

Title:

**Economic-Financial development nexus and their inverse interaction effects on bank risk alleviation.**

**Abstract:**

The study analyses the positive impact of economic and financial development interaction effects on bank risk reduction through non-performing loans and loan loss reserves proxies. This study uses a two-step system GMM approach with 350 active banks from 40 countries. Firstly, the results showed that economic and financial development interaction effects significantly diminished bank risk-taking in two ways: reduced non-performing loans on the one hand and strengthened credit security via an increase in loan loss reserves on the other hand. Secondly, results demonstrated that economic development is more influential than financial development. Thirdly, results evidenced that those interactions effects were significantly higher than the sum of each variable's effect evaluated separately. Finally, these results can inspire policymakers, especially governments in SSA countries, to elaborate economic development policies that parallelly comply with financial development plans for greater development impact.

**Keywords:** bank risk, Credit, stability, financial, economic, development, SSA.

**Gel classification:** G21, G33, E44, O4.

**1. Introduction.**

Since the 90s, the relations between economic development (ED) and financial development (FD) have been explored. The financial system's role in developing economies has fascinated and attracted greater attention from researchers and policymakers with different points of view on its relationship with economic development [2]. The banking sector in developing countries has an essential role in economic growth [3]. The banks involved in financial services work as intermediaries in economic structure and supply liquidity for innovative investments and real productions [4]. Through loans offered to the borrowers, those intermediaries institutions affect positively or negatively the overall financial and economic structure [5]. These relationships have been explored in the literature since the 90s' to 20s' [6]. Financial development provides liquidity to the entire economic system for better stability [7], [8]. This liquidity circulating in a financial system reflects the size of business and economic activities, which is the primary economic development measure, especially in developing countries[8].

In the same pipeline of theories on developing countries, this study supports theoretical literature on mutual effects of both factors [9]–[12]. However, in addition to the basic causality tests between these two variables[9][13]; and cointegration movements proved by some authors [14], [15], this study goes further and explores those benefits using their interaction effects on bank risk reduction.

Some recent arguments support that the financial market affects developed and developing countries differently. A comparative study confirmed higher effects of these relationships in developing economies than in developed economies [16]. Likewise, other studies supported these findings [1], [17], [18] and concluded that developing countries benefit much more from financial development than developed countries. Developing countries depend on local sources to develop financial services for better and significant economic impacts [19], [20]. Policymakers from developing countries need to sharpen the policy and strategies related to developing their financial system to enhance economic growth.

On the one hand, most previous discussions and findings were explicitly limited to determining the relationship between economic and financial development as developed in the literature. Some recent studies evaluated their cointegration in the long run [14], [15], [21]. On the other hand, recent authors only announced that more benefits exist (from such relationship between economic and financial development) for developing countries' side without demonstrating and specifying which benefits for which economic sector, and how developing countries can profit them. This research then follows the flows from the above findings and wants to fill this gap by assessing these benefits for the banking system in developing countries and demonstrating how those beneficial effects reduce bank risk and improve bank sustainability.

The leading question is how does the banking system from developing countries profit from economic and financial development interactions? This question arose from the conclusions of different studies[16], [17], [22]. However, while the authors declared that those concerned variables affect one another, our assumptions believe that bank risk depends more on their interaction effect rather than their individual effect measured separately.

While using human capital to arbitrate the interaction effect between economic and financial development in Sub-Saharan African countries, the study tries to analyze the effects of these interactions [23]. While some others studied examined ED

and FD separately as determinants of bank risks factors, other studies on this subject mainly used the individual approach (in one country). They evaluated the causal relationship between those two development factors (ED-FD), especially in Nigeria [24]–[26].

However, this holistic study intends to prove that both ED and FD influence bank stability differently. One influences it negatively while another one influences it positively. Furthermore, the study brings new contributions by evaluating the effect of the ED-FD interaction on the banking sector. It assesses how such interaction effects are more beneficial, sustains the banking system, and promotes bank stability. And finally, this study will compare the weight of the shocks when ED-FD interact and when ED and FD act individually. Based on the author's knowledge, these interaction effects on bank risk have not been studied previously.

Such interaction effects can be explained by the fact that GDP growth augments deposit/CDs and then allows an increase in bank credit volume for a productive sector that turns to re-increase the GDP growth through increases in real productions outputs [3], [25], [27], [28]. Thus, bank risk mitigation will be analyzed through two means: Non-performing loans reduction (NPLs) and increased credit security funds. This analysis uses two-step system GMM models to determine the effect of their interaction on bank risks reduction by comparing their influence with interactions and without interactions on two bank risk proxies (NPLs and LLR as dependent variables) [29]–[33]. Their trends indicate well whether the banks are encountering any risk-related challenge.

The study assumes that bank stability depends much more on the interaction between economic development and financial development rather than the sum of their effect measured separately. For intermediations institutions, the non-performing loans are critical bank factors that drive and affect even the whole results of financial institutions. Suppose an intermediation institution experiences a high rate of credit default. In that case, it is a bad sign for the stability and future of that institution, then non-performing loans act as a gauge of financial health and risks related. Such risks are shared with other intermediation institutions because most of the time, all financial intermediaries work as an entire financial system unified together through interbank relations and liabilities.

Moreover, the high default rate automatically reduces the bank liquidity rate besides those bank interconnections. That negative impact influences liquidity and risk-related affects loan loss reserve directly. If provisions for defaults credit are affected, it puts the financial institution in an insolvency and stress status. Thus, those intermediation institutions from developing countries need to master macroeconomic and bank-specific factors affecting non-performing loans and loan loss reserve to reduce such risk if not preventing them.

This study approves that an increase in the effects of the interactions increases economic activities and deposit/saving rate. This rise increases the bank credit volume offered for the real productive sector, diminishes non-performing loans, reduces bank risk-related, and increases bank performance. Here, the loan quality matters the most as it should be directed to the productive sector to mitigate the default risk by improving real production [34].

The structure of this paper is as follows: After this first party, the second section is about literature review and hypothesis development. The third section is concerned with the data, methodology, and models used for analysis. The fourth section talks about the empirical results and discussions with a summary comparison of the findings; before the conclusion.

## 2. Literature review

Two prominent and different theories have been developed in the literature: scepticism and pessimism. The sceptic thoughts argued that financial development has a crucial role in economic development[6], [35].

Recently in the 20s, some other studies have joined these sceptic theories and proved the effect of financial development on economic development[4], [36]–[38]. However, Robinson qualified the financial development effect as a response to the demand rather than the real effect of economic development [39]. While some other authors approved only the correlation between the two factors [40]–[42], others stay pessimists about its contribution to economic growth [10], [43].

Controversy, the pessimistic thoughts urged that financial development is not essential for economic development [44], [45]. Recently in the 20s', several studies supported that theory evidencing that financial product has an inverse relationship with economic development [34], [46], [47]. Deep stated analyzing their relationship since 90's [48]. Some authors suggested that further studies should consider the specificity of different states [22], [49] and their economic development stages [12]. Moreover, while studying the direction of causality between these concerned variables, one study approved a unilateral Granger causality from economic growth to financial development and checked their instantaneous causes between them. It concluded that the level of each component remains unclear [1]. Another recent study inserts a condition

on the effect of financial development on economic development, suggesting that impact might become negative if financial development raises considerably faster than real production [34].

Different studies have demonstrated that credit growth has a vital role in economic development [7], [50] [51]. Credit and GDP growths are significantly and positively related [52]. However, other authors argued that the negative effect of credit growth on global economic growth leads to economic depression [53]–[57]. Bank-related factors and economic growth are associated, and recent policy implications suggest improving credit growth to reach desirable economic growth [58], but another suggested that constraint to credit harms company growth while access to credit positively affects company growth [59].

Finance development contributes significantly to credit access and then improves the economic growth in developing countries [8]. Access to credit has a positive influence on farmers' production efficiency than the one who has no access to bank credit. [27]. Bank credits in Turkey play a positive and significant role in local development in all provinces [60]. Credit responds positively to a shock in GDP, while bank structure does not respond favorably [61]. Some authors demonstrated that credit growth determines GDP growth [54]. Strong economic growth leads to higher credit growth [50], and conversely, the GDP growth influences the credit growth of the private residents in Lebanon[59].

Some other studies have assessed the correlation between a nation's financial system and the overall country's economic growth and performance [40]–[42], [62]. All these studies converge in their findings to prove that the association among those factors exists and is not static. Moreover, beyond demonstrating this dynamism in their relationships, the same analysis showed that in countries where the financial services system is well performed, there is a high economic growth and vice versa. [63], [64]. However, an unreasonable banks' credit growth increases credit risk as the impact on bank credit in the economy is not weak [65]. The credit boom plays a significant role in dampening the economic downturn [53].

Studies on bank risk-taking behavior have been associated with external economic factors and the business cycle [66], [67]. Others have demonstrated that internal bank factors are a source of bank risk and finance crisis [51], [68]. For instance, the recent studies on the 2008 finance crisis evidenced that abnormal credit growth emerged from the USA and is the source of bank risk and finance crisis [69], besides country external finance [70]. These findings converged with the recent study showed that financial development through credit growth is a source of the financial crisis, affecting the entire economic structure and leading to high systemic risk [70], [80]–[83].

The same consideration is given in Kai Guo's conclusions saying that bank health matters due to the growth credit resulting in worldwide and domestic financing [71]. However, macro-prudential regulations, regional credit bureau, and loan information coverage can reduce abnormal loan growth and strengthen the solidity of the banking industries [72]. Furthermore, bank risk-taking has been assessed from different angles and combines macro and micro sources of risks.

Besides bank credits growth, many other studies have paid attention to mixed actions (as internal and external bank factors) and their effect on bank risk: determinants of NPLs risks [73]–[75]; determinants of LLR risks [76]; determinants of loan growth risks [26], [77], determinants of bank capital risks, and liquidities risks[78], [79].

One study shows that tourism, financial development, and economic growth are three related variables in the long run [15]. Another suggested that the real economic growth helps in increasing their effects [34]. One more analysis proved how liquidity ratio, inflation, M2, and risk premium raise the credit to the private sector; while reserving ratio and prime lending rate decrease it [26]. Nevertheless, other authors did not conclude the needed equilibrium level of Credit to the private sector to boost economic growth without causing any downturn [43]. His findings converged with Deidda's scepticism, suggesting that more capital with intensive technology factors is required to have a considerable effect [10].

Moreover, recent studies have demonstrated that different controllable factors arbitrate the relationship between ED and FD, suggesting that the third variable moderates the effect of each on another: corruption with an adverse effect on FD in developing but not in developed countries [84]; a positive effect of technology transfer on FD in developing countries [16]; trade openness, human capital financial integration, and macroeconomic policies [85]; cointegration between institutional quality, green economic growth, and FD [86]; the role of governance in moderating financial inclusion and ED [87]; the complex relationship between innovation and ED [88]; financial market and institutional on the ED [89]; human capita and FD as the determinants of ED [90]. Other researches associate renewable energy, FDI, and FD [91]; carbon emission, green energy production, and innovation on the environment quality and FD [92], [93].

While many studies in the above literature focused on the ED\_FD causal relationship effect on the one hand and how some different moderators regulate their influences on the other hands, this study assumes that the effects of their interactions have a more significant impact on bank risk reduction, especially risk proxies to which is directly or indirectly connected,

for two main reasons: the causal effects between ED-FD signify the mutual influence of one on another. If ED is growing, the FD has to grow too because the ED growth is pushed by either government or private finance projects. These public investments increase bank activities through financial intermediation system. Likewise, when the investment increases considerably, it provokes economic activities and influences the ED through the production outputs. The increase in national outputs results in surplus and augments bank savings, then increases bank lending ability (credit volume) needed to finance productive activities. In all these causal relations between ED-FD, the banking system plays a crucial and intermediations role as a channel and regulator of funds [94]. Then, the role of transistor and regulator is what gives the banks a place as an inevitable and beneficial third partner in the causal relationship between ED-FD. Thus the positive or negative changes that happen to one partner affect the other two partners directly, either negatively or positively. Thus, the more the ED-FD interact, the more their third partner is also activated/shocked, and similarly, the higher or, the lesser is the effect on bank risk reduction.

For that reason, the leading question is how do these three partners interact to affect bank risk factors? And especially, how their interaction effect influence the bank's stability? Those questions intend to shed light on individual effects of ED and FD that influence bank riskiness and prove how both contribute to the bank stability on one side and then demonstrate how the effects of their interactions play a significant role rather than their individual effect.

To verify these assumptions, we formulated one general hypothesis and two specific hypotheses:

H1: The ED-FD interaction effects influence bank risk proxies inversely.

H2: the ED-FD interaction effects increase loan loss reserves (+)

H3: the ED-FD interaction effects reduce non-performing (-)

### 3. Methodology, variables, and data description.

#### 3.1. Data source and variable descriptions

Bank-specific variables (calculated ratios) were downloaded from moody's analytics in Bank Focus (Bureau Van Dijk), while macroeconomic data were downloaded from the world bank database at: <http://data.worldbank.org/indicator>. FD represents financial development and is the credit to the private sector by banks [1], [5]. The ED denotes economic development, which is the growth rate of the gross domestic product [5], [34], and The GNLB is the gross national lending to borrowing and represents the government factors. The LLR is the loan loss reserves or provisions, and the NPLs represent the non-performing loans and are the dependent variables for bank risk proxies. The independent variables for the bankside are ROAE, which is the return on average assets and equity; the TCRatio represents the total capital Ratio.

Other valid and strong macroeconomic, government, and bank-specific instruments variables (internal and external) were used: the FDINI represents the foreign direct investment net inflow, the INLAT represents inflation, the TGE represents the total government expenses. On the bank side, the equity on total assets (ETA), the LATDB, which is the liquidity on total debt and borrowing, the net lending on debts of short-term funding (NLDSTF), and net loans to total assets (NLTA) were also used as internal instruments.

Table1 is a short panel data (larger N and small T) from 2010 to 2019, and this panel is a cross-sectional and times series combination. In this study, 40 countries are concerned as sample size, with 350 active banks. Data were organized, treated, and uploaded for GMM regression analysis in the Stata software. The logarithm form of data was used to avoid inflated results.

#### 3.2.Descriptive statistics.

<i>Variables</i>	<i>Observations</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Min</i>	<i>Max</i>
FD	3480	2.9	.748	1.308	10.602
ED	3480	2.082	3.024	-.919	19.012
EDFD	3480	4.556	1.297	1.615	20.494
NPL	3480	3.295	.555	1.837	3.95
LLR	3480	2.395	.666	1.211	3.941
ROAE	3480	3.502	.571	2.916	4.991
TCRATIO	3480	2.628	.107	2.425	2.753
GNLB	3480	2.93	1.306	.904	5.234

In the table1, the observations of all variables are standardized at 3480 observations. The standard deviation varies from 3.024 to .107. The ED has the highest standard deviation, and this can be explained by the fact that GDP growth in developing countries is largely different from country to country every year. In contrast, the lowest standard deviation number is for TCRatio. This is also explained by the fact that the total capital ratio is mostly unchangeable for banks.

### 3.4. Methodology: *The general method of moment (GMM)*

The research methods and models depend on the data structure. This study uses a dataset of 350 individual banks for forty countries. With such panel data, the appropriated methods are mainly random effect, fixed effect, or a mix of both, the GMM estimator [95], [96]. These system GMM estimators are used in different situations. In panel data with small T and large N, with cross-sectional times series and variables that are not strictly exogenous, meaning the presence of endogeneity problems [95]. However, to overcome the problem of endogeneity, GMM permits more instruments to improve the estimations outputs.

Country-specific effects were removed by using the first differences. The endogeneity problems (differences across countries and bias of the dynamic panel) were solved using the generalized methods of moments estimator (FD-GMM) [96]. The instruments were strictly exogenous and were both from macroeconomic and bank-specific factors. Moreover, the Arellano-Bond Test for AR(1) and AR (2) and Hansen test of over-identifying restrictions were used to get the best-unbiased estimations[96], [100]. This model used internal instruments (lagged dependent variables) and external instruments as well (bank-specific and macroeconomic variables).

Furthermore, it uses some additional options to improve the consistency of the estimates: collapse option to control and keep the number of instruments under the number of groups; robust command to report the corrected standard error and t-statistic values, etc. [95], [96]. For those reasons, the GMM estimator is used to offer the best and most unbiased estimates. The study used a two-step system GMM with Stata software, version fifteen. [95], [97]–[99].

The general models are specified as follow:

$$NPL_{sit} = \alpha_1 + NPL_{sit-1} + \beta_1 ED_{it} + \beta_2 FD_{it} + \beta_3 \Pi(ED_{it} * FD_{it}) + \sum \delta X_{it} + \varepsilon_{it} \quad (1)$$

$$LLR_{it} = \alpha_1 + LLR_{it-1} + b_1 ED_{it} + b_2 FD_{it} + b_3 \Pi(ED_{it} * FD_{it}) + \sum \delta X_{it} + \mu_{it} \quad (2)$$

Where  $NPL_{sit}$  and  $LLR_{it}$  are the dependent variables for country  $i$  and time  $t$ ,  $\alpha$ ,  $b_1$ ,  $b_2$ ,  $b_3$  and  $\beta_1, \beta_2$ , and  $\beta_3$  are the coefficients to be estimated.  $\Pi(ED_{it} * FD_{it})$  is the product of ED and FD that captured the interaction term [101], [102]., and  $\sum \delta X_{it}$  are the controllable variables, while  $\varepsilon_{it}$  and  $\mu_{it}$  account for the error term [23], [103].

## 4. Empirical results and discussions.

### 4.1. The GMM results and discussions.

This table5 displays the GMM results of bank riskiness for both models (NLPs and LLR). The results showed that economic and financial development significantly and differently impact bank risk factors. FD affects negatively NPLs (with a -0.504) at a 5 % significant level, ceteris paribus. Similarly, FD positively influences LLRs (1.073) at a 5% significance level, ceteris paribus. It implies that financial development negatively affects bank riskiness differently: when FD goes up, it diminishes as the NPLs decrease and LLRs increase. They corroborate another finding, suggesting that developing countries should raise the financial development and inclusion level to achieve the desired development level [104].

ED affects as well impacts both factors in a different and meaningful way. NPLs are affected negatively and significantly (-1.021), at a 5% significant level, ceteris paribus [76], [105]. In Comparison, LLR is impacted negatively and significantly (-1.750), at a 5% significant level as well, ceteris paribus. These results are as well very crucial for the sake of this study's hypotheses and objectives. They signify that these two bank risk proxies are affected differently by both ED and FD. However, both effects contribute to reducing the bank riskiness through decreasing NPLs and increasing LLRs.

*Tale2: two-step system GMM results for bank risk reduction.*

Bank risk model1: NPLs as the dependent			Bank risk model2: LLR as dependent		
Variables	Coefficients	Std. Error	Variables	Coefficients	Std. Error
NPLs(-1)	.059**	.021	LLR(-1)	.343**	.183
FD (1)	-0.504**	0.365	FD (1)	1.073**	.385

ED (2)	-1.021**	1.800	ED (2)	-1.750***	1.460
ED_FD[(1)*(2)]	-2.581***	.867	ED_FD [(1)*(2)]	3.781**	2.155
GNLB	.738***	.099	GNLB	.055***	.008
TCRATIO	.020***	.003	TCRATIO	.219	.179
ROAE	.005**	.019	ROAE	.0317	.037
AR(1)	0.24		AR(1)	0.428	
AR(2)	0.800		AR(2)	0.116	
Harsan Statistics	0.520		Harsan statistics	0.157	
No of groups	89		No of groups	117	
No of instruments	39		No of instruments	40	

*\*\**, and *\*\*\** stand for 5% and 1% significance levels, respectively.

Thus, these two bank risk measures act differently: when NPLs decrease, it increases LLR because the expected loss did not occur. The bank gains more reserves and can keep them for other loans or business purposes.

Inversely, when NPLs decrease, it reduces the LLR because the bank will cover the default loans with LLR funds. These inverse movements corroborate well with the economic expectations: in regular times, when the NPLs decrease, we expect a rise in LLR, and when LLR falls, it means that NPLs have increased and LLR covered them. These two bank risk proxies evaluate in different directions (see figure2).

#### 4.2. Effects of the interaction of ED-FD on bank risk reduction

From the comparison summary in the table3, the ED\_FD interaction affects the two variables differently and represent the proxy for bank risk alleviation. The ED\_FD interactions impact negatively and significantly (-2.581) the non-performing loans (NPLs) at a 1% significance level, ceteris paribus. It indicates that one increase in the interaction between ED and FD reduces the non-performing loans by -2.581. The fact of diminishing the non-performing loans implies that the risk of credit default is diminished and then at the same time increases the bank growth via gains obtained from cyclical offered loans, and then the banks become stable. These findings confirm our hypothesis3 (that the ED\_FD interaction effects reduce bank risk through NPLs reduction).

Nevertheless, the interaction between ED and FD positively and significantly (2.181) influences the loan loss reserves (LLR) at a 5% significance level, ceteris paribus. It infers that one increase in the interaction between ED and FD stimulates growth in the LLR by 2.181. This result has two interpretations: on the one hand, an increase in LLR supposes an increase in credit security, then an increase in bank stability. On the other hand, increasing the LLR indicates a previous decrease in non-performing loans due to the lack of default loans, meaning that there was no coverage found used for previous loans. These results confirm our hypothesis2 (the ED-FD interaction effects increase loan loss reserves). The summation of ED and FD (joined) on bank risk alleviation is lesser (-2.581 > -4.106 for NPLs and 2.181 > -.677 for LLR) than the effects of their interactions. Thus, these results conclude that bank risk reduction relies much more on the interaction between ED and FD rather than their individual effects measured and joined together. However, the ED seems to play an important role in these interactions as its coefficients are higher than the coefficients of FD [1]. In a nutshell, ED and FD's effect on bank risk depends not only on their ceteris paribus effect of each variable but mainly on their interactions. Thus the following table summarises the results related to those objectives.

#### 4.3. Comparison of two situations: with and without interactions effects

Table3: A comparison summary analysis.

Models	NPLs model 1	Coefficients	LLRs model 2	Coefficients
Lags	NPLs(-1)	0.059***	LLR(-1)	0.343***
Variables	FD (1)	-0.504***	FD (1)	1.073**
	ED (2)	-1.021***	ED (2)	-1.750**
	(1)+ (2) (a)	-1 .525	(1)+ (2) (a)	-.677
	ED*FD (b)	-2.581***	ED*FD (b)	2.181**
	Difference (b)- (a)	-4.106	Difference (b)- (a)	1.504

*\**, *\*\**, and *\*\*\** stand for 1%, 5%, and 10% levels of significance, respectively.( Results are from table4)

The findings match the economic theory's expectations supporting that the two variables move in the opposite direction. When a high interaction between economic and financial development negatively and significantly affects non-performing loans, as in this case study, the bank risk related to the credit default diminishes. Then when credit default reduces, it has

two immediate and benefit effects: on the one hand, the loan loss reserve is increased due to the reduction in non-performing loans. On the other hand, it increases the bank security and profits by accumulating loan loss reserves. These two direct effects contribute to the bank risk alleviation via credit default reduction and an increase in credit security, then bank stability and profitability.

Figure1 shows the cointegration of the ED and FD. From 2010 up to 2019, they have approximately the same trends. This figure corroborates the existing literature [14], [15]. However, figure2 shows the opposite directions between the FD and LLRs. The two figures tend to have opposite directions with time. These trends support the main results. From the beginning of 2010 up to 2017, the gap between these two variables increases with time. However, from 2015, they go in the same direction up to 2019.

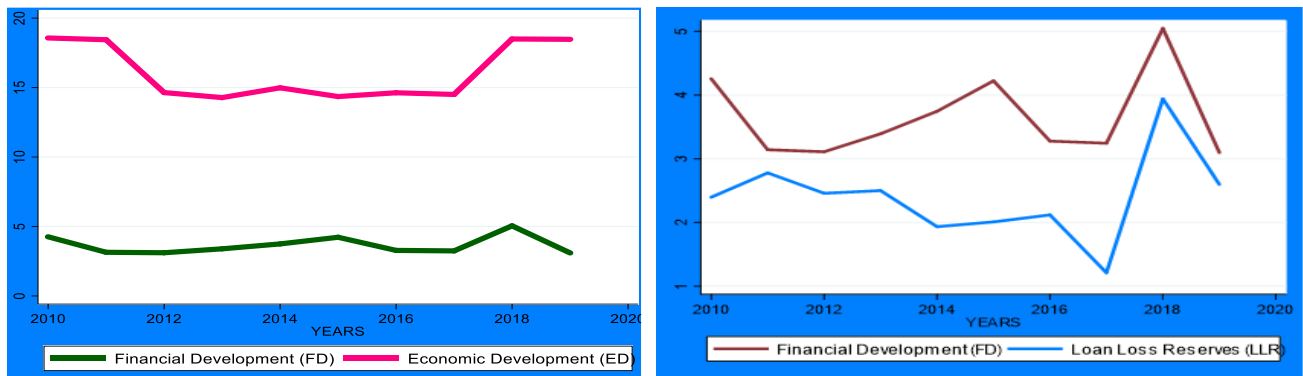
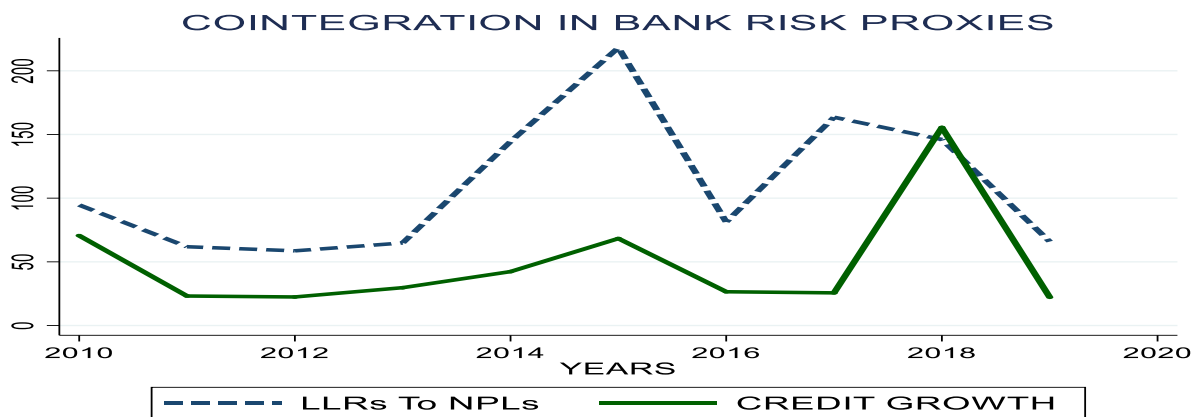


Figure 3 shows cointegration between FD and the ratio of the two bank risk factors (LLRs to Credit Growth). These two factors prove that credit growth is cointegrated with the bank factors. The three figures confirmed our two hypotheses (2 and 3).



This figure shows the comovement between the ratio of LLRs and NPLs to ED. It shows how these two variables move together in the same direction meaning that there is a reliance between bank risk proxies and FD. As long as FD is as well cointegrated with ED, then it means that the ED also has a relationship with LLRs and NPLs. Thus all these four variables are linked in one way or another.

## Conclusion

As most literature was focused on the causal effects between economic development and financial development, on one side and the economic development and financial development (separately) as determinants of either non-performing loans or loan loss reserves on the other side; the main intention of this study was firstly focused on the role of the effects of economic and financial development interactions in reducing bank riskiness in developing countries. Secondly, it was to demonstrate how both economic development and financial development affect individually and inversely the bank risk proxies, and thirdly to show that the sum of their effects joined together is less than their interaction effects.

Then based on the findings that confirmed all hypotheses, the study makes three conclusions: a) economic and financial development both sustain bank stability differently: economic development reduces non-performing loans while financial development increases loan loss reserves; b) the sum of their effect measured separately is lesser than the effect of their

interactions; c) however, economic development plays a considerable role in sustaining the banking system in SSA countries.

These findings can inspire policymakers, especially governments in SSA countries, to elaborate the policies that provide a parallel/equivalent and favourable financial environment that complies with economic development policies to maximize these interaction effects for a robust banking system and sustainable economic growth. Further research can explore how these interaction effects impact non-banking sectors or other bank factors such as performance proxies in developing countries

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#### **REFERENCES**

- [1] C. Calderón and L. Liu, "The direction of causality between financial development and economic growth," *J. Dev. Econ.*, vol. 72, no. 1, pp. 321–334, 2003.
- [2] L. Ndikumana, "Financial markets and economic development in Africa," 2001.
- [3] T. Beck and A. Demirguc-Kunt, "Small and medium-size enterprises: Access to finance as a growth constraint," *J. Bank. Financ.*, vol. 30, no. 11, pp. 2931–2943, 2006.
- [4] C.-Y. Park and R. Mercado, "Financial inclusion, poverty, and income inequality in developing Asia," *Asian Dev. Bank Econ. Work. Pap. Ser.*, no. 426, 2015.
- [5] R. Levine, N. Loayza, and T. Beck, "Financial intermediation and growth: Causality and causes," *J. Monet. Econ.*, vol. 46, no. 1, pp. 31–77, 2000.
- [6] J. R. Hicks, "A theory of economic history," 1969.
- [7] R. Levine, "Financial development and economic growth: views and agenda," *J. Econ. Lit.*, vol. 35, no. 2, pp. 688–726, 1997.
- [8] I. Otchere, L. Senbet, and W. Simbanegavi, "Otchere et al., 2017," *Rev. Dev. Financ.*, vol. 7, no. 1, pp. 1–5, 2017.
- [9] J. P. Bist, "Financial development and economic growth: Evidence from a panel of 16 African and non-African low-income countries," *Cogent Econ. Financ.*, vol. 6, no. 1, p. 1449780, 2018.
- [10] L. G. Deidda, "Interaction between economic and financial development," *J. Monet. Econ.*, vol. 53, no. 2, pp. 233–248, 2006.
- [11] A. Spears, "Financial development and economic growth-causality tests," *Atl. Econ. J.*, vol. 19, no. 3, pp. 66–67, 1991.
- [12] P. O. Demetriades and K. A. Hussein, "Does financial development cause economic growth? Time-series evidence from 16 countries," *J. Dev. Econ.*, vol. 51, no. 2, pp. 387–411, 1996.
- [13] Ö. Selma, "A literature survey on the relationship between financial development and economic growth," *Sos. Bilim. Derg.*, no. 1, pp. 135–149, 2007.
- [14] J. P. Bist and N. B. Bista, "Finance–growth nexus in Nepal: An application of the ARDL approach in the presence of structural breaks," *Vikalpa*, vol. 43, no. 4, pp. 236–249, 2018.
- [15] H. Rasool, S. Maqbool, and M. Tarique, "The relationship between tourism and economic growth among BRICS countries: a panel cointegration analysis," *Futur. Bus. J.*, vol. 7, no. 1, pp. 1–11, 2021.
- [16] M. K. Fung, "Financial development and economic growth: convergence or divergence?," *J. Int. money Financ.*,



vol. 28, no. 1, pp. 56–67, 2009.

- [17] A. B. Masten, F. Coricelli, and I. Masten, “Non-linear growth effects of financial development: Does financial integration matter?,” *J. Int. Money Financ.*, vol. 27, no. 2, pp. 295–313, 2008.
- [18] F. Rioja and N. Valev, “Finance and the sources of growth at various stages of economic development,” *Econ. Inq.*, vol. 42, no. 1, pp. 127–140, 2004.
- [19] P. Papadavid, J. Rewilak, and N. Brightly, “Financial barriers to economic growth in low-income countries,” *Growth Res. Program.*, 2017.
- [20] A. Gerschenkron, “Economic backwardness in historical perspective (1962),” *Polit. Econ. Read. Mark. as Institutions*, pp. 211–228, 1962.
- [21] N. Samargandi, J. Fidrmuc, and S. Ghosh, “Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries,” *World Dev.*, vol. 68, pp. 66–81, 2015.
- [22] F. Rioja and N. Valev, “Does one size fit all?: a reexamination of the finance and growth relationship,” *J. Dev. Econ.*, vol. 74, no. 2, pp. 429–447, 2004.
- [23] K. Yusheng, J. Bawuah, A. O. Nkwantabisa, S. O. O. Atuahene, and G. O. Djan, “Financial development and economic growth: Empirical evidence from Sub-Saharan Africa,” *Int. J. Financ. Econ.*, vol. 26, no. 3, pp. 3396–3416, 2021.
- [24] O. Adeniyi, A. Oyinlola, O. Omisakin, and F. O. Egwaikhide, “Financial development and economic growth in Nigeria: Evidence from threshold modelling,” *Econ. Anal. Policy*, vol. 47, pp. 11–21, 2015.
- [25] O. Gbenga, S. O. James, and A. J. Adeyinka, “Determinant of private sector credit and its implication on economic growth in Nigeria: 2000-2017,” *Am. Econ. Soc. Rev.*, vol. 5, no. 1, pp. 10–20, 2019.
- [26] A. E. Akinlo and I. O. Oni, “Determinants of bank credit growth in Nigeria 1980-2010,” *Eur. J. Sustain. Dev.*, vol. 4, no. 1, p. 23, 2015.
- [27] A. Missiame, R. A. Nyikal, and P. Irungu, “What is the impact of rural bank credit access on the technical efficiency of smallholder cassava farmers in Ghana? An endogenous switching regression analysis,” *Heliyon*, vol. 7, no. 5, p. e07102, 2021.
- [28] M. Nizaeva and A. Coşkun, “Nizaeva,” *J. Econ. Soc. Stud.*, vol. 7, no. 2, p. 81, 2018.
- [29] T. R. Mpofu and E. Nikolaidou, “Determinants of credit risk in the banking system in Sub-Saharan Africa,” *Rev. Dev. Financ.*, vol. 8, no. 2, pp. 141–153, 2018.
- [30] J. Saurina, “Loan loss provisions in Spain. A working macroprudential tool,” *Rev. Estab. Financ.*, vol. 17, pp. 11–26, 2009.
- [31] Z. Wang, N. Xie, and Y. Jin, “Do loan loss provisions affect the credit fluctuations in China’s banking system?,” *Emerg. Mark. Financ. Trade*, vol. 55, no. 11, pp. 2425–2436, 2019.
- [32] S. Jesus and J. Gabriel, “Credit cycles, credit risk, and prudential regulation,” 2006.
- [33] K. Guy and S. Lowe, “Non-performing loans and bank stability in Barbados,” *Econ. Rev.*, vol. 37, no. 1, pp. 77–99, 2011.
- [34] L. Ductor and D. Grechyna, “Financial development, real sector, and economic growth,” *Int. Rev. Econ. Financ.*, vol. 37, pp. 393–405, 2015.
- [35] J. A. Schumpeter, *The Theory of Economic Development: An Inquiry into Profits, Capita I, Credit, Interest, and the Business Cycle*. Routledge, 2017.
- [36] S. Manganelli and A. Popov, “Financial dependence, global growth opportunities, and growth revisited,” *Econ. Lett.*, vol. 120, no. 1, pp. 123–125, 2013.
- [37] I. Otchere, L. Senbet, and W. Simbanegavi, “Financial sector development in Africa-an overview,” *Rev. Dev. Financ.*, vol. 7, no. 1, pp. 1–5, 2017.
- [38] A. L. Owen and J. Temesvary, “Heterogeneity in the growth and finance relationship: How does the impact of bank finance vary by country and type of lending?,” *Int. Rev. Econ. Financ.*, vol. 31, pp. 275–288, 2014.

- [39] J. F. Robinson, "International Financial Business Centres in Vancouver," *Can. Tax J.*, vol. 37, p. 420, 1989.
- [40] P. Abedifar, I. Hasan, and A. Tarazi, "Finance-growth nexus and dual-banking systems: Relative importance of Islamic banks," *J. Econ. Behav. Organ.*, vol. 132, pp. 198–215, 2016.
- [41] A. E. Akinlo and T. Egbetunde, "Financial development and economic growth: The experience of 10 sub-Saharan African countries revisited," *Rev. Financ. Bank.*, vol. 2, no. 1, 2010.
- [42] Z. Aurangzeb and T. Stengos, "Economic policies and the impact of natural disasters on economic growth: a threshold regression approach," *Econ. Bull.*, vol. 32, no. 1, pp. 229–241, 2012.
- [43] B. Égert, P. Backé, and T. Zumer, "Private-sector credit in Central and Eastern Europe: New (over) shooting stars?," in *Global Banking Crises and Emerging Markets*, Springer, 2016, pp. 98–129.
- [44] R. E. Lucas Jr, "On the mechanics of economic development," *J. Monet. Econ.*, vol. 22, no. 1, pp. 3–42, 1988.
- [45] A. Singh, "Financial liberalisation, stockmarkets and economic development," *Econ. J.*, vol. 107, no. 442, pp. 771–782, 1997.
- [46] T. B. Andersen and F. Tarp, "Financial liberalization, financial development and economic growth in LDCs," *J. Int. Dev. J. Dev. Stud. Assoc.*, vol. 15, no. 2, pp. 189–209, 2003.
- [47] R. Ayadi, E. Arbak, S. Ben Naceur, and W. P. De Groen, "Financial development, bank efficiency, and economic growth across the Mediterranean," in *Economic and social development of the Southern and Eastern Mediterranean countries*, Springer, 2015, pp. 219–233.
- [48] R. G. King and R. Levine, *Financial indicators and growth in a cross section of countries*, vol. 819. World Bank Publications, 1992.
- [49] J. De Gregorio and P. E. Guidotti, "Financial development and economic growth," *World Dev.*, vol. 23, no. 3, pp. 433–448, 1995.
- [50] P. Sharma and N. Gounder, "Determinants of bank credit in small open economies: The case of six Pacific Island Countries," *Available SSRN 2187772*, 2012.
- [51] V. Bouvatier, A. López-Villavicencio, and V. Mignon, "Short-run dynamics in bank credit: Assessing nonlinearities in cyclicity," *Econ. Model.*, vol. 37, pp. 127–136, 2014.
- [52] A. Shingjergji and M. Hyseni, "The impact of macroeconomic and banking factors on credit growth in the Albanian banking system," *Eur. J. Econ. Bus. Stud.*, vol. 2, no. 1, pp. 113–120, 2015.
- [53] K. Liu and Q. Fan, "Credit expansion, bank liberalization, and structural change in bank asset accounts," *J. Econ. Dyn. Control*, vol. 124, p. 104066, 2021, doi: 10.1016/j.jedc.2021.104066.
- [54] S. P. Berkmen, G. Gelos, R. Rennhack, and J. P. Walsh, "The global financial crisis: Explaining cross-country differences in the output impact," *J. Int. Money Financ.*, vol. 31, no. 1, pp. 42–59, 2012.
- [55] P. R. Lane and G. M. Milesi-Ferretti, "The cross-country incidence of the global crisis," *IMF Econ. Rev.*, vol. 59, no. 1, pp. 77–110, 2011.
- [56] S. G. Cecchetti, M. S. Mohanty, and F. Zampolli, "The real effects of debt," 2011.
- [57] D. Giannone, M. Lenza, and L. Reichlin, "Market freedom and the global recession," *IMF Econ. Rev.*, vol. 59, no. 1, pp. 111–135, 2011.
- [58] M. Alam, M. R. Rabbani, M. R. Tausif, and J. Abey, "Banks' Performance and Economic Growth in India: A Panel Cointegration Analysis," *Economies*, vol. 9, no. 1, p. 38, 2021.
- [59] B. Fowowe, "Ali Awdeh, The Determinants of Credit Growth in Lebanon, 2017," *Rev. Dev. Financ.*, vol. 7, no. 1, pp. 6–17, 2017.
- [60] Z. Önder and S. Özyıldırım, "Role of bank credit on local growth: Do politics and crisis matter?," *J. Financ. Stab.*, vol. 9, no. 1, pp. 13–25, 2013.
- [61] V. Bouvatier, A. López-Villavicencio, and V. Mignon, "Does the banking sector structure matter for credit procyclicality?," *Econ. Model.*, vol. 29, no. 4, pp. 1035–1044, 2012.

- [62] M. I. Tabash and R. S. Dhankar, "Islamic banking and economic growth: An empirical evidence from Qatar," *J. Appl. Econ. Bus.*, vol. 2, no. 1, pp. 51–67, 2014.
- [63] M. Q. Alam and M. S. Alam, "Financial development, economic growth, and poverty reduction in India," *Etikonomi J. Ekon.*, vol. 20, no. 1, pp. 13–22, 2021.
- [64] R. T. Cavalcante, V. A. Sobreiro, and H. Kimura, "Determinants of the non-life insurance market in Brazil," *Rev. Dev. Financ.*, vol. 8, no. 2, pp. 89–95, 2018.
- [65] C.-W. Su, X.-Y. Cai, M. Qin, R. Tao, and M. Umar, "Can bank credit withstand falling house price in China?," *Int. Rev. Econ. Financ.*, vol. 71, pp. 257–267, 2021.
- [66] T. R. Mporfu and E. Nikolaidou, "Macroeconomic and bank-specific determinants of non-performing loans in sub-Saharan Africa," *Sch. Econ. Macroecon. Discuss. Pap. Ser.*, vol. 2, 2019.
- [67] C. Borio, "Towards a macroprudential framework for financial supervision and regulation?," *CESifo Econ. Stud.*, vol. 49, no. 2, pp. 181–215, 2003.
- [68] G. G. Kaufman and K. E. Scott, "What is systemic risk, and do bank regulators retard or contribute to it?," *Indep. Rev.*, vol. 7, no. 3, pp. 371–391, 2003.
- [69] C. Vithessonthi, "Deflation, bank credit growth, and non-performing loans: Evidence from Japan," *Int. Rev. Financ. Anal.*, vol. 45, pp. 295–305, 2016.
- [70] M. Feldkircher, "The determinants of vulnerability to the global financial crisis 2008 to 2009: Credit growth and other sources of risk," *J. Int. Money Financ.*, vol. 43, pp. 19–49, 2014.
- [71] V. Stepanyan and K. Guo, *Determinants of bank credit in emerging market economies*. International Monetary Fund, 2011.
- [72] S. G. Hanson, A. K. Kashyap, and J. C. Stein, "A macroprudential approach to financial regulation," *J. Econ. Perspect.*, vol. 25, no. 1, pp. 3–28, 2011.
- [73] D. Erdinc and E. Abazi, "The determinants of NPLs in emerging Europe, 2000-2011," *J. Econ. Polit. Econ.*, vol. 1, no. 2, pp. 112–125, 2014.
- [74] M. Umar and G. Sun, "Determinants of non-performing loans in Chinese banks," *J. Asia Bus. Stud.*, 2018.
- [75] N. Haniifah, "Economic determinants of non-performing loans (NPLs) in Ugandan commercial banks," *Taylor's Bus. Rev.*, vol. 5, no. 2, pp. 137–153, 2015.
- [76] M. Y. M. Isa, Y. V. Choong, D. Y. G. Fie, and M. Z. H. A. Rashid, "Determinants of loan loss provisions of commercial banks in Malaysia," *J. Financ. Report. Account.*, 2018.
- [77] A. Awdeh, "The determinants of credit growth in Lebanon," *Int. Bus. Res.*, vol. 10, no. 2, pp. 9–19, 2017.
- [78] R. Ahmad, M. Ariff, and M. J. Skully, "The determinants of bank capital ratios in a developing economy," *Asia-Pacific Financ. Mark.*, vol. 15, no. 3–4, pp. 255–272, 2008.
- [79] M. A. Ben Moussa, "The determinants of bank liquidity: Case of Tunisia," *Int. J. Econ. Financ. Issues*, vol. 5, no. 1, p. 249, 2015.
- [80] F. Allen and E. Carletti, "Credit risk transfer and contagion," *J. Monet. Econ.*, vol. 53, no. 1, pp. 89–111, 2006.
- [81] P. Gai, S. Kapadia, S. Millard, and A. Perez, "Financial innovation, macroeconomic stability and systemic crises," *Econ. J.*, vol. 118, no. 527, pp. 401–426, 2008.
- [82] N. Gennaioli, A. Shleifer, and R. Vishny, "Neglected risks, financial innovation, and financial fragility," *J. financ. econ.*, vol. 104, no. 3, pp. 452–468, 2012.
- [83] B. Goderis, I. W. Marsh, J. V. Castello, and W. Wagner, "Bank behaviour with access to credit risk transfer markets," *Bank Finl. Res. Discuss. Pap.*, no. 4, 2007.
- [84] C.-Q. Song, C.-P. Chang, and Q. Gong, "Economic growth, corruption, and financial development: Global evidence," *Econ. Model.*, vol. 94, pp. 822–830, 2021.
- [85] K. Mhadhbi, C. Terzi, and A. Bouchrika, "Banking sector development and economic growth in developing

- countries: a bootstrap panel Granger causality analysis,” *Empir. Econ.*, vol. 58, no. 6, pp. 2817–2836, 2020.
- [86] F. Ahmed, S. Kousar, A. Pervaiz, and A. Shabbir, “Do institutional quality and financial development affect sustainable economic growth? Evidence from South Asian countries,” *Borsa Istanbul Rev.*, vol. 22, no. 1, pp. 189–196, 2022.
- [87] N. Emara and A. El Said, “Financial inclusion and economic growth: The role of governance in selected MENA countries,” *Int. Rev. Econ. Financ.*, vol. 75, pp. 34–54, 2021.
- [88] K. Mtar and W. Belazreg, “Causal nexus between innovation, financial development, and economic growth: The case of OECD countries,” *J. Knowl. Econ.*, vol. 12, no. 1, pp. 310–341, 2021.
- [89] K. Purewal and H. Haini, “Re-examining the effect of financial markets and institutions on economic growth: evidence from the OECD countries,” *Econ. Chang. Restruct.*, vol. 55, no. 1, pp. 311–333, 2022.
- [90] N. M. Ha and B. H. Ngoc, “The asymmetric effect of financial development on human capital: Evidence from a nonlinear ARDL approach,” *J. Int. Trade Econ. Dev.*, pp. 1–17, 2022.
- [91] A. Samour, M. M. Baskaya, and T. Tursoy, “The impact of financial development and FDI on renewable energy in the UAE: a path towards sustainable development,” *Sustainability*, vol. 14, no. 3, p. 1208, 2022.
- [92] M. Usman and D. Balsalobre-Lorente, “Environmental concern in the era of industrialization: Can financial development, renewable energy and natural resources alleviate some load?,” *Energy Policy*, vol. 162, p. 112780, 2022.
- [93] H. Khan, L. Weili, and I. Khan, “Institutional quality, financial development and the influence of environmental factors on carbon emissions: evidence from a global perspective,” *Environ. Sci. Pollut. Res.*, vol. 29, no. 9, pp. 13356–13368, 2022.
- [94] L. Grassi, D. Lanfranchi, A. Faes, and F. M. Renga, “Do we still need financial intermediation? The case of decentralized finance–DeFi,” *Qual. Res. Account. Manag.*, 2022.
- [95] D. Roodman, “How to do xtabond2: An introduction to difference and system GMM in Stata,” *stata J.*, vol. 9, no. 1, pp. 86–136, 2009.
- [96] M. Arellano and S. Bond, “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations,” *Rev. Econ. Stud.*, vol. 58, no. 2, pp. 277–297, 1991.
- [97] Richard Blundell; Stephen Bond, “Initial conditions and moment restrictions in dynamic panel data models,” *J. Econom.*, vol. 115—143, p. <https://www.ucl.ac.uk/~uctp39a/Blundell-Bond-1998.>, 1998.
- [98] H. J. Newton and N. J. Cox, “The Stata Journal Editors’ Prize 2012: David Roodman,” *Stata J.*, vol. 12, no. 4, pp. 571–574, 2012.
- [99] Richard Blundell; Stephen Bond, “Initial conditions and moment restrictions in dynamic panel data models,” *J. Econom.*, vol. 10, no. 1, p. <https://www.ucl.ac.uk/~uctp39a/Blundell-Bond-1998.>, Jan. 2021, doi: 10.1108/AJEMS-10-2018-0302.
- [100] C. F. Baum, M. E. Schaffer, and S. Stillman, “Instrumental variables and GMM: Estimation and testing,” *Stata J.*, vol. 3, no. 1, pp. 1–31, 2003.
- [101] J. Jaccard, R. Turrisi, and J. Jaccard, *Interaction effects in multiple regression*, no. 72. sage, 2003.
- [102] H. Aguinis and R. K. Gottfredson, “oderated multiple regressionBest-practice recommendations for estimating interaction effects using m,” *J. Organ. Behav.*, vol. 31, no. 6, pp. 776–786, 2010.
- [103] J. Gareth, W. Daniela, H. Trevor, and T. Robert, *An introduction to statistical learning: with applications in R*. Springer, 2013.
- [104] P. K. Ozili and A. Adamu, “Does financial inclusion reduce non-performing loans and loan loss provisions?,” *J. Corp. Governance, Insur. Risk Manag.*, 2021.
- [105] M. Inekwe, “The relationship between real GDP and non-performing loans: Evidence from Nigeria (1995–2009),” *Int. J. Capacit. Build. Educ. Manag.*, vol. 2, no. 1, pp. 2312–2350, 2013.

