An Examination of the Effect of Financial Inclusion on Financial Stability: Evidence From a Panel of Ten African Countries

Emmanuel Anoruo
Coppin State University

Felix Afolabi
Morgan State University

This paper examines the impact of financial inclusion on financial stability for a group of 10 African countries using the system Generalized Method of Moments (GMM) panel estimator for the period running from 2004 through 2019. To shortlist the financial inclusion indicators, the study used the Principal Component Analysis to construct the financial inclusion index. Economic growth and inflation variables are used as control variables. To explore the stationarity of the variables, the study applied the Im, Pesaran, and Shin, ADF Fisher, and the PP-Fisher panel unit root tests. The sample countries include Botswana, Cameroon, Kenya, Madagascar, Morocco, Mozambique, Nigeria, Uganda, South Africa, and Zambia. The results from the panel unit root tests indicate that the four variables in the system, including the financial inclusion index, bank Z-score, economic growth rate, and inflation, are level stationary. The results from Pearson correlations provided cursory evidence that financial inclusion and financial stability are significantly positively correlated. The results from the GMM panel estimator indicate that financial inclusion has a significantly positive effect on financial stability. This finding entails that access to financial services engenders bank stability. Policy implications are discussed.

Keywords: financial inclusion, financial stability, economic growth, GMM, inflation

INTRODUCTION

This paper investigates the effect of financial inclusion on financial stability. In particular, the paper seeks to underpin financial inclusion's role in promoting financial system stability using data from a group of ten African countries. Financial inclusion and financial stability are paramount for economic growth, given that the financial system serves as a conduit for most transactions in the real economy. The concepts of financial inclusion and financial stability have long been embraced by developed and developing countries in their quest for sustainable economic growth. The two concepts have garnered the attention of policymakers, financial analysts, and central banks, especially after the 2008 global financial crisis. Financial inclusion requires financial institutions to make financial products and services accessible as well as affordable to all households and firms. Numerous international organizations and researchers have presented different definitions of financial inclusion in the literature. For example, the World Bank (2018) refers to financial inclusion as the ability of individuals and business enterprises to access financial products and services at reasonable prices. The World Bank, however cautions that banks should exercise prudence in offering financial products and services to both individuals and businesses due to the possibility of default risk. Similarly, the United Nations (UN, 2015) refers to financial inclusion as the provision of inclusive access by different financial organizations to various financial services at reasonable costs to promote sustainable growth and development.

In addition, the Center for Financial Inclusion (CFI, 2013) postulates that financial inclusion is a situation whereby all economic agents have access to varioushigh-caliber financial products and services delivered at reasonable costs by diverse financial organizations with deference and poise. Financial services are to be delivered respectfully and dignity in a stable and competitive market. Sarma (2012) contends that financial inclusion is a process that promotes accessibility and usage of the formal financial system by all members of society. Similarly, Khan (2011) posits that financial inclusion is the process that guarantees that disadvantaged groups, including the unbanked and low-income customers, have access to financial services and credit at affordable costs. Khan (2011) further argues that financial inclusion can be demonstrated by providing access to credit, electronic payment systems, and bank accounts, such as checking and saving accounts. Financial inclusion has been touted in the literature as an avenue through which poverty and inequality can be mitigated.

Furthermore, financial inclusion promotes investments, fosters savings, empowers female employment and free enterprise, and attains sustainable economic growth (Beck *et al*., 2007b; Banerjee *et al*., 2013; Allen et al., 2016; Qasba *et al*., 2016; Mlachila *et al*., 2016). The reoccurring theme of the various definitions of financial inclusion involves accessibility and affordability. This study adopts the definition by Sarma (2012), given that it encompasses the various dimensions of financial inclusion, such as availability, accessibility, and usage of the formal banking system by all members of society.

Equally important is the concept of financial stability, which the World Bank (2016) describes as the absence of system-wide periods in which the financial system ceases to operate. It also involves the ability of the financial system to withstand stress. The World Bank also points out that a stable financial system can allocate resources efficiently, assess, and manage financial risks while maintaining employment levels close to the economy's natural unemployment rate. The World Bank further purports that a stable financial system can eliminate relative price movements of real or financial assets that might adversely influence monetary stability or employment levels. A stable financial system can easily absorb shocks through self-corrective mechanisms and thus prevent harmful events from disrupting the real economy. Houben *et al.* (2004) assert that financial stability is the ability of the economic system to manage financial risk, absorb shocks, and allocate resources efficiently. In addition, these authors suggest that financial stability encompasses the three dimensions of the financial system, including the financial markets, institutions, and infrastructure.

Popovska (2014) views financial stability as the cornerstone upon which the economic stability of a country is anchored. Other scholars, including Motelle and Biekpe (2015) suggest that financial stability enables financial markets to absorb shocks without causing financial institutions, financial markets, and payment structures to falter. Hannig and Jansen (2010) argue that financial stability is essential for all the components of the financial system and hence plays a significant role in sustainable economic growth and development. Creel, *et al.* (2015) define financial stability as the ability of the financial system to withstand both internal and external shocks and mitigate their consequences when they do occur. In this study, the Bank Z-Score is employed as the measure of bank stability given that it has been extensively utilized in the literature and has been shown to possess good quality as a measure of bank riskiness. For instance, Ariss (2010), Fang et al. (2014), and Houston et al. (2010) all maintain that the Bank Z-score provides an unbiased and complete indicator of bank riskiness.

Several studies including Neaime and Gaysset (2018) and Siddik et al. (2018) have documented some channels through which financial inclusion might ameliorate financial stability. These authors suggest that at the banks' level, low-income customers tend to maintain their habits relative to depositing and borrowing even during periods of financial crises. Consequently, banks have a stable deposit-base that they can tap into for loan purposes during crises periods. Furthermore, financial inclusion has been shown to buttress financial stability by broadening and diversifying the customer base by expanding the financial system's intermediation role between savers and borrowers. Lastly, financial inclusion reinforces financial stability by bridging the gap between the poor and the rich reducing income inequality in society. Based on these facts, it is, therefore unarguably challenging to attain financial inclusion without the stability of the financial system (Neaime and Gaysset, 2018). A country that excludes segments of its population either financially, socially or economically will find it difficult to attain financial stability (Neaime and Gaysset, 2018). The notion that financial inclusion positively impacts financial stability has been further collaborated by Morgan and Zhang (2017), Ahamed and Mallick (2017), Wairimu and Omagwa (2020), and Sethy and Goyari (2022).

However, Garcia (2016) and Mehrotra and Yetman (2015) hold the opposite view that financial inclusion may engender financial stability. These studies identified some avenues through which financial inclusion could impede financial stability. These studies point out that the participation of low-income customers at the bank level tends to present information asymmetry problems and hence weakens the ability of the financial system to function efficiently. These studies also contend that the participation of local financial institutions makes them vulnerable to financial risks due to lack of sound governance and regulatory structures. Lastly, these authors contend that the absence of coherent supervision and regulations harms financial stability as innovative financial tools such as electronic banking may be destabilized.

The sample countries present an excellent opportunity to explore the impact of financial inclusion on financial stability for several reasons. First, the literature on this topical issue is sparse relative to the developing African economies, as most earlier studies focused on the Organization for Economic Co-operation and Development (OECD) countries. Second, the financial sectors in most of the sample countries tend to be underdeveloped compared to other developing economies (Amatus and Alireza, 2015). Third, most sample countries have developed and implemented strategies for financial inclusiveness. Nigeria, for example, has developed and implemented the Financial System Strategy 2020 (FSS2020) aimed at developing various financial products, enhancing payment processes, strengthening the credit system, and promoting a savings culture in the country. Fourth, the Findex 2021 Report shows that most of the sample countries have witnessed massive increases in financial inclusion indicators between 2011 and 2021. For instance, account ownership in Cameroon, Kenya, Nigeria, Uganda, South Africa, and Zambia increased from 14.81%, 42.34%, 29.46%, 53.65%, and 21.36%, respectively in 2011 to 51.65%, 79.2%, 45.32%, 65.9%, 85.38%, and 48.52% in 2021, per the Findex 2021 Report. In addition, a study by the British research platform Merchant Machine (2022) revealed that some of the sample counties have a large number of unbanked adults in the world. The study reported that the percentages of unbanked adults in Morocco, Nigeria, Kenya, and South Africa are 71%, 60%, 44%, and 31%, respectively (Merchant Machine, 2022).

Against this backdrop, the present study employs the System GMM estimator to assess the effect of financial inclusion on the financial stability of a panel of 10 African countries, including Botswana, Cameroon, Kenya, Madagascar, Morocco, Mozambique, Nigeria, Uganda, South Africa, and Zambia. Unlike the previous studies that measured financial inclusion through financial accessibility indicators, such as share of total lending to small and medium enterprises (MSEs) or through mortgage lending by individual banks, the present study constructs a financial inclusion index consisting of several indicators of financial availability, accessibility, and usability via the Principal Component Analysis (PCA). Several diagnostic tests were implemented to ensure the appropriateness of the financial inclusion index obtained from the PCA. The results from this study support the notion that financial inclusion is an important determinant of bank stability.

The remainder of the paper is structured as follows. Section 2 reviews the literature. Section 3 describes and summarizes the data. Section 4 discusses the methodologies of the study. Section 5 presents the empirical results. Section 6 offers the summary and policy implications of the study.

LITERATURE REVIEW

The literature on the impact of financial inclusion on bank stability is sparse, given that it is a new area of research interest spurred by the 2007- 2008 global financial crises. The few studies in the literature on this relationship lack consensus. For instance, Barik and Pradhan (2021), using the system Generalized

Method of Moments (GMM), examined the effect of financial inclusion on bank stability for BRICS countries for the time period running from 2005 to 2015. They used the Principal Component Analysis (PCA) to construct the financial inclusion index. They find that financial inclusion has a significantly negative effect on bank stability. Using the Dumitrescue and Hurlin (2012) panel granger test, they find evidence of causality running from financial inclusion to financial stability but not vice versa. Wang and Luo (2021) explore the influence of financial inclusion on financial stability for 36 developing economies utilizing data from over 1500 commercial banks for the period running from 2004 through 2018. They used PCA to construct the financial inclusion index. They find that financial inclusion engenders financial stability.

Danisman and Tarazi (2020) investigated the role of financial inclusion in promoting bank stability. They used 4168 commercial bank data from 28 European Union countries for the period running from 2010 through 2017. They find financial inclusion has implications for bank stability via digital payments and account ownership. They conclude that the major driving force behind bank stabilization can be attributed to the underprivileged adults who are youthful, ill-educated, unemployed, or underemployed, and living in countryside. Sahay *et.al.*, (2015) explored the effect of financial inclusion on financial stability for the time period 2004 – 2011 using panel data approach. They find evidence that financial inclusion is detrimental to financial stability. Nguyen and Du (2022) explore the impact of financial inclusion on bank stability for six ASEAN countries for the period 2008 through 2019. Using data from 102 banks in the six ASEAN countries, they find that financial inclusion significantly and positively impacts bank stability. Ahmad (2018) examined the relationship between financial inclusion and financial stability in Nigeria. He finds that greater financial inclusion in Nigeria hampers financial stability. Al-Smadi (2018) examined the relationship between financial inclusion and financial stability in Jordan using the Fully Modified Ordinary Least Squares (FMOLS) method for the period 2006 through 2017. They find that financial inclusion has significant and positive effects on financial stability in Jordan.

Using worldwide cross-country panel data, Siddik et al. (2018) examined the effect of financial inclusion on financial stability. They proxied financial inclusion by small and medium-sized enterprises (SMEs) borrowers to total borrowers and the ratio of outstanding SME loans to total loans. They also use Bank's Z-score as a proxy for financial stability. Their study covers the period from 2001 to 2013. Their results show that financial inclusion fosters financial stability. Morgan and Pontines (2014) used the system-GMM dynamic panel estimator, and cross-country data explored the relationship between financial inclusion and financial stability from 2005 to 2011. They used lending to SMEs as a proxy for financial inclusion. They find that increases in lending to SMEs promote financial stability by lowering bank non-performing loans and the probability of defaults of financial institutions.

Neaime and Gaysset (2018), using data from MENA countries examined the effect of financial inclusiveness on financial stability mainly from 2002 to 2015. They find that financial inclusion reduces deposit volatility and hence engenders financial stability. Le *et al*. (2019) utilized data for 31 Asian countries from 2004 to 2006 and find that financial inclusion and financial stability reinforce one another. Using the fixed- and random-effects models, Pham and Doan (2020) examined the relationship between financial inclusion and financial stability. For robustness, they employed the Feasible Generalized Least Squares (FGLS) regression. They utilized both country-level and bank-level data for 42 Asian countries in three separate years: 2011, 2014, and 2017. For inclusiveness of the financial system, they assessed two dimensions: usage of financial services and access to the financial system. They find that financial inclusion has a positive and sluggish effect on financial stability.

Hakimi *et al*. (2021) examined the effect of financial inclusion on bank stability for Middle East and North Africa (MENA) region using the System-Generalized Method of Moments (System-GMM) framework. Their study covered the period from 2004 to 2017. They find that greater financial inclusion significantly promotes financial stability. They further find that bank stability tends to be more sensitive to non-performing loan ratio increases and bank size. In addition, they find that bank liquidity fosters stability. Their findings concluded that bank stability could benefit from a stable macroeconomic environment. Vo *et al*. (2021) investigated the relationship between financial inclusion and bank stability using data for 3071

Asian banks for the period 2008 through 2017. They find that greater financial inclusion tends to promote greater bank stability.

Boachie *et al*. (2021) investigated the relationships between financial inclusion, banking stability, and economic growth for 18 sub-Saharan African countries using data from 2008 to 2018. Specifically, they used the system GMM since it provides unbiased and consistent estimates even in the presence of endogeneity in the panel. They find that economic growth promotes banking stability but not vice versa. They further find that financial inclusion has a significant and positive impact on bank stability and economic growth. L´opez and Winkler (2019) using data for a sample of 189 countries for the period commencing from 2004 to 2017, argue that countries with a high level of financial inclusion tend to experience less volatility when borrowing and lending substantially fall. Morgan and Zhang (2017) using the System GMM dynamic panel estimator examined the relationship between financial inclusion and financial stability for a sample of 1889 banks from both developing and developed countries. The study sample spans the time period 1987 to 2014. They find that financial inclusion through increased mortgage lending positively affects financial stability. Ahamed and Mallick (2017), applying both the OLS and System (GMM) dynamic panel estimator, investigated the association between financial inclusion and financial stability for the period running from 2004 to 2012. The study sample consists of 2635 banks from 86 countries. They find that financial inclusion positively influences bank stability. Wairimu and Omagwa (2020) examined the effect of financial inclusion on bank stability of Commercial banks listed in the Nairobi Securities Exchange, Kenya. In particular, they sought to underpin the influence of financial availability, financial accessibility, financial usage, and service delivery on bank stability. They applied multiple regression analysis, correlation analysis, and descriptive statistics. They found that financial availability, financial accessibility, financial usage, and service delivery significantly affect the bank stability of commercial banks listed in Nairobi Securities Exchange, Kenya. They therefore concluded on these findings that financial inclusion enhances financial stability of listed commercial banks in Kenya.

Sethy and Goyari (2022) explored the relationship between financial inclusion and financial stability for a panel of South Asian countries, including Afghanistan, Bangladesh, Bhutan, India, Maldives, Pakistan, and Sri Lanka, using the panel cointegration test, fully modified ordinary least squares and dynamic ordinary least squares techniques. In addition, they implemented the Dumitrescu-Hurlin panel causality test to ascertain the causality direction between financial inclusion and financial stability. Their study covered the period running from 2004 to 2018. They find that financial inclusion has a positive and statistically significant effect on financial stability. They further find evidence of a unidirectional causality from financial inclusion to financial stability based on the Dumitrescu-Hurlin panel causality test results. Based on these findings, they concluded that the South Asian countries could achieve long-run financial stability by promoting financial inclusiveness. Olusegun, et al, (2021) investigated the relationship between financial inclusion and financial stability Nigeria using panel data analysis for the time period running from 2014Q1 to 2018Q4. They constructed a financial inclusion index consisting of three dimensions: penetration, availability, and usage. They find that financial inclusion has a positive effect on contemporaneous financial stability, and therefore concluded that greater level of financial inclusion engenders greater financial stability in Nigeria. Concerning financial inclusion dimensions, they find that penetration and availability have a positive and significant effect on financial stability. They, however, find that usage hurts financial stability.

METHODOLOGY

The study first ascertains the order of integration of the variables, including financial inclusion index, financial stability measure (Bank Z-score), economic growth, and inflation rate to avoid spurious regression in a dynamic panel estimation. The study employed the CIP, CADF, and the Moon and Perron (2004) panel unit root procedures to this effect. Details about these panel unit tests will not be rehearsed in this study as have been widely utilized in the literature. The study further employs several cross-sectional dependence tests, including the Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM, and Pesaran CD procedures. To underpin the effect of financial inclusion on financial stability, the study applied the system dynamic Generalized Method of Moments (GMM) dynamic panel regression. The study adopted the system dynamic GMM estimator because it tends to yield consistent parameter estimates for both large cross-sectional data and finite number of periods (Arellano and Bover, 1995; Blundell and Bond, 1998). According to Blundell and Bond (1998), the system GMM estimator offers superior finite sample properties relative to bias and root mean squared error in comparison to the difference GMM estimator. In addition, unlike the other panel estimation methods such as the random-effects and fixed-effects model, the system GMM model has the ability to account for neglected serial correlation, heterogeneity, and heteroskedasticity that may be present in the panel.

The Arrellano and Bond GMM panel estimation technique uses the lags and first differences of the endogenous variables as instruments to correct for joint endogeneity problem that may be present within the panel, especially in the cases where T is small, and N is large. Arrellano and Bond (1991) dynamic panel data models of the interaction between financial stability and financial inclusion are given by the following equation:

$$FS_{(i,t)} = \beta_1 FS_{i,t-1} + \beta_2 FII_{it} + \delta_t + \alpha_i + \varepsilon_{i,t} \quad (1)$$

$$FS_{(i,t)} = \beta_1 FS_{i,t-1} + \beta_2 FII_{it} + \beta_3 EGR_{i,t} + \delta_t + \alpha_i + \varepsilon_{i,t} \quad (2)$$

$$FS_{(i,t)} = \beta_1 FS_{i,t-1} + \beta_2 FII_{it} + \beta_3 EGR_{i,t} + \beta_4 INF_{i,t} + \delta_t + \alpha_i + \varepsilon_{i,t} \quad (3)$$

where FS is the financial stability measure, proxied by bank Z-score, FII represents the financial inclusion index, EGR stands for economic growth rate, and INF is the inflation rate. In equations (1), (2) and (3), the lagged value of the financial stability variable is included as an independent variable to account for possible fixed, random, and unobserved effects in the panel, β_1, β_2, β_3 and β_4 are parameters to be estimated. The error terms are given by $\varepsilon_{i,t}$. Where δ_t and α_i, represent unobserved time-specific effect and unobserved firm-specific effect. The validity of the Arrellano and Bond GMM panel estimation approach results is tested by applying the AR2 test of second-order serial correlation of the residuals and the Sargan (1958) over-identifying restrictions test. The null hypothesis under the AR2 test is that the residuals have no second-order serial correction. The null hypothesis of the Sargan test is that there is no over-identifying restrictions. Under both the AR2 and Sargan tests, the null hypotheses are not rejected when the *p*-values are greater than 5% (i.e., *p*-value > 0.05).

DATA AND CONSTRUCTION OF FINANCIAL INCLUSION INDEX

This study utilizes annual data on bank stability proxied by Bank Z-score, inflation, financial inclusion, and economic growth (annual growth of GDP). The financial inclusion index is constructed using the Principal Component Analysis (PCA). The financial inclusion indicators used in constructing the financial inclusion index are listed in Table 1. Bank Z-score measures the probability of bank insolvency or bankruptcy (Berger et al., 2009). A higher Bank Z-score indicates stronger financial stability. The inflation and economic growth variables were retrieved from the World Bank World Development Indicators website. Both financial inclusion indicators and bank stability variables were retrieved from International Monetary Fund Financial Access Survey (FAS). The sample consists of 10 African countries: Botswana, Cameroon, Kenya, Madagascar, Morocco, Mozambique, Nigeria, Uganda, South Africa, and Zambia. The availability of consistent data determined the selection of sample countries. The sample period for each of the countries runs from 2004 through 2019. Inflation rates are calculated as percentage changes in consumer price indexes for the sample countries.

TABLE 1
FINANCIAL INCLUSION INDICATORS

Variable	Notation
Number of branches of commercial banks per 100,000 adults	FII_1
Number of ATMs per 1,000 km^2	FII_2
Number of ATMs per 100,000 adults	FII_3
Number of deposit accounts with commercial banks per 1,000 adults	FII_4
Outstanding loans with commercial banks (% of GDP)	FII_5
Outstanding loans from commercial banks (% of GDP)	FII_6

Source: Prepared by the authors

Developing Financial Inclusion Index

Most of the earlier studies used single indicators to proxy financial inclusion. However, Sarma and Pais (2011) argue that a comprehensive index that incorporates multi-dimension of financial inclusion should be preferred over the single indicator measures. To this effect, the study uses the PCA to construct a financial inclusion index consisting of three dimensions: availability, accessibility, and usage. The PCA determines the factor scores (weights) of the six financial inclusion indicators. The weights are then multiplied by the original variables, and their products are added together to get a single financial inclusion index. The financial inclusion index is computed as follows:

$$FII_{(i,t)} = W_1 FII\_1_{i,t} + W_2 FII\_2_{i,t} + W_3 FII\_3_{i,t} + W_4 FII\_4_{i,t} + +W_5 FII\_5_{i,t} + +W_6 IFI\_6_{i,t} \quad (4)$$

where FII is the financial inclusion index, W_1, W_2, W_3……W_6 are the weights of the factor coefficients obtained from the PCA. The financial inclusion indicators: FII_1, FII_2,., FII_6 remain as defined in Table 1.

Before implementing the PCA, the Bartlett's sphericity and Kaiser-Meyer-Olkin (KMO) tests were used to determine the appropriateness of the data for factor analysis. KMO compares the magnitude of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. KMO index value greater than 0.50 is acceptable. Whereas KMO index value less than 0.50 is unacceptable. Bartlett's test for sphericity is designed to compare the correlation matrix against the identity matrix.

Simply put, it checks for redundancy between variables that can be summarized with some factors (Bartlett, 1951). Table 2 displays the KMO and Bartlett test results. The Kaiser–Meyer–Olkin test statistic for measuring the sampling adequacy is 0.526, suggesting that the factor analysis is appropriate. Bartlett's test of sphericity is [χ^2 (15) 1614.620, $p < .01$]. Taken together, these results indicate that PCA is appropriate for constructing the financial inclusion index.

TABLE 2
KMO AND BARTLETT TEST RESULTS

Kaiser–Meyer–Olkin (KMO) Sampling Adequacy Test	0.526	
Bartlett Test of Sphericity	Chi-square (χ^2)	1614.620*** (*df*=15)
	P-value	0.010

*** Denotes significance at the 1% level.

The results from the PCA presented in Table 3 consist of two parts, namely, the principal correlations and the eigenvectors. The first part of the table displays the eigenvalues of the correlation matrix, arranged from largest to smallest. The eigenvalues are the variances of the components. The eigenvalues generally sum up the total variances of the variables in the PCA. The practice in the literature is to standardize the variables to ensure that the eigenvalues/variances sum up to one, since the analysis involves a correlation matrix. The total variance in this analysis is 6, which is equivalent to the total number of variables in the PCA. The variance of 6 is found by adding the eigenvalues together. The third column of Table 3 displays the difference between two consecutive eigenvalues. While the fourth column exhibits the percentage of the variation in the data explained by the respective components. In short, the proportions are derived by dividing the eigenvalue of each component by the total variance in the data. For instance, the first component explained 73% (calculated as: [4.37/6] *100) of the total variation in the data. Following the same analogy, the second, third, fourth, fifth and sixth components respectively accounted for 15%, 9%, 2%, 1% and 0.0% of variations in the data. The last column shows the cumulative sum of successive proportions and sums to unity. As reported in Table 3, ρ = 1 indicates that the principal components have fully accounted for all of the variation in the data.

TABLE 3
PRINCIPAL COMPONENT ANALYSIS RESULTS

Number of Observations = 160 Number of Components = 6 ρ = 1				
Components (Cmpt)	Eigenvalue	Difference	Proportion	Cumulative
Cmpt1	4.37	3.50	0.73	0.73
Cmpt2	0.88	0.32	0.15	0.87
Cmpt3	0.56	0.42	0.09	0.97
Cmpt4	0.14	0.08	0.02	0.99
Cmpt5	0.05	0.04	0.01	1.00
Cmpt6	0.01	.	0.00	1.00

Principal Components- (eigenvectors)							
Variable	Cmpt1	Cmpt2	Cmpt3	Cmpt4	Cmpt5	Cmpt6	Unexplained
FII_1	0.37	0.40	0.64	-0.32	0.23	-0.36	0.00
FII_2	0.34	0.71	-0.25	0.38	0.06	0.41	0.00
FII_3	0.40	-0.42	0.52	0.19	-0.18	0.57	0.00
FII_4	0.45	-0.25	-0.13	0.61	0.00	-0.58	0.00
FII_5	0.43	-0.30	-0.38	-0.36	0.65	0.16	0.00
FII_6	0.45	0.03	-0.30	-0.46	-0.70	-0.08	0.00

Note: FII_1, FII_2, FII_3, FII_4, FII_5, and FII_6 remain as defined in Table 1. Cmpt represents component.

The second part of Table 3 provides the principal components also known as the eigenvectors. These eigenvectors comprise of uncorrelated eigenvalues. As can be seen, the eigenvalue is greater than 1 only for the first component (Cmpt1), which explains 73% of variation in the data. It can be further seen from the table that each of the remaining 5 principal components has an eigenvalue of less than 1. Cmpt2, Cmpt3, Cmpt4, Cmpt5, and Cmpt6 accounted for the rest (i.e., 27%) of the total variation in the data. Following the standard practice in the literature, the study utilized only the first principal component in the second part of Table 3, with an eigenvalue greater than 1 to construct the financial inclusion index. Accordingly, the financial inclusion index (FII) is based on the following equation:

$$FII_{(i,t)} = 0.37FII\_1_{i,t} + 0.34FII\_2_{i,t} + 0.40FII\_3_{i,t} + 0.45FII\_4_{i,t} + 0.43FII\_5_{i,t} + 0.45FII\_6_{i,t} \quad (5)$$

Where in equation (5), the financial indicators FII_1 through FII_6 remain as defined in Table 1.

SUMMARY STATISTICS

Table 4 presents the descriptive statistics for the financial inclusion index, financial stability measure (Bank Z-score), economic growth, and inflation. The mean values for the financial inclusion index, economic growth rate, inflation, and Bank Z-score are 34.86, 4.68, 7.08, and 14.57, respectively. The minimum and maximum statistics show that four variables varied between sample countries. For example, Bank Z-score varied from a minimum of 3.30 for Mozambique to a maximum of 49.50 for Morocco. The standard deviations are 27.62, 2.77, 4.81, and 9.35 for financial inclusion index, economic growth rate, inflation, and Bank Z-score, respectively. The statistics displayed in Table 4 show that the financial inclusion index, inflation, and Bank Z-score are positively skewed, while the economic growth rate is negatively skewed. The Kurtosis statistics for the financial inclusion index, economic growth rate, inflation, and Bank Z-score are all greater than 3, indicating the presence of a heavy tail in the distributions of the variables. The Jarque-Bera statistics for the financial inclusion index, economic growth rate, inflation, and Bank Z-score are statistically significant at the 1 percent level, thus rejecting the null hypothesis that variables are normally distributed.

TABLE 4
DESCRIPTIVE STATISTICS

Statistic	FII	EGR	INF	FS
Mean	34.86	4.68	7.08	14.57
Maximum	104.88	11.34	26.24	49.50
Minimum	5.31	-7.65	-0.69	3.30
Std. Dev.	27.62	2.77	4.81	9.37
Skewness	1.21	-0.89	0.85	1.82
Kurtosis	3.32***	5.99***	3.69***	6.41***
Jarque-Bera	40.03***	80.87***	22.42***	166.13***
Probability	0.00	0.00	0.00	0.00
Number of Observations	160.00	160.00	160.00	160.00

*** Denotes rejection of normality assumption at the 1% level of significance. FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score.

Table 5 displays the Pearson correlation coefficients between the financial inclusion index, economic growth rate, inflation, and Bank Z-score. The results show that the correlation (0.67) between the financial inclusion index and Bank Z-score is positive and statistically significant at the 1 percent level. However, the correlation (-0.28) between the financial inclusion index and economic growth is negative and statistically significant at the 5 percent level. Similarly, the correlation (-0.36) between the financial inclusion index and inflation is negative and statistically significant at the 5 percent level. Even though these results provide cursory evidence that financial inclusion promotes bank stability, a more thorough, theoretically grounded framework is required before a conclusive inference can be drawn.

TABLE 5
PEARSON CORRECTION COEFFICIENT

Variable	FII	EGR	INF	FS
FII	1.00			
EGR	-0.28***	1.00		
INF	-0.36***	0.13	1.00	
FS	0.67***	-0.17**	-0.28***	1.00

*** and ** indicate level of significance at the 1% and 5%, respectively. FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score.

EMPIRICAL RESULTS

The study's empirical analysis commences with the application of four cross-sectional dependence tests, including the Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and Pesaran CD tests. Table 6 displays the results obtained from the various cross-sectional dependence tests. The results in Table 6 suggest that the null hypothesis of no cross-sectional dependence between the countries in the panel should be rejected. For example, the test statistics for financial inclusion (FII) are 499.84, 47.94, 47.61, and 22.16, respectively for Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and Pesaran CD procedures. The test statistics are statistically significant at the 1 percent level. Equally, for the financial stability measure (FS), the CD test statistics, 176.69, 13.88, 13.55, and 7.12, respectively for the Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM and Pesaran CD procedures indicate that the null hypothesis of no cross-sectional dependence should be rejected at the 1 percent level of significance. These results suggest that shocks to financial inclusion, financial stability, economic growth, or inflation in one of the sample countries can be easily transmitted to other countries.

TABLE 6
CROSS-SECTIONAL DEPENDENCE TEST RESULTS

Variable	B-P	P-scaled	B-corrected	P-CD
FII	499.84***	47.94***	47.61***	22.16***
EGR	97.69***	5.55***	5.22***	6.50***
INF	109.63***	6.81***	6.48***	6.23***
FS	176.69***	13.88***	13.55***	7.12***

*** denotes the rejection of the null hypothesis at the 1% level. B-PLM = Breusch-Pagan LM, P-scaled = Pesaran scaled LM, B-corrected = Bias-corrected scaled LM and P-CD = Pesaran CD. FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score.

The presence of cross-sectional dependence in the panel requires the implementation of the second-generation panel unit root test, such as the CIPS, CADF, and Moon-Perron procedures capable of correcting for cross-sectional dependence. The results from the Pesaran (2003) and Moon and Perron (2004) for financial inclusion (FII), economic growth (EGR), inflation (INF), and financial stability (FS) are presented in Table 7. The test statistics from the CIPS and CADF reveal that the null hypothesis of a unit root should be rejected at least at the 5 percent significance level. For instance, the computed test statistics for the CIPS panel unit root test, -5.51, -6.78, -3.70, and -2.44, respectively for financial inclusion (FII), economic growth (EGR), inflation (INF) and financial stability (FS) are statistically significant at least at the 5 percent level. Similarly, the test statistics from the CADF procedure, -5.13, -6.45, -3.46, and -2.84, respectively for financial inclusion (FII), economic growth, (EGR), inflation (INF) and financial stability (FS) are statistically significant at least at the 5 percent level. The results from the Moon-Perion unit root corroborate those obtained from the Pesaran panel unit root. The results suggest that the four variables in the model have zero order of integration. The financial inclusion, economic growth, inflation, and financial stability variables are stationary.

TABLE 7
PANEL UNIT ROOT TEST RESULTS

	Pesaran (2003)		Moon and Perron (2004)	
Variable	CIPS	CADF	*tstar_a*	*tstar_b*
FII	-5.51^{***}	-5.13^{***}	-3.78^{***}	-4.86^{***}
EGR	-6.78^{***}	-6.45^{***}	-10.56^{***}	-9.61^{***}
INF	-3.70^{***}	-3.46^{***}	-9.51^{***}	-9.34^{***}
FS	-2.44^{**}	-2.84^{**}	-4.31^{***}	-3.94^{***}

*** and ** represent 1% and 5% level of significance, respectively. The null hypothesis is a unit root (assumes common unit root process). FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score.

Having established the order of integration for financial inclusion, economic growth, inflation, and financial stability, the study next implements slope homogeneity delta tests proposed by Pesaran and Yamagata (2008) and the HAC procedure advanced by Blomquist and Westerlund (2013). The results from the various slope homogeneity tests are displayed in Table 8. The computed test statistics for both $\breve{\Delta}$ and $\breve{\Delta}$adj 4.215 and 5,085 are statistically significant at the 1 percent level. Similarly, the test results from the HAC procedures 4.839 and 5.839, respectively for Δ(HAC) and Δ(HAC)adj are statistically significant at the 1 percent level. These results suggest that the null hypothesis of slope homogeneity across the panel should be rejected in favor of the alternative hypothesis of heterogeneity.

TABLE 8
SLOPE HOMOGENEITY TEST RESULTS

Pesaran and Yamagata Delta Test			Blomquist and Westerlund HAC Test		
	Statistic	P-value		Statistic	P-value
$\breve{\Delta}$	4.215^{***}	0.000	Δ(HAC)	4.839^{***}	0.000
$\breve{\Delta}$adj	5.083^{***}	0.000	Δ(HAC)adj	5.839^{***}	0.000

*** indicates statistical significance at the 1% level. $\breve{\Delta}$ and $\breve{\Delta}$adj are the “simple” and “mean variance bias adjusted” slope homogeneity tests, respectively. Δ(HAC) and Δ(HAC)adj are the “heteroscedasticity and autocorrelation consistent” versions of the “simple” and “mean variance bias adjusted” slope homogeneity tests, respectively.

Before estimating the system GMM model of equations (1, 2 and 3), the study used the Sargan over-identifying restrictions test and the AR2 serial correlation procedure to confirm the validity of the selected instruments. The Sargan test’s null hypothesis is that there are no over-identifying restrictions. The result from the serial correlation AR (2) test (1.127, *p*-value =0.260) displayed in Table 9 indicate that the null hypothesis of no serial correlation in the residuals should not be rejected. Likewise, the Sargan test statistic (117.804, *p*-value = 0.244) reported in Table 9 reinforces the appropriateness of the chosen instruments.

After confirming that the chosen instruments are applicable, the study next implements the system GMM model to ascertain the effect of financial inclusion on financial stability. Table 9 presents the results from the system GMM estimator. Equation (1) serves as the baseline model, while equations (2) and (3) introduce economic growth and inflation as mediating variables in examining the effect of financial inclusion on financial stability. The results from equation (1) reveal that the current level of financial stability is significant and positively affected by its past value. The regression coefficient on the lagged value of financial stability ($FS_{(t-1)}$) is positive and statistically significant at the 1 percent level. Similarly, the results show that financial inclusion significantly and positively influences financial stability. The regression coefficient on the financial inclusion index (FII) is positive and statistically significant at the 1 percent level. Turning to equation (2) where economic growth is introduced as a control variable, the results obtained from the baseline model of equation (1) are upheld. The regression coefficients on $FS_{(t-1)}$ and FII are again positive and statistically significant at the 1 percent level. The results further show that economic growth has a significantly positive impact on financial stability.

Finally, turning to the results from equation (3) where both economic growth and inflation are introduced as control variables, the results from equations (1) and (2) are once again upheld as financial inclusion and economic growth have a significantly and positive effect on financial stability. The regression coefficients on FII and EGR are 0.085 and 0.109, respectively. However, the regression coefficient on inflation (INFL) is negative and statistically insignificant. In all, the results from the system GMM estimator indicate that financial inclusion has consequential implications for financial stability. The finding of this study is consistent with those obtained by Wang and Luo (2021) and Nguyen and Du (2022).

TABLE 9
SYSTEM GMM ESTIMATOR RESULTS (DEPENDENT VARIABLE = BANK Z-SCORE)

	Equation (1)		Equation (2)		Equation (3)	
Variable	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	t-stat
Constant	1.001**	2.310	0.373	0.670	0.378	0.490
$FS_{(t-1)}$	0.752***	14.280	0.747***	14.290	0.746***	14.230
FII	0.079***	3.930	0.085***	4.200	0.085***	4.100
EGR	-	-	0.108*	1.740	0.109*	1.750
INF	-	-	-	-	-0.001	-0.020
Wald x^2	1127.81***	-	1153.79***	-	1145.80***	-
AR(2)	1.127 (0.260)	-	1.049(0.294)	-	1.051 (0.293)	-
Sargan Test (χ^2)	117.804(0.244)	-	117.395(0.253)	-	116.776(0.265)	-

***, ** and * denote 1%, 5% and 10% levels of significance. *P*-values in parentheses. FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score.

To check the robustness of the results provided by the system GMM estimator, the study implemented the Feasible Generalized Least Squares (FGLS) proposed by Parks (1967). Rosenfeld and Fornango (2007) suggest that the parameter estimates from the FGLS model are generally unbiased and consistent even in the presence of correlated and heteroskedastic error terms across the panel. Before implementing FGLS estimator, the study used the Breusch and Pagan (1980) Lagrangian multiplier (B-P LM) test and the Hausman test to check the suitability of the random effects model (i.e., FGLS estimator). The test statistics from the B-P LM procedure are statistically significant at the 1 percent level. These test results indicate that the null hypothesis of no random effects in the panel should be rejected. Likewise, the Hausman test statistics presented in Table 9 are statistically insignificant, confirming the validity of the random effects model. The results from both the B-P LM and Hausman tests indicate that the parameter estimates from the FGLS model are unbiased and consistent. The results from the FGLS model are presented in Table 10. The results from the baseline of equation (1) show that financial inclusion (FI) has significant and positive impact on financial stability (FS). The regression coefficient (0.23, *t-stat* =58.12) on FI is positive and statistically significant at the 1 percent level.

Similarly, the results from equation (2) show that both FII and EGR significantly positively affect financial stability. The regression coefficients are 0.23 (*t-stat* = 56.01) and 0.06 (*t-stat* = 2.63), respectively for FI and EGR. The results from equation (3) show that FI and EGR significantly positively influence financial stability. However, inflation has a significant negative effect on financial stability. In all, the results the FGLS model corroborate those from the system GMM estimator. These results suggest that financial inclusion promotes financial stability for the sample countries.

TABLE 10
FEASIBLE GENERALIZED LEAST SQUARES ESTIMATES

	Equation (1)		Equation (2)		Equation (3)	
Variable	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Constant	6.68^{***}	65.35	6.34^{***}	36.80	6.93^{***}	33.56
FII	0.23^{***}	58.12	0.23^{***}	56.01	0.22^{***}	60.02
EGR	-	-	0.06^{**}	2.63	0.05^{*}	1.74
INF	-	-	-	-	-0.05^{***}	-3.45
Wald x^2	3378.48^{***}	-	3576.04	-	5139.28^{***}	-
B-P LM	976.64(0.00)	-	976.64(0.00)	-	975.18(0.00)	-
Hausman Test	0.21(0.65)	-	0.14(0.93)	-	0.14(0.99)	-

***, ** and * represent 1%, 5% and 10% levels of significance. *P*-values in parentheses. FII = Financial Inclusion index, EGR = Economic growth rate, INF = Inflation rate, FS = Bank Z-score (measure of bank stability). B-P LM tests for random effects. Hausman test refers to the Hausman specification test.

SUMMARY AND CONCLUSIONS

This paper has used the GMM estimator system to explore the effect of financial inclusion on financial stability for a panel of 10 African countries, including Botswana, Cameroon, Kenya, Madagascar, Morocco, Mozambique, Nigeria, Uganda, South Africa, and Zambia for the time period running from 2004 to 2019. The PCA was used to construct the financial inclusion index based on 6 financial indicators. Financial stability was proxied by Bank Z-score. Economic growth rate and inflation were used as the control variables. The study employed various CD procedures to test for cross-sectional dependence across the panel. The robustness of the results obtained from the system GMM model was checked with the FGLS estimator. The results from the cross-sectional dependence tests rejected the null hypothesis of no cross-sectional dependence in all of the cases. The existence of cross-sectional dependence in the panel necessitated the application of the second-generation panel unit root tests, namely – CIP, CADF and Moon and Perron (2004) procedures. These various panel unit root tests indicate that the financial inclusion, inflation, economic growth, and financial stability variables are level stationary. This study adopted the system GMM model because it can account for neglected serial correlation, heterogeneity, and heteroskedasticity that may be present in the panel.

The results from the system GMM estimator indicate that financial inclusion has a significantly positive effect on financial stability for the sample countries. Regarding the control variables, economic growth significantly and positively impacts financial stability. Conversely, inflation has a negative and insignificant effect on financial stability. The results from the FGLS model corroborate those from the system GMM estimator in the sense that financial inclusion was found to positively impact financial stability. The finding of this study is in congruence with Boachie et al. (2021) who have shown that economic growth and financial inclusion promote financial stability for 18 sub-Saharan African countries. However, the finding of this study contradicts Barik and Pradhan (2021) who found that financial inclusion negates financial stability for BRICS countries. The difference in the findings between these two studies could be attributed to the different financial indicators the authors used to construct the financial inclusion indexes and the period studied. The finding that financial inclusion and economic growth positively influences is consistent with Al-Smadi (2018), who found that both variables engender bank stability in Jordan.

From a policy perspective, the results from this study imply that authorities and policymakers should be aware of the important role that financial inclusiveness plays in ensuring financial stability. This finding also highlights the need for authorities to expand access to banking services. In particular, the results suggest that commercial banks should incentivize households to increase the number of deposit accounts. The study further uncovers the need for commercial banks to increase the number of ATMs and branches to ensure that the unbanked and underbanked, especially those in rural areas, have access to financial products and services. In addition, commercial banks and other financial institutions in the sample countries should be encouraged by authorities to extend loans to residents in rural areas. However, these financial institutions should exercise caution in extending loans to the unbanked and underbanked to minimize their exposure to default risks. In a nutshell, the authorities should devise and execute policies favorable to financial inclusiveness to safeguard the stability of their financial systems.

REFERENCES

Ahamed, M.M., & Mallick, S.K. (2017). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior and Organization*, *157*, 403–427.

Ahmad, D. (2018). Financial inclusion and financial Stability: Survey of the Nigeria's financial system. *International Journal of Research in Finance and Management*, *1*(2), 47–54.

Al-Smadi, M.O. (2018). The role of financial inclusion in financial stability: Lesson from Jordan. *Banks and Bank Systems*, *13*(4), 31–39.

Amatus, H., & Alireza, N. (2015). Financial inclusion and financial stability in Sub-Saharan Africa (SSA). *The International Journal of Social Sciences*, *36*(1), 39–49.

Ariss, R.T. (2010). On the implications of market power in banking: Evidence from developing countries. *Journal of Banking & Finance*, *34*(4), 765–775.

Barik, R., & Pradhan, A.K. (2021). Does financial inclusion affect financial stability: Evidence from BRICS nations? *The Journal of Developing Areas*, *55*(1), 341–356.

Bartlett, M.S. (1951). The effect of standardization on a Chi-square approximation in factor analysis. *Biometrika*, *38*(3/4), 337–344.

Berger, A.N., Klapper, L.F., & Turk-Ariss, R. (2009). Bank competition and financial stability. *Journal of Financial Services Research*, *35*(2), 99–118.

Blomquist, J. and Westerlund, J. (2013). Testing slope homogeneity in large panels with serial correlation. *Economic Letters*, *121*, 374–378.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143.

Boachie, R., Aawaar, G., & Domeher, D. (2021). Relationship between financial inclusion, banking stability and economic growth: A dynamic panel approach. *Journal of Economic and Administrative Sciences.* https://doi.org/10.1108/JEAS-05-2021-0084

Breusch, T.S., & Pagan, A.R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, *47*(1), 239–253.

CFI. (2013). *Microfinance vs. Financial inclusion: What's the difference?* Retrieved January 15, 2021, from https://www.centerforfinancialinclusion.org/microfinance-vs-financial-inclusion-whats-the-difference

Čihák, M., Mare, D.S., & Melecky, M. (2021). Financial Inclusion and Stability: Review of Theoretical and Empirical Links. *The World Bank Research Observer*, *36*(2), 197–233.

Creel, J., Hubert, P., & Labondance, F. (2015). Financial stability and economic performance. *Economic Modelling*, *48*, 25–40.

Danisman, G.O., & Tarazi, A. (2020). Financial inclusion and bank stability: Evidence from Europe. *The European Journal of Finance*, *26*(18), 1842–1855.

Dumitrescu, E.I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, *29*(4), 1450–1460.

Fang, Y., Hasan, I., & Marton, K. (2014). Institutional development and bank stability: Evidence from transition countries. *Journal of Banking and Finance*, *39*, 160–176.

Financial Access Survey (FAS). (n.d.). *Country Data - IMF Data–Washington, DC*. Retrieved May 16, 2022, from https://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C

Garcia, M.J.R. (2016). Can financial inclusion and financial stability go hand in hand? *Economic Issues*, *21*(2), 81–103.

Hakimi, A., Boussaada, R., & Karmani, M. (2021). Are financial inclusion and bank stability friends or enemies? Evidence from MENA banks. *Applied Economics*, *53*(55), 2473–2489.

Hannig, A., & Jansen, S. (2010). Financial inclusion and financial stability: Current policy issues. *ADBI Working Paper Series*, (259).

Hausman, J.A. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251–1271.

Houben, A.G., Kakes, J., & Schinasi, G.J. (2004). Toward a framework for safeguarding financial stability. *IMF Working Papers*, (101), 3–27. Retrieved June 15, 2023, from https://www.elibrary.imf.org/view/journals/001/2004/101/article-A001-en.xml

Houston, J F., Lin, C., Lin, P., & Ma, Y. (2010). Creditor rights, information sharing, and bank risk taking. *Journal of Financial Economics*, *96*(3), 485–512.

Khan, H.R. (2011). Financial inclusion and financial stability: Are they two sides of the same coin? *BANCON*.

Mehrotra, A., & Yetman, J. (2015). Financial inclusion-issues for central banks. *BIS Quarterly Review*, pp. 83–96.

Merchant Machine. (2022). *The countries most reliant on cash in 2022*. Retrieved December 21, 2022, from https://merchantmachine.co.uk/the-countries-most-reliant-on-cash-in-2022/

Moon, H., & Perron, B. (2004). Testing for a unit root in panels with dynamic factors. *Journal of Econometrics*, *122*, 81–126.

Morgan, P., & Pontines, V. (2014). Financial stability and financial inclusion. *ADBI Working Paper 488*. Tokyo: Asian Development Bank Institute. Retrieved May 18, 2022, from http://www.adbi.org/working-paper/2014/07/07/6353.financial.stability.inclusion/

Morgan, P.J., & Zhang, Y. (2017). Mortgage lending, banking crises, and financial stability in Asia and Europe. *Asia Europe Journal*, *15*(4), 463–482.

Motelle, S., & Biekpe, N. (2015). Financial integration and stability in the Southern African development community. *Journal of Economics and Business*, *79*, 100–117.

Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, *24*, 230–237.

Nguyen, T.D., & Du, Q.L.T. (2022). The effect of financial inclusion on bank stability: Evidence from ASEAN. *Cogent Economics and Finance*, *10*(1), 2040126.

Olusegun, T.S., Evbuomwan, O., & Belonwu, M.C. (2021). Does Financial Inclusion Promote Financial Stability in Nigeria? *Central Bank of Nigeria Economic and Financial Review*, *59*(1), 77–99.

Pesaran, H. (2003). A simple panel unit root test in the presence of cross section dependence. *Cambridge Working Papers in Economics 0346*. Faculty of Economics (DAE), University of Cambridge.

Pesaran, M.H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*, 50–93.

Pham, M.H., & Doan, T.P.L. (2020). The impact of financial inclusion on financial stability in Asian countries. *Journal of Asian Finance, Economics and Business*, *7*(6), 47–59.

Sahay, R.A, Čihák, M., N'Diaye, P., Barajas, A., Mitra, S., Kyobe, A., . . . Yousefi, S.R. (2015). *Financial inclusion: Can it meet multiple macroeconomic goals? IMF's Discussion note*. Washington, D.C.: International Monetary Fund.

Sargan, J.D. (1958). The estimation of economic relationships using instrumental variables. *Econometrica*, *26*(3), 393–415.

Sarma, M. (2012). Index of financial inclusion. *Berlin Working Papers on Money, Finance, Trade and Development*. No. 07/2012. Competence Center, 'Money, Finance, Trade and Development'.

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development*, *23*(5), 613–628.

Sethy, S.K., & Goyari, P. (2022). Financial inclusion and financial stability nexus revisited in South Asian countries: Evidence from a new multidimensional financial inclusion index. *Journal of Financial Economic Policy*, *14*(5), 674–693.

Siddik, M., Alam, N., & Kabiraj, S. (2018). Does financial inclusion induce financial stability? Evidence from cross-country analysis. *Australasian Accounting, Business and Finance Journal*, *12*(1), 34–46.

UN. (2015). *Inclusive finance*. Retrieved March 29, 2021, from https://www.un.org/esa/ffd/topics/inclusive-local-finance/inclusive-finance.html

Vo, D.H., Nguyen, N.T., & Van, T.H. (2021). Financial inclusion and stability in the Asian region using bank-level data. *Borsa Istanbul Review*, *21*(1), 36–43.

Wairimul, K.D., & Omagwa, J. (2020). Financial inclusion and bank stability of commercial banks listed in Nairobi Securities Exchange, Kenya. *International Journal of Current Aspects in Finance, Banking and Accounting*, *2*(1), 64–81.

Wang, R., & Luo, H. (2022). How does financial inclusion affect bank stability in emerging economies? *Emerging Markets Review*, *51*, Part A.

World Bank. (2016). *Financial stability*. Retrieved from https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-stability

World Bank. (2018). *Financial inclusion overview*. Retrieved July 15, 2022, from https:// www.worldbank.org/en/topic/financialinclusion/ overview

World Bank. (2021). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. Retrieved December 18, 2022, from https://www.worldbank.org/en/publication/globalfindex

World Bank. (n.d.). *World Development Indicators*. Washington, DC: The World Development Bank. Retrieved May 16, 2022, from http://data.worldbank.org/datacatalog/world-development-indicators