THE EFFECT OF DIGITAL FINANCIAL INCLUSION ON BANKING SECTORS STABILITY IN ETHIOPIA

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Abstract

The study's main objective was to investigate the effect of digital financial inclusion on banking sectors in Ethiopia. The data were gathered from the World Bank database, IMF, and the National Bank of Ethiopia from 2014 to 2023 to ascertain the specified aim. The generalized method of moments (GMM) econometrics model was used to control the three sources of endogeneity problems. The result of the study shows that the lagged value of a Z-score significantly affects the financial stability of banking sectors. In addition, the main variable of the study is that digital financial inclusion has a substantial and positive impact on the banking sector's stability. Furthermore, the Loan Ratio, Capitalization, and Capital adequacy ratio significantly affect bank-specific variables. Finally, macroeconomic factors such as GDP Inflation, Interest, and Exchange rates also have significant effects. Therefore, to make the banking sector of Ethiopia more financially well-off, it is advisable to adopt the following strategic approaches; Digital financial access, betterment of key psychographic and tangible aspects of the bank, including Loan Ratio and Capital Adequacy and the necessity of paying attention toward external forces like GDP, inflation, interest, and exchange rates.

Keywords: Digital Financial Inclusion, Financial Stability, Bank-Specific Variables, Macroeconomic Variable Generalized Method of Moments, Z-Score.

1. INTRODUCTION

Recently,(Banna & Alam, 2021) and Group (2016) have described DFI as the extension of Financial inclusion, looking into technology upgrades. Access to financial services requires special attention since it helps accelerate economic development. Increasing digital finance in the present era of technological advancement is considered one of the most effective ways to support the banking sector's sustainability and ensure a long-term contribution to economic growth. Digitalization also promotes transparency since it moves funds from a country's budget to the government agencies and individuals with the least opportunities for embezzlement(Nandru et al., 2021). In Ethiopia, the Homegrown Economic Reform Agenda and the Ten-Year National Development Plan (FDRE, 2020), which was proclaimed in 2019, acknowledge digital transformation as a key means of enhancing financial inclusion (FDRE, 2020). Only positive utilization of digital financial inclusion leads to improved profitability of banks, which in return promotes financial

development and soundness (Ozili, 2018). Digital financial inclusion may enhance the formal financial services disadvantaged groups use in Low- and middle-income countries to improve nontrivial inequality and sustainable economic development(Durai & Stella, 2019). Remain for some African countries have made significant progress in monetary consideration in recent years due to the enhancement of computerized financial control, as observed by (David-West et al., 2018). Thus, digital financial services have been seen as the solution to the existing economic difficulties. David also looks into the role of Fintech in sustainable economic development and the high possibility of financial inclusiveness.

Modern financial services and products delivered by Fintech companies have become a suitable strategy for offering services to individuals with low and unstable earnings that are cheaper than those provided by banks regulated by traditional institutions (Durai & Stella, 2019). Digital finance is one of the business functions that encompasses Internet banking and mobile banking. Internet banking is defined as business functions, requisite technology, technological concepts, and institutions that provide digital finance solutions (Gomber et al., 2018). Therefore, this research will employ financial technology to measure financial technologies, arguing that digital financial technologies help alleviate poverty by improving productivity through increased access to formal customer financial services. Therefore, the study aims to evaluate the role of DFI in the stability of the Ethiopian banking sector.

2. LITERATURE REVIEW

Over the last few years, DFI has attracted much attention across the globe, and it is considered an innovation in financial and banking systems. To assess the usefulness of digital finance for FI, Siddik, and Kabiraj (2020) asserted that the actualization of DFI can drive long-run economic development alongside eradicating poverty. The vulnerable individuals will feel reduced purchasing power, low economic growth rate, and food insecurity ramifications. Therefore, ensuring better access to funds, reducing the cost per transaction, and directing the salary payments and social benefits through such accounts will be essential in mitigating the issues (Nandru et al., 2021). When the soundness of a nation's banking system is questioned, it is believed that the whole economy has crumbled. Thus, banking stability is crucial for sustainable economic development, which the banks can attain by implementing financial inclusiveness, especially digital finance. Researchers now state that the methods of eradicating poverty are saving and digital financial access(Ozili, 2018).

Banna & Alam (2021) shared insights from the field visits conducted in seven countries: Brazil, the People's Republic of China, Ethiopia, India, Mexico, Nigeria, and Pakistan; besides these, more than 150 experts were surveyed/interviewed. They argue that through digital banking, all customers in developing countries gain unlimited opportunities to acquire another channel for accessing financial services. A review of the existing literature has shown that the critical barriers to consumers' acquisition of formal financial services include lack of funds, perceived account fees, availability of a family member

with a bank account, no trust, religion, inability to provide necessary identification, and geographic proximity to a financial institution (Abrar et al., 2021; Alfadli & Rjoub, 2020).

It has been estimated that by 2025, due to the widespread utilization of DFI, the combined GDP of all developing economies will have been boosted by 6% or $ 3.7 trillion and generate a new 95 million employment opportunities in all sectors globally. Depending on the type of business and the nature of the products offered, it has evolved to online banking, mobile banking, e-wallet, mobile wallet, credit cards, and debit cards, where the clients are provided conveniences and comfort in their financial transactions, among other factors. Although people are getting used to the idea of zero-cash electronic transactions, there are issues such as security risks, low network signals, merchants' unwillingness to accept the digital money method, costly transactions, users' lack of familiarity with the technology, and many others which seem to be discouraging the many from embracing the new system(Durai & Stella, 2019).

Kandpal and Mehrotra (2019) examined financial inclusion in India, where the government's efforts to make positive changes in financial inclusion have had some positive and negative impacts recently. This was possible through legislative and regulatory approaches that expanded people's access to bank accounts. However, the mobilization of these accounts and the uptake of other formal financial services beyond the basic current/money-saving accounts have remained almost a nightmare. The recent government measures on demonetization and the shift towards a cashless economy are expected to bring innovation and new players to the market. Despite being significantly cheaper and more effective means of offering banking services as compared to the traditional value-chain models, digital financial services require the involvement of multiple stakeholders such as financial institutions, Fintech firms, regulators, agents, retail chains, and clients, which are face difficulties in most developing nations to mobilize (Haider, 2018; Neaime & Gaysset, 2018).

Some of the measures introduced by international organizations in the field of digital identification and the use of mobile phones can be used to extend the account ownership of those individuals underserved (Demirgüç-Kunt et al., 2022; Nandru et al., 2021). According to a 2021 survey, while 74 % of the men in developing economies had an account, this percentage was 68 % among women. According to Global Findex (2021), 61 percent of adults in emerging economies have a financial account, and the gap between genders in using this account is reduced from 9 percent to 6 percent (Demirgüç-Kunt et al., 2022).

Nevertheless, the limited penetration revealed that only 39% of mobile money account holders in Sub-Saharan use the account to save. Over a third of customers in emerging economies made or received a payment for their energy bill via an account for the first time since the COVID-19 outbreak. Through the improvement of finance services and also due to the growth of technology, due to the areas calling for digital financial services, we have Fintech. Developments in apps and solutions are being designed to ensure we can obtain financial products such as business loans or online personal loans (Kandpal & Mehrotra, 2019).

This is made possible through digitalization, which may, to an extent, transform a smartphone into a wallet, checkbox, branch, and accounting ledger all in one service (David-West et al., 2018). The government of Ethiopia has only recently realized the value of the demand for more financial services. However, the first National Financial Inclusion Strategy (NFIS) was published in 2017, following the creation of the National Council for Financial Inclusion (NCFI). This is even though in Ethiopia, arguably, there is little awareness about the paramount importance of realizing Digital Financial Inclusion studies.

Nevertheless, because of the significance of DFI, practically every country in the world today has adopted it as a priority. In this regard, African countries are not behind where they want to be or where they should be. Ethiopia also tries to implement DFI at every level in the 2025 plan. Moreover, to match the global activities, the Ethiopian banking system would make most of its transactions 'cashless' as is the basic MOTO of DFIs. However, as explained in detail in the following sections, there is a limited empirical analysis that explores the link between DFI and banking sector financial stability, although the idea of this relationship has attracted some attention from researchers lately with a few, including; Ahamed & Mallick (2019), and Banna, (2020), that tend to focus on bank stability and financial inclusion, in general, with little emphasize on DFI.

There are other works, such as Ozili (2018) and Koh et al. (2018), where authors discuss the significance of digital finance and financial inclusion. Still, there is no quantitative support for this claim. Therefore, this study will help close this knowledge gap by offering empirical data that illustrates the effect of the DFIs on the financial stability of the banking system in Ethiopia. However, the major hurdle to growing Ethiopia's Digital Financial Services (DFS) ecosystem remains and must be addressed: its penetration level is still relatively low compared to other LID countries in the East and Southern Africa.

This is more so because the mobile money Ecosystem, which plays a central role in access and usage of Digital financial services within the region, continues to disappoint. As a result of conducting a detailed analysis of the current mobile banking scenario, it has been observed that the general access to the network is good, while Internet connectivity is a concern. According to the Global System for Mobile Communication (GSMA), it asserts that the possession of mobile handsets remains low, and affordability is a big concern.

3. MATERIAL AND METHODS

The study employed an explanatory sequential triangulation mixed research design in which the researcher performs quantitative analysis and then explains the outcomes through qualitative research. Such methodologies depend on the study's objectives and the beliefs used in conducting the study. The study research methodology utilized an empirical check and panel data to learn about the effect of DFI on the banking sector's stability (Banna & Alam, 2021). The data were obtained from the National Bank of Ethiopia's annual report, the International Monetary Fund, and a World Bank database.

Theoretically, the study analyses are done using pooled ordinary least squares (pooled OLS), fixed effects model (FEM) or random effects model (REM). The F-test and Hausman test should be used to pick the right model. It is appropriate to check for multicollinearity, heteroscedasticity, and auto-correlation. Wooldridge (2010) pointed out that one should use pooled OLS when there is a different sample for the entities of the panel data. Random effects are used where the study is likely to measure the same cross-section of entities, while fixed effects are used when the study must ascertain the same units of analysis. In the empirical studies of Arellano & Bond (1991), the regression could appear as the correlation between the observation matrix of the repressor and the error terms. In addition, the POLS, FE, and RE have limitations in addressing the dynamic model compared to the GMM. To mitigate endogeneity, preferably, GMM has to be carried out.

Moreover, the nonexistence of such defects can improve the research results, make them more effective and objective, and even have a normal distribution. They found it necessary to investigate in line with the study's objective; the key independent variable was thus both the individual component and the aggregate index as revealed in the analysis. This study adopted the Z-score as a measure of banking stability as proposed by Ahamed & Mallick (2019) and Banna (2020) since the Z-score is widely used in the banking and financial literature and is considered an unbiased measure of a bank's stability. The Z-score has been calculated as follows:

$$Z \text{ score } it = \frac{\text{ROAA } it + \text{Equity/Asset } it}{\text{Sd(ROAA)} it}$$ Where: ROAA_{it}, Equity/Asset_{it} and $\sigma(\text{ROAA})_{it}$ are the return on average assets, the equity to assets ratio, and the standard deviation of return on average assets of bank i in year t, respectively. The natural logarithm of the Z-score has been used in this study to minimize the skewness. The bank-specific and macroeconomic variables are also taken into account. Thus, the model specification is as follows:

$$lnZ\text{-}score_{it} = \alpha + \beta_1 lnZ\text{-}score_{it-1} + \beta_2 DFI_t + Z_{it}(\beta_3 LR_{it} + \beta_4 logBS_{it} + \beta_5 LLP_{it} + \beta_6 IND_{it} + \beta_7 CP_{it,}$$
$$\beta_8 lnHH_{it} + \beta_9 CAR_{it}) + M_t(\beta_{10}GDP_t + \beta_8 InfR_t + \beta_9 ExR_t + \beta_{10} IntR_t) + \varepsilon_{it}$$

Where: ln (Z-score) is the dependent variable considered as a proxy for the stability of bank i in year t. $lnZ\text{-}score_{it-1}$ = lagged value of a dependent variable. DFI_t = the digital financial inclusion proxy. Z_{it} = company-specific factors of bank i and year t such as log of Bank's Size(logBS), Loan Ratio (LR), Loan Loss Provision (LLP), Income Diversification (IND), Capitalization (CP), ln of Herfindahl-Hirschman index (lnHH), and Capital adequacy ratio. M_t = macroeconomic factors in year t such as Real GDP (GDP), Inflation rate (InfR), Interest Rate (IntR), and Exchange rate (ExR).

Digital Financial Inclusion proxies; Since the objective of this study is to examine the impact of DFI on the financial stability of Ethiopia's' banking sectors, DFI proxies were measured by data from the selected banking sectors, National Bank of Ethiopia, World Bank database, and IMF for the period 2014 to 2023.

Using previous works, like Banna (2020), Ahamed & Mallick (2019), and Ozili (2018), an integrated financial outreach assessment was conducted on DFI. However, it was seen that proxy selection was slightly different from earlier studies which focused on financial inclusion in a broader perspective instead of digital financial inclusion. Based on available data, the number of debit or credit cards and mobile money accounts (% age 15 +) and made or received a digital payment (% age 15 +) were measures of financial service penetration.

Bank-specific and macroeconomic variables: This analysis also ensured that bank-specific and macroeconomic factors were kept constant. Closely related, the ratio of total loans to total assets (loan ratio) has been applied to gauge the extent of liquidity risk for individual banks. To address the possible size effect and the risk related to the loan portfolio of an individual bank, this study uses the log of total assets (bank size) and loan loss provision to the total loan (loan loss provision) as other control variables. To address the uncertainty of off-balance sheet operations, income sources were separated using the income diversification technique where the percentage of non-interest revenue to total income was used.

Equity or capitalization is used to fix capital risk because institutions take less risk if they are well-capitalized. Herdahl–Hirshman index was also used to regulate market power and measure market competition. Last, the study used capital to risk-weighted asset ratio (capital adequacy ratio) to compare the banks' capital adequacy to test whether they possess sufficient capital to cover a specific amount of loss before the bank became insolvent. Other macroeconomic factors included in the study are real gross domestic product, inflation rate, interest rates, and exchange rates (Banna & Alam, 2021).

4. RESULT AND DISCUSSION

4.1. Descriptive statistics

The following are the descriptive statistics of the research variables; Table 1 shows that the mean of the ln Z- score is 0. 10409, and the standard deviation is 0. 011214. However, since the minimum value is 0. 0847 and the maximum value is 0. 1238, there is no series gap in financial stability. The corresponding result of lnZ-score-L1 as a lagged value of lnZ score has an average of 0,102822, a standard deviation of 0,011119, a minimum value of 0,0847, and a maximum value of 0,1238. This has illustrated that there is a huge gap related to the lagged value of Z-Score. In addition, DFI has a mean value of 0. 0769, a minimum value equal to 0. 023333, and a maximum value of 0. 127. It shows a massive gap in digital financial inclusion issues in Ethiopia.

The loan-ratio indicator has an average value of 0. 538059 and ranges between 0,2849 and 0,7465. Priority lending suggests a very large gap in the bank's loan ratio compared with the industry average. Further, the variables log of bank size has a mean of 7. 161846 with a minimum value of 3. 92 and a maximum value of 10. 8. It also shows that the bank size ratio is considered a large gap.

The other variables that are specific to the bank include Loan Loss Provision, Income Diversification, Capitalization, Herfindahl-Hirschman index, and Capital adequacy ratio have a mean value of 0. 020347, 0. 327575, 0. 126168, 7. 409743, of 0. 254308 respectively and with the minimum value of, 0.0051, 0.0455, 0.0372, 6.645091, and 0.129 respectively where the maximum value of each variables was 0.0887, 0.7638, 0.197, 8.014667 and 0.49 respectively. The value difference is still significant except for the Herfindahl-Hirschman index.

The mean values for the macroeconomic variables, including real GDP, inflation rate, exchange rate, and interest rate, are 0.0783, 0.17465, 0.32722, and 0.13089, respectively. The minimum values are 0.0532, 0.0662, 0.1958, and 0.1188 for each variable, respectively, and the maximum values are 0.1039 for GDP, 0.3388 for inflation rate, 0.546 for exchange rate, and 0.1425 for interest rate.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Dependent variable					
lnZscore	130	0.10409	0.011214	0.0847	0.1238
Independent Variables					
lnZ-score-L1	117	0.102822	0.011119	0.0847	0.1238
DFI	130	0.0769	0.033461	0.023333	0.127
LR	130	0.538059	0.110781	0.2849	0.7465
logBS	130	7.161846	2.087672	3.92	10.8
LLP	130	0.020347	0.011849	0.0051	0.0887
IND	130	0.327575	0.164969	0.0455	0.7638
CP	130	0.126168	0.029813	0.0372	0.197
lnHH	130	7.409743	0.303257	6.645091	8.014667
CAR	130	0.254308	0.072808	0.129	0.49
GDP	130	0.0783	0.018873	0.0532	0.1039
InfR	130	0.17465	0.094271	0.0662	0.3388
ExR	130	0.32722	0.12409	0.1958	0.546
IntR	130	0.13089	0.009522	0.1188	0.1425

Source: Analysed by authors (2024)

4.2. Correlation

The correlation matrix explains how digital financial inclusion and other factors, including bank-specific and macroeconomic variables, are statistically associated. These provide helpful information for further analysis, including regression analysis to examine the effect digital financial inclusion could have on banking sector stability. As presented in the correlation table 2 below, a significant and robust positive relationship exists between the inflation rate, exchange rate, and interest rate with DFI at 0.9037, 0.9031, and 0.9112, respectively. On the other hand, there is a negative significant and robust relationship between GDP and inflation rate, exchange rate, and interest rate at -0.8632, -0.8259, and -0.8553, respectively. Furthermore, a significant positive and robust relationship exists between the interest rate inflation and exchange rates at 0.9368 and 0.9138, respectively.

Finally, a significant positive and robust relationship exists between the exchange and inflation rates at 0.98.

Table 2, Correlation Matrics													
	Zscore	Zscore L1	DFI	LR	logBS	LLP	IND	CP	lnHH	CAR	GDP	InfR	ExR	IntR
Zscore	1													
Z score L1.	-0.2464	1												
DFI	0.2568	-0.3228	1											
LR	0.2579	-0.0444	0.5364	1										
logBS	0.0918	-0.0609	0.2213	-0.0371	1									
LLP	-0.1197	-0.0187	-0.2325	-0.3411	-0.3679	1								
IND	-0.1618	0.0611	-0.3484	-0.1623	-0.1718	0.1917	1							
CP	0.0254	0.0726	-0.1007	0.2256	-0.6541	0.1394	0.0987	1						
lnHH	-0.2316	0.137	-0.5389	-0.034	-0.136	0.0831	0.0961	0.3484	1					
CAR	-0.0218	-0.0371	-0.0413	-0.0976	0.1798	0.2722	-0.0445	0.2024	0.3648	1				
GDP	-0.0737	0.0386	-0.86	-0.5238	-0.2047	0.217	0.3594	0.1106	0.4866	0.075	1			
InfR	0.2922	-0.0278	0.9037	0.6054	0.2211	-0.2586	-0.381	-0.0743	-0.546	-0.0459	-0.8632	1		
ExR	0.3393	-0.1137	0.9031	0.6001	0.2236	-0.2412	-0.3836	-0.0715	-0.5578	-0.0273	-0.8259	0.98	1	
IntR	0.4379	-0.2633	0.9112	0.5869	0.2249	-0.2469	-0.3843	-0.0912	-0.5427	-0.051	-0.8553	0.9368	0.9138	1

Source: Analysed by authors (2024)

4.3. Regression

As shown in Figure 1, the lnZ-score value (proxy of financial stability value) of the Commercial Bank of Ethiopia (state bank) and the lnZ-score average value of the other private banks fluctuated from 8% to 12% in a different way even though the 63% and above total market shares of overall commercial banks in Ethiopia were covered by only one state bank (CBE) in recent years.
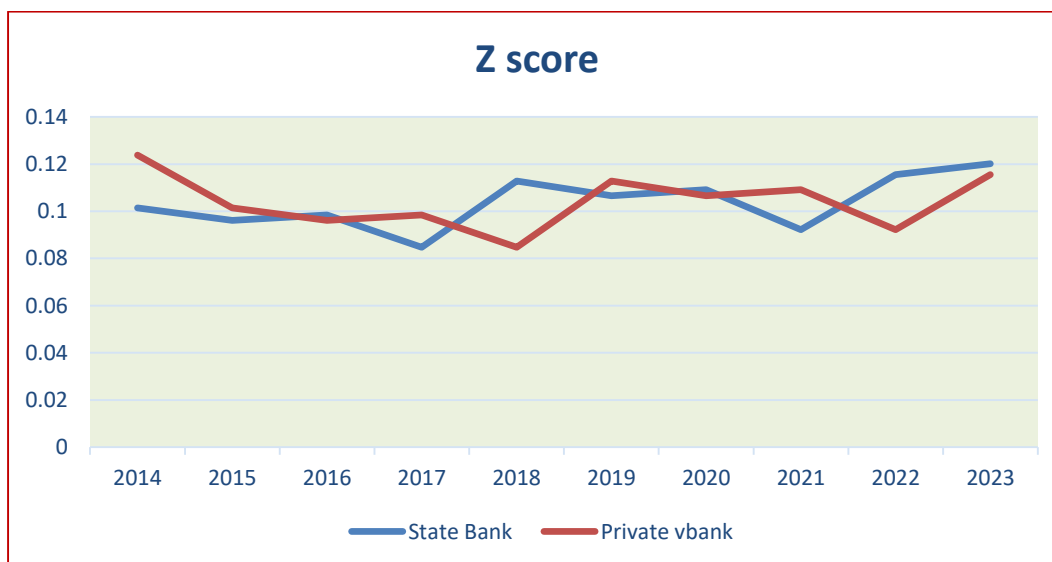

Figure 1: The Commercial Banks of Ethiopia Z-score from 2014 to 2023

Table 3. Previewed the concept that the magnitude of the impact of the DFI on the stability of the banking sector can be performed with pooled OLS, FEM, and REM, but due to endogeneity and diagnostic issues GMM was used. From the analysis provided in Table 3, it is clear that the coefficient of ln Zscore_1 has a positive significant relationship with the bank's financial stability. This suggests that, due to its financial stability in the previous year, the variable should positively affect the bank's financial stability during this year.

Digital financial inclusion effect: The regression analysis has established that digital financial inclusion positively and significantly impacts the banking sector's financial stability, with a regression coefficient of 0. 265345. This results in the fact that for any one-point rise in the level of digital financial inclusion, the financial stability of the banking sector approximately rises by 0. 265 points. The estimate of 0. 0607213 is within a small range; hence, it can be considered very accurate; the p-value equals 0.000; hence, it is less than 0. 05. This means the test is highly significant. In a related study, Banna and Alam (2021) noted that digital financial inclusion boosts banking stability in emerging Asian countries. According to their research based on data from 574 banks in seven countries in 2011-2018, other scholars also found that improved digital financial services increase economic growth and enhance the stability of the banking industry (Wang et al., 2023).

Table 3: Regression output

Variables		POLS	FEM	REM	GMM
Z score L1.	Coefficient				0.899932
	Std. err.				0.0906565
	P>|t|				0.000
DFI	Coefficient	0-.4053386	-0.35022	-0.40534	0.265345
	Std. err.	0.0636002	0.0678899	0.0636002	0.0607213
	P>|t|	0.000	0.000	0.000	0.000
LR	Coefficient	-0.015	-0.03817	-0.015	0.050144
	Std. err.	0.0102867	.0215225	0.0102867	0.0200249
	P>|t|	0.148	0.079	0.145	0.012
logBS	Coefficient	0.000656	-0.0312	0.000656	0.001779
	Std. err.	0.0005913	0.0100996	0.0005913	0.0124764
	P>|t|	0.270	0.003	0.267	0.887
LLP	Coefficient	-0.02601	-0.08034	-0.02601	-0.04618
	Std. err.	0.0763634	0.085765	0.0763634	0.0679095
	P>|t|	0.734	0.351	0.773	0.496
IND	Coefficient	0.001145	-0.00069	0.001145	0.000963
	Std. err.	0.0048921	0.007392	0.0048921	0.0054489
	P>|t|	0.815	0.926	0.815	0.860
CP	Coefficient	0.076756	0.249683	0.076756	0.160954
	Std. err.	0.0398252	0.0612153	0.0398252	0.0533684
	P>|t|	0.056	0.000	0.054	0.003
lnHH	Coefficient	0.001716	-0.10084	0.001716	0.011935
	Std. err.	0.003933	0.0324294	0.003933	0.0342953
	P>|t|	0.663	0.002	0.663	0.728
CAR	Coefficient	-0.01868	-0.07977	-0.01868	-0.06848
	Std. err.	0.013458	0.0221569	0.013458	0.018828

	P>|t|	0.168	0.000	0.054	0.000
GDP	Coefficient	0.382221	0.304231	0.382221	0.678187
	Std. err.	0.0924529	0.0911659	0.0924529	0.0659622
	P>|t|	0.000	0.000	0.000	0.000
InfR	Coefficient	-0.20552	-0.21621	-0.20552	-0.62892
	Std. err.	.050566	0.0528809	0.050566	0.0525303
	P>|t|	0.000	0.000	0.000	0.000
ExR	Coefficient	0.160503	0.129928	0.160503	0.255413
	Std. err.	0.0333868	0.0376424	0.0333868	0.0296101
	P>|t|	0.000	0.001	0.000	0.000
IntR	Coefficient	2.197418	2.416523	2.197418	3.711289
	Std. err.	0.2673552	0.2746232	0.2673552	0.2586514
	P>|t|	0.000	0.000	0.000	0.000
_cons	Coefficient	-0.21303	0.767961	-0.21303	-0.6553
	Std. err.	0.0458989	0.3102493	0.0458989	0.3424021
	P>|t|	0.000	0.015	0.000	0.056
No of Obs	104				
No of Group	13				
Instrumental V.	16				
Mean VIF	1.97				
Wald chi2 (13)	562.78				
Prob > chi2	0.0000				
Hausman test	Test of H0: Difference in coefficients not systematic $chi2(12) = (b-B)'[(V\_b-V\_B)^{(-1)}](b-B)$ = 26.62 Prob > chi2 = 0.0088 (V_b-V_B is not positive definite)				
Instruments for different equation GMM-type: L(2/.).Zscore Standard: LD.Zscore D.DFI D.LR D.logBS D.LLP D.IND D.CP D.lnHH D.CAR D.GDP D.InfR D.ExR D.IntR Instruments for level equation Standard: _cons					

Source: Analysed by authors (2024)

Bank-specific factors: Concerning the loan ratio, the coefficient estimate of 0. 050144 revealed that the financial stability of the banking sector relative to the loan ratio increases by about 0. 050 for every one-unit change. To ensure that the result is statistically significant, it is corroborated by a p-value of 0. 012. Regarding the log of bank size, the coefficient estimate is 0. 001779. This suggests that there is a very weak positive correlation between the bank's size and the bank's financial stability. However, the standard error equals 0. 0124764, and the p-value equals 0. 887. Hence, from the above analysis, there is no significant relationship between the bank size and the financial stability of the banking sector as far as digital financial inclusion is concerned. The merits of bank size commonly exhibit variabilities, which are also true for most research studies that seek to explore the effects of bank size on the stability of finances. For instance, Garcia (2016) recognized in their study that large banks use more leverage and put more capital at risk than small ones and, hence, can shift a country's economy to a fragile state.

Nonetheless, works carried out by Beck et al. (2018) posit that a larger bank is an indicator of economies of scale and diversification, which positively influences stability.

The GMM regression result shows a coefficient of capitalization of 0. 160954 has proved that higher capitalization contributes towards the better financial health of the firms. The standard error is 0. 0533684, and the p-value =0. 000 proving the hypothesis that the relationship is statistically significant. Hence, we may establish that appropriate capitalization contributes to strengthening the financial base of banking sectors in the context of the digital financial inclusion effect.

According to Bouwman (2013), capitalization increases to help a banking firm streamline and cushion losses, making it more financially stable. Furthermore, (Agur et al., 2020) have pointed out that risk management and such operational changes as digital financial inclusion enhance financial stability. Exacerbating this context of digital financial inclusion deepens this positivity of capitalization to stability.

The regression analysis reveals that the capital adequacy ratio hurts the financial stability of the banking sector with a coefficient of -0. 06848. The values of 0. 018828 of the standard error indicate that the estimates are accurate, and with a p-value of 0. 000, it can be concluded that this relationship is statistically significant. All in all, it can be concluded that high capital adequacy ratios are negatively related to the financial stability of the banking sector. Consequently, there is limited consensus in research studies on the impact of capital adequacy ratio (CAR) on the stability of the banking sector's finances. Research shows that high CAR enhances financial stability in light of a bank's ability to build up capital that may be used to absorb shocks during the period of economic crises. For example, research carried out on Nigerian banks reveals that there is a positive relationship between CAR and profitability that is pro-stability (Wang et al., 2023).

However, other findings conclude differently. For instance, international empirical research using information from over a hundred countries revealed that enhanced general regulatory capital benefits banking stability and is likely to restrain economic development(Stewart et al., 2021). This implies that although CAR is necessary for stability, other related objectives in the economic area should also be achieved or pursued. Therefore, it can be concluded that, apart from generally improving the banking sector's stability, capital adequacy ratios can have intricate relationships with other economic factors.

Macroeconomic variables: The regression result demonstrates that the banking sector's financial stability is positively affected by GDP, with a coefficient estimate of 0. 678187. This shows that with an increase in the GDP, there is an increase in the level of financial stability. The standard error of 0. 0659622 indicates that the estimate is precise and has a p-value of 0. 000 confirms that this relationship is statistically significant. Overall, higher levels of a country's GDP correspond to the stability of the banking sector in that country. The World Bank study on banking sector concentration and financial stability shows that macroeconomic factors, such as gross domestic product, directly reflect financial stability.

The author believes that higher GDP levels can increase the banking system's stability, which means greater profitability and sound credit conditions (Calice, 2018). However, the Nexus of Governance, Macroeconomic Conditions, and Financial Stability study shows that GDP growth and other macroeconomic variables enhance the country's financial stability level (Kim et al., 2022). Also, the Federal Reserve Board Review on Macroeconomic Implications covers the banking sector's stability through macro-economic factors such as GDP. It stresses that high and sustained GDP growth can yield a better financial structure by mitigating the financial costs of transmitting money (Ullah et al., 2024). In general, these works collectively affirm what the current study finds through regression analysis, which is that increased GDP is helpful to stability in the banking sector.

On the other hand, inflation significantly negatively affects financial stability. Using regression results, it is clear that an increase in the inflation rate reduces the banking sector's stability, as provided in the coefficient of -0. 62892. Looking at the standard error 0. 0525303, we can infer that this also indicates that the estimate is accurate, based on the p-value of 0. 000 This is a significant relationship. In conclusion, the results show that increasing inflation rates negatively affect the financial stability of Ethiopia's banking industry. The Financial Stability Report: The Amharic version published by the National Bank of Ethiopia pointed out that high inflation rates have been a particularly compelling issue that has challenged the financial sector's stability. Inflation affects banks' profitability, leading to high non-performing loans and compromising financial stability (Kim et al., 2022).

World Bank Report on Ethiopia's Financial Sector Development elaborates that inflation, especially when it is externally induced and or due to domestic supply side factors, is dangerous to the financial sector. It looks like high inflation results in the depreciation of financial assets and savings, causing people to lose confidence in the banking system(Kim et al., 2022). World Bank Report on Ethiopia's Financial Sector Development: Some of the financial sector vulnerabilities this report addresses include the role of inflation APP, mainly when external shocks and dormant supply constraints cause it. This stems from high inflation levels reducing the value of financial assets and savings, ultimately destroying confidence in the banking system (Isayev, 2024). These sources agree with the outcome of this study, which is that high inflation is connected to a low level of financial stability in Ethiopia's banking sector. The coefficient of 0. 255413 about the exchange rate means that banking sector stability increases with the exchange rate. There is an indication that the estimate is precise since the standard error is 0. 0296101 and the p-value is 0. 000.

The study by the World Bank on Exchange Rate and Structural Transformation talks about how an appropriate rate in the foreign exchange market can help to encourage exports and growth of the economy, which in turn can improve the soundness of the financial systems. It stresses that sound exchange rate management can enhance people's confidence in the banking system and the economy's stability (Haile, 2019). For the interest rate, the coefficient = 3. 711289, which means that an increase in the interest

rate causes an improvement in the banking sector stability based on the standard error of 0. 2586514 and p < 0. 05 thus, our estimate is precise, and the relationship is statistically significant. A well-managed interest rate policy can help stabilize the financial sector by controlling inflation, encouraging savings, and strengthening the banking sector. Also, interest rates, bank size, and liquidity significantly influence the financial stability of commercial banks in Ethiopia (Oberholzer & Ayele Haylemariam, 2024).

5. CONCLUSION AND POLICY IMPLICATIONS

5.1. Conclusion

From the study's main findings, it was understood that digital financial inclusion is a very important factor in improving the overall stability of the banking sector in Ethiopia. Therefore, the positive effect of financial inclusion for the digitally excluded population implies that expanding digital access could continue to strengthen and sustain banks. Also, this study brings into focus other variables peculiar to the banking sector. These include Loan Ratio, Capitalization, and Capital Adequacy Ratio, which also account for high financial stability. In addition, this study establishes that the GDP, the inflation rate, the interest rate, and the exchange rate have a significant impact on the banking sector's stability. Thus, to enhance the financial stability of the banking system of Ethiopia in the context of the macro environment, it is crucial to pay attention to such components as the level and changes in financial inclusion for digital and other financial services, the selected key performance indicators for individual banks and the evaluation of its impact on the Ethiopian banking system and the fluctuations in the macro sphere. Adopting these strategic directions will, in return, positively impact and enhance Ethiopia's sound, robust, and sustainable banking sector.

5.2. Policy implications

Based on the study's conclusions, several policy implications can be drawn to enhance the financial stability of Ethiopia's banking sector:

Promote Digital Financial Inclusion: The gap in digital finance needs to be addressed through better policies to enhance the usage of digital finance platforms. This can be done through investment in the necessary base infrastructure to support such services, support and advocate for the use of mobile money, and support payment systems. Improving citizens' digital financial literacy is also a key aspect.

Strengthen Bank-Specific Metrics: What remains is for regulatory bodies to channel their efforts to fix key bank indicators, including the Loan Ratio, Capitalization, and Capital Adequacy Ratio. Another way of ensuring that these metrics are kept at the right level is by adopting tight regulatory compliance measures and conducting frequent checks.

Monitor Macroeconomic Conditions: Policymakers should, therefore, always keep an eye on factors such as gross domestic product, inflation rate, interest rate, and exchange rate. Writing down policies that put measures in place the factors to a more stable position can

help in banking. For example, measures dealing with controlling inflation and even stabilizing the exchange rate can help control the banking sector's risk.

Encourage Strategic Planning: Hence, banks need to embark on strategic planning that considers internal and external variables. This also means promoting digital financial services, improving the company's financial efficiency, and being sensitive to the macroeconomic environment.

Public-Private Partnerships: Most developing countries have shown that the initiation and advancement of digital financial services can be enhanced through partnerships between the government, and other private players. This has the potential to be enhanced through public-private partnerships that assist in establishing the basic framework and environment for the delivery of Fintech products within countries.

Financial Education and Awareness: Financial education, and raising the public's awareness about financial products and services will contribute to the increase in the uptake of digital finance services. Public awareness can play a central role in this sense through educational initiatives at a network level.

Through these policy measures, Ethiopia's banking sector's capability is increased by being fitted with strong pillars that will prevent the sectors from being easily eroded by internal and external factors.

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