. On the contrary, older-aged banks are inflexible to adapt to new circumstances. Regarding Size, large banks have the capability to diversify investment, the ability to explore economies of scale, and less in the probability of bankruptcy (Marandu & Sibindi, 2016) which make banks more effective than less sized banks. Alternatively, "bank size is correlated with market power along with power x-inefficiencies are developed leading them less efficient". Bank size (Zhang, 2011) also positively correlated with profitability due to additional market control and also they can set their favorable lending interest rate, nevertheless; if the size is tremendously high it may cause negative correlation due to management inefficiency. A bank with higher capital (Syaifuddin et al., 2018) becomes relatively safer at the time of liquidation, reduces dependency on the external fund, and enhances its profitability.

2.2 Empirical Review

The study conducted by (Sulub, 2014) on age, size, and leverage of bank on profitability results show that bank Size has positive but bank Age has a negative relationship on banking sector in Sudan (Akben-Selcuk, 2016) and significant with profitability while positive but insignificant with leverage of the Turkey banks. Age has no significant effect (Haryati et al., 2019) on Indonesian Islamic banks. The study conducted in India on 1020 firms (Majumdar, 1997), old aged firms are less profitable but larger-sized firms are more profitable. Bank size has positive and significant to Sri Lankan Domestic banks (Hirindu & Kushani, 2017), Jordanian commercial banks (Aladwan, 2015) bank size is negative but significant with profitability. Bank Size affects positively and significantly on ROE but

Leverage influence negatively (Büyüklüğü, Karlılığını, İstanbul, Ampirik, & Kanıt, 2020) the banks of Turkey, and (Bunyaminu A. et al, 2021) of the capitalized banks of Ghana. Lager-sized banks (Parvin, Chowdhury, Siddiqua, & Ferdous, 2019) produce higher ROA on the Bangladesh banks but insignificant influence profitability. The effect of banks Size is uncertain according to the study conducted on US banking sectors (Zhang, 2011) because he measured bank size by categorizing banks' assets into large, medium, and small sizes and had got different results from regression coefficient. The Age and Leverage of the Kenyan small and medium enterprises (Mallinguh, Wasike, & Zoltan, 2020) result a positive and significant effect on performance in case of non- bank firms. The age and equity to asset ratio (Syaifuddin et al., 2018) were positively and significantly affected ROE.

Table 1: Summary of Empirical Review

Variable	Authors	Study Period	Methodology	Effect	Significance
Size	(Sulub, 2014)	2009-2012	Multiple L. regression	positive	significant
	(Majumdar, 1997)		M. Linear regression	positive	significant
	(Hirindu & Kushani, 2017)	2011-2015	M. Linear regression	positive	significant
	Aladwan, 2015	2007-2012	Two sample t-test	negative	significant
	(Bunyaminu A. et al, 2021)	2008-2017	Random Effect-OLS	positive	significant
	(Büyüklüğü, Karlılığını, İstanbul, Ampirik, & Kanıt, 2020)	2005-2019	Multiple regression	positive	significant
	Zhang, 2011	2000-2008	OLS		uncertain
	(Parvin, Chowdhury, Siddiqua, & Ferdous, 2019)	2011-2015	Descriptive and co relational	positive	insignificant
Age	(Sulub, 2014)	2009-2012	Multiple L. regression	negative	significant
	(Akben-Selcuk, 2016)	2005-2014	Fixed effect model	negative	convex
	(Haryati et al., 2019)	2015-2017	PLS- SEM		insignificant
	(Majumdar, 1997)		M. Linear regression	negative	significant
	Mallinguh, Wasike, & Zoltan, 2020	2019	SEM	positive	significant
	(Syaifuddin et al., 2018	2012-2016	Multiple L. regression	positive	significant
Leverage	(Sulub, 2014)	2009-2012	OLS	positive	insignificant
	(Bunyaminu A. et al, 2021)	2008-2017	Random Effect-OLS	negative	significant
	(Büyüklüğü, Karlılığını,	2005-2019	Multiple L.	negativ	significant

	İstanbul, Ampirik, & Kanıt, 2020)		regression	e	
	Mallinguh, Wasike, & Zoltan, 2020	2019	SEM	positive	significant
Capital	(Hirindu & Kushani, 2017)	2011-2015	M. Linear regression	positive	significant
	(Syaifuddin et al., 2018	2012-2016	Multiple L. regression	positive	significant

Note: SEM-Structural equation modeling, PLS-Partial least square,

3. Methodology

The objective of the study was to assess the impact of banks' size, age, leverage, and capital on profitability. The secondary data was collected from all 17 commercial banks in Ethiopia which 16 are private and one is the government bank. The study covers the periods of eight years from 2013 to 2020. To analyze this panel data series of statistical techniques were applied. The unit root test for stationarity using panel unit root tests, co-integration test for a long-run relationship between variables, and application of Fully Modified Ordinary Least Square long-run equation model for statistical inferences and pairwise Granger causality test to find out the direction of causality between the study variables.

3.1 Variable Definition

Bank Size was measured using a natural logarithm of the balance sheet value of total assets of each year for the study periods. The Ages of the banks are also the natural logarithm counted for the duration of the banks in operation since they have been established. The Leverage ratio in terms of total debt to total equity and the Capital ratio is in terms of total equity to total asset were calculated and taken for analysis. The dependent variables considered for this study were ROA and ROE which prominently used by various studies so far have been conducted hitherto. ROA is a ratio evaluated by dividing net income by total assets while ROE is a ratio assessed by dividing net income to total capital of the banks.

3.2 Model Specification

$$ROA_{it} = \beta_0 + \beta_1 LogSIZE_{it} + \beta_2 LogAGE_{it} + \beta_3 LEV_{it} + \beta_4 CAP_{it} + \mathcal{E}_{it}$$

$$ROE_{it} = \beta_0 + \beta_1 LogSIZE_{it} + \beta_2 LogAGE_{it} + \beta_3 LEV_{it} + \beta_4 CAP_{it} + \mathcal{E}_{it}$$

Where, β_0 = intercept, $\beta_{1\text{-}4=}$ coefficients, t=time periods, ε= stochastic error which do not captured by independent variables.

3.3 Panel Unit Root Test

The panel unit root test (Zhongming, 2019) is conducted to ensure stationarity among study variables in order to avoid spurious regression results. The panel data with long time dimensions like time-series data (Ranjan R. 2009) needs to qualify for stationarity tests. The panel unit tests such Levin, Lin, and Chu, Im, Pesaran and Shin, Breitung, Maddala and Wu, Hadri, and ADF and Pedroni tests are similar to the tests carried out on a single series (such as Augmented Dickey-Fuller (ADF) unit root test), even more, powerful to less likely to commit a type II error. They are extensions (Mitić, Ivanović, & Zdravković, 2017) of the ADF unit root test for univariate time series modeling. However, in this study, the following tests of panel data unit roots tests were used.

1. Levin, Lin, and Chu tests- who assume common unit root process. The null hypothesis for these tests is that; panel data have unit root (non-stationary).

2. Im, Pesaran, Shin, ADF, and PP tests- Fisher chi-square who assume individual variables tested for unit root. The null hypothesis for such tests is also that; panel data have a unit root.

3.4 Panel Co-integration Analysis

Panel co-integration test is used to check the existence of long-run relationships among variables. If the variables are co-integrated, they have associations to move together for long periods. Pedroni tests have four-panel statistics of which eight p-values resulted from statistic and weighted statistic, and three grouped panel statistics. Both Pedroni and Kao residual co-integration tests under individual intercept tell that there was statistically significant long-run co-integration between individual dependent and independent variables.

3.5 Fully Modified Ordinary Least Square (FMOLS) model

Since co-integration presents among variables under the tests of Pedroni and Kao, then the FMOLS and Dynamic Ordinary Least Square (DOLS) are frequently preferred over OLS because of some reasons such as taking care of small sample, endogeneity biases and to estimate long-run elasticity. If there exists (Shabbir et al. 2020) the co-integration among variables in panel data, estimating using the OLS method may lead to a biased result and the regression is said to be spurious. OLS estimator (Shahzad, Ali, Ur Rehman, & Abbasi, 2015) is an inconsistent and biased estimator in presence of a co-integrated panel because OLS regressions (peter C. 2017) are not designed to take into account long-run endogeneities in the regressors. To get the best result it is better to use long-run models such as FMOLS and DOLS. However, in this study FMOLS model was used due to data fit. FMOLS (Bashier, 2014) is used in a small sample size and provides a check for robustness of results. DOLS is a complete parametric approach which (Nuval, 2015) takes care of or eliminates the endogeneity and serial correlation presented in standard OLS by augmenting the panel co-integration equation with cross-section by adding the leads and lags of the first differenced regressors. FMOLS is a non-parametric approach that performs the same as DOLS but it adds some more requirements such as possessing the variables should the same order of integration and that the regressors should not appear as co-integrated.

4. Results and Discussion

4.1 Unit Root

The output of the unit root tests for panel data was telling that some variables like logSIZE have a unit root at level, however; all variables become stationary after the first difference.

4.2 Co-integration

Null Hypothesis: No co-integration

Table 2: Pedroni and Kao- Co-integration test output

1. Pedroni Residual Co-integration Test				
Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-3.449375	0.9997	-3.695990	0.9999
Panel rho-Statistic	4.091927	1.0000	3.600620	0.9998
Panel PP-Statistic	-9.211885	0.0000	-10.94351	0.0000
Panel ADF-Statistic	-3.062610	0.0011	-4.800802	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)				
Group rho-Statistic	5.309117	1.0000		
Group PP-Statistic	-16.74298	0.0000		
Group ADF-Statistic	-6.210126	0.0000		
Kao Residual Co-integration Test				
ADF	-3.928532	0.0000		

Table3: Summary Statistics

	ROE	ROA	LOGSIZE	LOGAGE	LEV	CAP
Mean	0.190395	0.025229	23.27908	2.483267	6.638623	0.152008
Median	0.175000	0.024950	23.29878	2.484907	6.144300	0.140150
Maximum	0.682200	0.056400	27.42503	4.060443	22.88590	0.951200
Minimum	0.000000	-0.035100	18.68324	0.000000	0.051300	0.041900
Std. Dev.	0.092427	0.008946	1.409786	0.732744	3.363089	0.081900
Skewness	3.260494	-2.043031	0.257210	-0.251774	2.785812	6.913456
Kurtosis	16.60746	18.07612	4.374894	3.418592	13.17605	67.98404
Jarque-Bera	1290.223	1382.583	12.21145	2.429759	762.7050	25013.28
Probability	**0.000000**	**0.000000**	**0.002230**	**0.296746**	**0.000000**	**0.000000**
Sum	25.89370	3.431100	3165.955	337.7244	902.8527	20.67310
Sum Sq. Dev.	1.153268	0.010804	268.3119	72.48329	1526.900	0.905528
Observations	136	136	136	136	136	136

As it is depicted in table 2, under the Pedroni test six tests out of eleven and the Kao ADF test demonstrated the rejection of the null hypothesis. The importance of between-dimension estimators (Ranjan R. 2009) is that the data are pooled allows for greater flexibility in the presence of heterogeneous co-integrating vectors.

4.3 Descriptive Statistics

Under descriptive statistics output in table 3, the Jarque–Bera probability indicated that there were no normal distributions except the LogAge variable but normal distribution is the most common parametric assumption in statistics. If the data against this assumption strongly, following those parametric procedures may lead to the wrong conclusion. To escape from such problems, using a non-parametric procedure such as FMOLS is applicable instead (Hoskin, 2010).

4.4 FMOLS Output

The Size and Age of the banks were significant to affect the profitability in terms of ROA and ROE. The long-run coefficient of bank Size is positive while the long-run coefficient of bank Age becomes negative. Both banks Leverage in terms of debt to equity and capital in terms of equity to the asset has a negative long-run coefficient and they become an insignificant relationship with profitability in terms of both ROA and ROE which are depicted in tables 4 and 5. If the banks' Size increased by 1% then the ROA and ROE went up by 0.67% and 4.21% respectively and if the banks got older (increased in age) by 1% the ROA and ROE went down by 2.87% and 19.81% respectively.

Table 4: FMOLS result for model 1 group estimation

Dependent Variable: ROA				
Method: Panel Fully Modified Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGSIZE	0.006736	0.002894	2.327348	0.0217
LOGAGE	-0.028719	0.010238	-2.804987	0.0059
LEV	-0.006419	0.004196	-1.529928	0.1288
CAP	-0.126361	0.159228	-0.793585	0.4291

Table 5: FMOLS result for model 2 group estimation

Dependent Variable: ROE				
Method: Panel Fully Modified Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGSIZE	0.042105	0.020997	2.005311	0.0473
LOGAGE	-0.198089	0.087112	-2.273947	0.0248
LEV	-0.015883	0.027957	-0.568135	0.5711
CAP	-1.578069	1.110805	-1.420653	0.1581

4.5 Granger Causality Output

To check the direction of causality of association ship, Granger Causality between variables took place in table 6. Granger Causality tests using lag 2 revealed that the direction of causality between banks Size and ROA, Age and ROA, Leverage and ROA, and Capital and ROA were unidirectional associations ship running from bank Size, bank Age, Leverage, and Capital to ROA. In addition, causality between bank Age and ROE, and Leverage and ROE were also unidirectional relationships running from ROE to bank Age and from Leverage to ROE.

Table 6: Pairwise Granger Causality Tests

Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
LOG SIZE does not Granger Cause ROA	102	5.46863	0.0056
ROA does not Granger Cause LOG SIZE		0.14165	0.8681
LOG AGE does not Granger Cause ROA	102	4.68469	0.0114
ROA does not Granger Cause LOG AGE		0.03887	0.9619
LEV does not Granger Cause ROA	102	4.36727	0.0153
ROA does not Granger Cause LEV		0.73528	0.4820
CAP does not Granger Cause ROA	102	3.66162	0.0293
ROA does not Granger Cause CAP		0.29403	0.7459

LOG AGE does not Granger Cause ROE	102	0.48634	0.6164
ROE does not Granger Cause LOG AGE		5.99115	0.0035
LEV does not Granger Cause ROE	102	4.17375	0.0182
ROE does not Granger Cause LEV		1.27884	0.2830

5. Conclusion

Quantitative data were used for analysis; unit root test conducted, some of the variables have unit root but stationary after first difference. Co-integration test conducted to check long-run association ship between variables. There were statistically significant long-run co-integrated relationship exists between variables. Normality checked and confirmed that the data were not normally distributed; so the non-parametric FMOLS model was applied. The finding of the study measured by the FMOLS model was that the banks' Size and the banks Age significantly influence ROA and ROE. The banks' Age had adversely influenced the profitability while bank Size influenced positively. Based on the result, it could be concluded that when the size of the bank increases the performance also increases but when the banks had got older, the performance declines in terms of ROA and ROE. However, both banks Leverage and Capital had insignificant influence. Regarding the Granger Causality of study variables, unidirectional causality was running from banks Size, Age, Leverage, and Capital to ROA. Moreover, unidirectional causality also was running from ROE to the banks' Age and from the Leverage to ROE.

Reference

1. *Akben-Selcuk, E. (2016). Does Firm Age Affect Profitability? Evidence From Turkey. International Journal of Economic Sciences, V(3), 1–9.*
2. *Aladwan, M. S. (2015). the Impact of Bank Size on Profitability"an Empirical Study on Listed Jordanian Commercial Banks".*
3. *Alshehri, A. F. (2016). An Examination of the Relationship between Size, Age and Financial Performance in Islamic Banks : Evidence from around the World. Journal of Islamic Economics Banking and Finance, 12(4), 155–178.*
4. *Bashier, A. (2014). Immigration and Economic Growth in Jordan : FMOLS Approach. 1(9), 85–92.*
5. *Büyüklüğü, B., Karlılığını, B., İstanbul, B., Ampirik, T. Den, & Kanıt, B. (2020). Does Bank Size Affect The Bank Profitability ? An Evidence From Borsa Istanbul (BIST), Turkey. (January), 63–71.*
6. *Gul, S. I. F. Z. K. (2011). Factors Affecting Bank Profitability in Pakistan. Romanian Economic Journal, (November 2014), 61–87.*
7. *Haryati, N., Burhany, D. I., & Suhartanto, D. (2019). Assessing the Profitability of Islamic Banks: The Role of Bank Age and Bank Performance. IOP Conference Series: Materials Science and Engineering, 662(6).*
8. *Hirindu, K., & Kushani, P. (2017). The Factors Effecting on Bank Profitability. International Journal of Scientific and Research Publications.*
9. *Hoskin, T. (2010). Parametric and nonparametric: demystifying the terms. Ctsa.Mayo.Edu, 1–5.*
10. *Majumdar, S. K. (1997). The impact of size and age on firm-level performance: Some evidence from India. Review of Industrial Organization, 12(2), 231–241.*
11. *Mallinguh, E., Wasike, C., & Zoltan, Z. (2020). The business sector, firm age, and performance: the mediating role of foreign ownership and financial leverage. International Journal of Financial Studies, 8(4), 1–16.*
12. *Marandu, K. R., & Sibindi, A. B. (2016). Capital structure and profitability: An empirical study of South African banks. Corporate Ownership and Control, 14(1), 8–19.*
13. *Mitić, P., Ivanović, O. M., & Zdravković, A. (2017). A cointegration analysis of real gdp and CO2 emissions in transitional countries. Sustainability (Switzerland), 9(4).*

14. *Nuval, A. (2015). Munich Personal RePEc Archive Do profit and loss sharing (PLS) deposits also affect PLS financing ? Evidence from Malaysia based on DOLS , FMOLS and system GMM techniques.*
15. *Parvin, S., Chowdhury, A. N. M. M. H., Siddiqua, A., & Ferdous, J. (2019). Effect of Liquidity and Bank Size on the Profitability of Commercial Banks in Bangladesh. Asian Business Review, 9(1), 7–10.*
16. *Peter C . B . Phillips . (2017). Fully Modified Least Squares and Vector Autoregression Author (s): Peter C . B . Phillips Published by : The Econometric Society Stable URL .Shahzad, S. J. H., Ali, S., Ur Rehman, M., & Abbasi, F. (2015). Relationship between remittances, exports, foreign direct investments and growth in South Asia: A panel cointegration and causality analysis. Journal of Economic Cooperation and Development, 36(3), 93–122.*
17. *Sulub, S. A. (2014). Do the Bank Size, Age and Leverage are Important Factors to Determine its Profitability? SSRN Electronic Journal, (249).*
18. *Syaifuddin, F., Rio, S., Sarita, B., Syaifuddin, D. T., Saleh, S., Hamid, W., & Budi, N. (2018). Effect Of Equity To Assets Ratio (EAR), Size , And Loan To Assets Ratio (LAR) On Bank Performance Fahrul Puas Sriawan Rio Prabowo Halim Buyung Sarita Dedy Takdir Syaifuddin Sujono Salma Saleh Wahyuniati Hamid. 9(4), 1–6.*
19. *Zhang, C. (2011). Determinants of bank profitability : evidence from the u . S banking sector by research project submitted in partial fulfillment of the requirements for the degree of © C Zhang and LY Dong 2011*