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Effects of Financial Inclusion on Financial Stability: Evidence from SSA Countries

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Abstract

The study explores the link between financial inclusion and financial stability in 37 Sub-Saharan African countries. Results of our panel data analysis show that financial inclusion positively impacts financial stability, especially in low-income countries with low levels of financial stability. Additionally, prior improvements in financial stability were found to have positive effects on present levels of financial stability. The study recommends policymakers to enhance cooperation, target excluded communities for financial inclusion, improve financial literacy, and cross-fertilize skills.

Keywords:

Sub-Saharan Africa; Financial Inclusion; Financial Stability; Dynamic Common Correlated Effects; Quantile Regression

JEL Classification: G0, G2, G21, G28

1. INTRODUCTION

The term financial inclusion has grown in popularity among academics and policymakers since the early 2000s. This is mostly because of modern economic theories that emphasize the importance of finance in inclusive economic growth, poverty reduction, and economic development (see McKinnon 1973; King and Levine 1993; Levine 2005; Goldsmith, 1969; Schumpeter, 1911; WSBI, 2010). Nonetheless, there is no single definition of financial inclusion. Generally, financial inclusion is defined as when formal financial products and services are widely available and accessible for use by businesses and households in a way that is affordable, secure, effective, informed, transparent, and that also supports the efficient operation of the financial system by way of a sound financial infrastructure (Sahay *et al.*, 2015; World Bank, 2018; Gadanecz and Tissot, 2017; OECD, 2013). One strand of literature suggests that an inclusive financial system facilitates the delivery of financial services to underserved parts of society and encourages investment by businesses (Beck *et al.* 2007; Mehrotra and Yetman 2015; Owen and Pereira 2018; Asante *et al.* 2023). Further, access to financial products and services is crucial for mobilizing financial resources, encouraging investment, and so creating value for small businesses and start-ups, with beneficial spillover effects on socioeconomic growth (Demirgüç-Kunt *et al.* 2017; Park and Mercado 2015; Kim 2016; Nanda and Kaur 2016; Naceur *et al.* 2017; Sethi and Sethy, 2018; Sethi and Acharya, 2018; Burgess and Pande, 2005; Aportela, 1999; Chibba, 2009). For these reasons, financial inclusion is acknowledged as a vital driver for many of the UN Sustainable Development Goals (SDGs) and the African Union (AU) Agenda 2063. Several emerging nations, including those in Sub-Saharan Africa (SSA), have developed national financial inclusion strategies (NFISs) to expand funding sources, limit informal financial services, and stimulate investment and economic growth (Zins and Weill 2016; Demirgüç-Kunt *et al.*, 2018). Nonetheless, when compared to other regions, the SSA region has the lowest rates of financial inclusion, with only 43 percent of adults having a bank account, significantly less than what the UN's SDGs aim for. This implies that many adults in the SSA region are financially excluded and disadvantaged (Makoni 2014; Demirgüç-Kunt et al. 2018).

Another strand of literature, however, argues that excessive increases in access to financial services and products may make banks more sensitive to shocks and cause numerous liquidity vulnerability issues and jeopardize financial stability (Laeven & Valencia, 2013). A stable financial system is generally understood as one that ensures that finance's role in resource and risk allocation, savings mobilization, development, growth, and wealth accumulation facilitation, as well as the smooth operation of the economy, is adequately fulfilled (Schinasi, 2004; World Bank, 2015; Gadanecz & Jayaram, 2008; Jeanneau, 2014; ECB, 2012). When strategies to increase financial inclusion are not carefully planned, and their macroeconomic implications not well understood, they can potentially lead to financial instability (Arora, 2019). The global financial crisis of 2007-2009 is a notable example of how unregulated and excessive financial expansions may infringe on financial stability across countries, despite their level of development. It has raised the question of whether, despite purported benefits, expanding financial inclusion to the poor and disenfranchised parts of society may endanger countries' financial stability, particularly in developing and underdeveloped nations such as those in the SSA region (Arora, 2019; Griffith-Jones & Karwowski). In this regard, the pursuit of financial stability, alongside the promotion of financial inclusion has gained prominence among policy makers.

There has been little empirical research into the specific relationships between financial inclusion and financial stability (Cull *et al.*, 2012; Arora, 2019). Empirical research, of which very few is conducted in the context of the SSA region, yields conflicting conclusions about the exact nature of the association between financial inclusion and financial stability. On the one hand, some research has discovered a significant positive association between financial inclusion and financial stability, implying that financial inclusion contributes to financial stability (Jungo *et al.*, 2022; Hakimi *et al.,* 2022), Other research, on the other hand, has discovered a significant negative association between the two, showing that increased financial inclusion undermines financial stability (Amatus and Alireza, 2015; Naceur *et al.*, 2019). Inconsistent conclusions about the effects of financial inclusion on financial stability necessitate further investigation. This lack of agreement among academics has motivated this research, in the case of the SSA region. The SSA region was chosen because, while financial policy reforms in the region have been successful in increasing financial depth and stabilizing macroeconomic indicators including exchange rate, economic growth, inflation, and financial stability, they have been less successful in increasing financial inclusion since the 1980s. This is also despite the impressive launching of NFISs in most of the region’s economies. As a result, the SSA region is among the bottom regions in the world, in terms of actual account ownership and usage. For instance, Nigeria, the SSA region's most populous country is one of seven economies that jointly house more than half of the world's unbanked people (World Bank, 2022). Additionally, the gender disparity in bank account ownership in SSA grew from 5 percent in 2011 to 12 percent in 2021, which is three times the global average and double that of comparable developing countries (Sarpong and Nketiah-Amponsah, 2022; World Bank, 2022).

The primary objective of our study is to investigate the effect of financial inclusion on financial stability of the banking sector in SSA countries. Given the importance of the banking sector in SSA, financial stability is framed in the context of banks – therefore, financial stability and bank level stability or financial stability of the banking sector are used interchangeably in our study. To support our study, we use country specific data collected from the most recent vintages (i.e., 2022) of the World Bank Global Financial Development Database (GFDD) and World Bank Development Indicators (WDI), on which we applied the Dynamic Common Correlated Effects Mean Group (DCCE-MG) technique by Chudik and Pesaran (2015), the Augmented Mean Group (AMG) estimator pioneered by Eberhardt and Teal (2010) and Bond and Eberhardt (2009), and the Quantile Regression (QREG) model with fixed effects of Koenker and Bassett (1978) as well as Machado and Santos Silva (2019). The DCCE-MG controls for possible cross-sectional dependence in the data. Further, by employing the Jackknife correction approach, it can be used with small sample sizes (Chudik & Pesaran, 2015). In addition, the method can still deliver accurate results even in the presence of structural breaks or unbalanced panel data (Kapetanios et al., 2011; Ditzen, 2016). Similarly, the AMG is resilient to possible endogeneity and cross-sectional dependency. Along with being resistant to serial correlation, missing data, and probable causes of non-stationarity in the series, it also accounts for diverse slope coefficients (Voumik et al., 2023; Shi et al., 2021). The QREG model allows for investigating the impact of financial inclusion across the entire conditional distribution of banking sector financial stability in the SSA region. The technique gives weights to the observations and uses the entire sample to estimate each quantile using the information that is available. Therefore, the weighted data of the whole sample is utilized to estimate the coefficients for each quantile regression, rather than only the portion of the sample at that quantile (Oliveira et al., 2013; Machado and Santos Silva, 2019).

This study contributes to literature in several ways. First, it caters for the presence of unobserved cross-sectional dependence among SSA countries. Existing cross-country research on the influence of financial inclusion on financial stability does not always account for the possibility of panel cross-sectional dependence (see Brei *et al.*, 2020; Al-Smadi, 2018; Čihák *et al.*, 2016; Morgan and Pontines, 2018; Ahamed and Mallick, 2019; Jima and Makoni, 2023). In the recent past, countries in the SSA region have embarked on political agreements to facilitate regional financial integration (RFI) on financial market development, financial stability, and access to finance in SSA. These RFI initiatives are set to culminate in an opening up of capital accounts among countries of geographical proximity as well as the liberalization of cross-border activities of financial institutions within the integrating area (Lovegrove *et al.*, 2007; Bhatia *et al.*, 2009; Frey and Volz, 2013). Furthermore, SSA countries are members of various intraregional groupings[2] that foster broader economic integration while also promoting the development of sound regional macroeconomic policies. The resultant intra-regional spillovers suggest the possibility of cross-sectional dependence between countries. There is evidence to suggest that if unobserved cross-sectional dependence is not accounted for in panel data analysis, spurious results can arise (Pesaran, 2006; Chudik and Pesaran, 2015; Ditzen, 2018). Therefore, we fill this gap by employing the Dynamic Common Correlated Effects (DCCE) model capable of detecting and modeling cross-sectional dependency in data while allowing for heterogeneous coefficients and the evaluation of the impact of financial stability in the previous period on financial stability in the current period. This will allow policy makers to avoid sub-optimal policy design that would otherwise prevail if the empirical analysis and subsequent research results ignored the possible existence of cross-sectional dependence.

Second, we investigate whether financial inclusion affects financial stability differently when levels of financial stability change in the SSA countries. Past studies estimating the influence of financial inclusion on financial stability have relied on classic regression techniques that focus on the mean impacts of financial inclusion on financial stability (see Matsebula and Sheefeni, 2022;

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[2] These include, the West African Economic and Monetary Union (WAEMU), Economic and Monetary Community of Central African States (CEMAC), Common Market for Eastern and Southern Africa (COMESA), East Africa Community (EAC-5), Southern African Development Community (SADC), Southern Africa Customs Union (SACU), Economic Community of West African States (ECOWAS), to name a few.

Anthony-Orji *et al.*, 2019; Al-Smadi, 2018; Neaime and Gaysset, 2018; Jungo *et al.*, 2022; Jima and Makoni, 2023). As a result, crucial relationships along the conditional distribution of financial stability may be overlooked, underestimated, or overstated (Binder and Coad, 2011). To overcome this challenge, we propose a fixed effect panel quantile regression model in addition to linear dynamic panel regression approaches. This enables us to investigate the impact of financial inclusion on financial stability in SSA throughout the conditional distribution while accounting for unobserved individual country variation. For policy makers, this is useful because it enables a nonlinear analysis of the relationship between financial inclusion and financial stability with a focus on how policy can be formulated across different levels of financial stability, and not just the mean.

Third, we examine whether the impact of financial inclusion on financial stability varies along the level of economic development. Recent research examining the relationship between financial inclusion and financial stability in the SSA region has typically focused on a single nation case, a subgroup within the regional group, or a particular income group within the regional group (see Aduda and Kalunda, 2012; Amatus and Alireza, 2015; Leigh and Mansoor, 2016; Arora, 2019; Jungo, *et al.*, 2022). Furthermore, such research yields conflicting results about the impact of financial inclusion on financial stability across country income levels. In this sense, our research aims to give a comprehensive empirical understanding of how financial inclusion affects financial stability at the regional level and across low, lower-middle, and upper middle-income SSA countries. For policy makers, the granularity brought about by income classification is beneficial for analytical and operational reasons. Analytically, income classification helps in understanding and identifying differences in developmental achievements and processes within countries. Operationally, the classification of countries by income informs better tailoring of policies to country specific circumstances on the basis of evidence.

Fourth, we investigate whether financial inclusion affects financial stability differently in the SSA countries when different indicators of financial inclusion are used. Most studies on the relationship between financial inclusion and financial stability demonstrate a lack of consistency in the use of inclusion and stability proxies across studies, owing to a lack of similar data across nations or a lack of agreement on a precise definition in each case (see Al-Smadi, 2018; Čihák *et al.*, 2016;

Morgan and Pontines, 2018, Neaime and Gaysset, 2018). As a result, drawing parallels and generalizing study outcomes is difficult. To address this issue, the current study employs several proxies of inclusion and stability in conjunction with composite indicators produced using the principal composite analysis (PCA) approach, in a similar way to Jungo *et al.*, (2022), to provide a comprehensive and multidimensional view of inclusion and stability in SSA. This study therefore provides helpful inputs to policy makers, bankers, and financial sector regulators to make informed decisions on how best to promote financial inclusion in the region while ensuring financial stability. This is valuable given the current low levels of financial inclusion in most countries in SSA.

The remainder of the research is structured as follows. Section 2 gives a brief review of the theoretical and empirical literature. Section 3 presents the methodology and offers the data sources. Section 4 discusses the empirical results. The last section deals with concluding remarks and offers policy recommendations.

2. LITERATURE REVIEW

Financial inclusion's social and economic significance is well-documented, but its impact on financial stability, particularly bank stability, is less understood. Financial inclusion can have both positive and negative impacts on financial stability. Theoretically, positive impacts of financial inclusion on financial stability can be explained through the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983) which suggests that greater financial inclusion leads to improved institutional quality, which in turn positively impacts financial stability (Ozili, 2023; Koudalo & Toure, 2023). That is, the promotion of financial inclusion narrows income inequality and fosters improvements in financial literacy, regulatory reforms, micro-prudential supervision, data collection systems, and appropriate financial products, all of which positively impact financial stability (Kuznyetsova *et al.*, 2022; Arora, 2019; Koudalo & Toure, 2023; Cicchiello *et al.*, 2021; Zhang & Posso, 2019; Aracil *et al.*, 2022). Therefore, the level of economic development or institutional quality, often measured by income classification, significantly influences financial inclusion’s impact and financial stability.

Additionally, financial inclusion can foster financial stability by reducing information asymmetry between lenders and borrowers, while fostering complementarity with employment creation and economic growth (see, Wang & Luo, 2022; Allen *et al.,* 2016; Prasad, 2010; Ahamed & Mallick 2019; Hanning and Jansen, 2010; Cull *et.al.,* 2012; Han and Melecky, 2013; Neaime and Gaysset, 2018). It also facilitates greater monetary policy transmission and financial supervision effectiveness; while also helping banks diversify retail deposit funding and attain greater balance sheet diversification, thus boosting the level of less volatile deposits and the bank's soundness, as more financially excluded economic actors are brought into the formal financial system (Wang & Luo, 2022; Allen *et al.,* 2016 Mehrotra and Yetman, 2014; 2015; Huong, 2018; Prasad, 2010; Rahman, 2014; Ahamed & Mallick 2019; Hanning and Jansen, 2010; Hawkins, 2006; Han and Melecky, 2013; Cull *et.al.,* 2012; Neaime and Gaysset, 2018). Furthermore, by boosting lending to small and medium-sized businesses, banks can diversify the assets they hold and reduce the comparative loan size of any single debtor in the whole portfolio. As a result, financial stability is achieved through lowering non-performing loans (NPLs) and the likelihood of default (Khan, 2011; Rahman, 2014; Čihák *et.al.,* 2016; Chen, *et al.,* 2018).

Negative impacts of financial inclusion on financial stability can be explained by the theory of extreme credit expansion or extreme financial inclusion theory (Morawetz, 1908). That is, the widespread engagement of individuals with low incomes in the formal financial system that raises transaction and information costs, resulting in greater inefficiencies in the system of finance (Khan, 2011; Garcia and Jose, 2016; Sahay *et. al.,* 2015; Beck and De Jonghe, 2013). Second, by outsourcing certain activities like as credit assessment to target small and medium-sized borrowers, the bank may face reputational risk. Third, widespread participation of microfinance institutions (MFIs) or the rise of unregulated financial institutions will broaden the loan base, complicating credit assessment and perhaps increasing the likelihood of loans to default, leading to liquidity crises in banks and diluting overall financial system management (Khan, 2011; Garcia and Jose, 2016; Dell'Ariccia, and Marquez, 2006; Ahmad, 2018).

Our study's conceptual framework draws lessons from the discussion of the theoretical literature on the relationship between financial inclusion and financial stability. It also draws from empirical work by Hakimi et al., (2022); Le et al., (2019); Vo et al, (2021); Wang and Luo (2022); Čihák et al, (2016, 2021) and Koudalo and Toure (2023). To identify channels through which the negative effects of financial inclusion on financial stability are transmitted, we rely on the extreme financial inclusion theory (Morawetz, 1908). It suggests that financial stability can be compromised when financial services are promoted to economic agents regardless of their income or risk level (Morawetz, 1908; Hakimi et al. 2022; Le et al. 2019; Čihák et al, 2016; Koudalo and Toure, 2023). Increased financial inclusion, particularly for low-income individuals, may pose risks such as increased transaction and information costs due to information asymmetry and credit and collateral history deficiencies. This could put financial stability at risk. Therefore, sound governance and sufficient financial regulation and oversight are crucial for ensuring financial stability (Hakimi et al. 2022; Le et al. 2019; Wang and Luo, 2022).

To identify channels through which the positive effects of financial inclusion on financial stability are transmitted, we rely on the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983). It posits that increased access and utilization of financial producers and services can enhance financial system regulation and supervision, leading to improved financial stability. (Meyer & Rowan, 1977; DiMaggio & Powell, 1983; Wang and Luo, 2022; Čihák et al, 2016; Koudalo and Toure, 2023). Financial inclusion enables banks to diversify loan portfolios, reduce nonperforming loans, and improve savings, retail deposits, and monetary policy transmission. This effect is more pronounced in high-institutional quality economies (Hakimi et al., 2022; Le et al., 2019; Wang and Luo, 2022).

Empirically, some authors have found evidence of a positive impact of financial inclusion on financial stability (Adasme et al., 2006; Jungo et al., 2022; Hakimi et al., 2022; Morgan & Pontines, 2014; Wang & Luo, 2022; Ahamed & Mallick 2019; Nguyen & Du 2022; Hannig & Jansen 2010; Cihak et al. 2016; Koudalo & Toure, 2023). They argue that financial inclusion enhances financial stability by expanding banks' customer base, diversifying risk, broadening the deposit base, narrowing income inequality, improving institutional quality, and enhancing regulatory efficiency. Conversely, some scholars suggest that excessive financial inclusion may lead to a decrease in financial stability, as it may result in a loosening of lending standards for low-income households and small businesses. This may lead to increased levels of non-performing loans which could have significant adverse results on the stability of the financial system (Khan, 2011; Amatus and Alireza, 2015; Naceur et al., 2019; Igan & Pinheiro,2011; Sahay et al., 2015).

3. METHODOLOGY AND DATA

3.1 General Functional Form

Informed by the review of literature and the study's conceptual framework that is enshrined in theory, the general form of our model illustrating the relationship between financial inclusion and financial stability is consistent with the benchmark models used by Amatus and Alireza (2015), Morgan and Pontines (2018), Greene (2001), Brei *et al.*, (2020), and Siddik *et al.*, (2018). Based on these previous empirical studies and their choice of variables, the model that guides the inquiry of how financial inclusion affects financial stability in SSA countries is shown in Equation 1.

$$FINSTAB_{i,t} = \alpha FINSTAB_{i,t-1} + \beta INCL_{i,t}, + \gamma X_{i,t} + \Omega_{i,t} + \vartheta_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where $i = 1, \dots, N$ *and* $t = 1, \dots, T$, respectively refer to the study's temporal dimension and the panel of nations. $FINSTAB$ is financial stability, the study dependent variable which is proxied by Bank credit to bank deposits (%), Bank Z-scores / distance to default, Liquid assets to deposits & short-term funding (%) and a composite indicator of financial stability, respectively. $INCL$ is a measure of financial inclusion and it is proxied by bank branches per 100,000 adults, ATMs per 100,000 adults, and a composite indicator of financial inclusion, respectively. X is a vector of parsimonious control variables that have a potential effect on financial stability in our baseline model. They include the logarithm of GDP per capita (which is used as a proxy for economic development), the ratio of private sector credit by deposit money banks and other financial institutions to GDP (which is used to proxy financial sector development), and a measure of inflation.

The selected control variables are commonly used in models that investigate the financial stability and financial development nexus (Brei *et al.*, 2020; Morgan and Pontines, 2018; Siddik *et al.*, 2018; Amatus and Alireza, 2015). The decision to limit our choice of control variables to these commonly used variables is informed by the desire to easily compare our findings with those of previous studies. A host of other control variables including external debt stocks as a percent of gross national income, gross savings as a percent of GDP and the official exchange rate - local currency unit per US$, period average, as guided by the literature, are considered in the study. α, β and γ are coefficients of the model. The time and country fixed effects are captured with $\Omega_{i,t}$ *and* $\vartheta_{i,t}$, respectively. They control for unobserved time-invariant variation in banking system stability across countries. ε is the error term.

3.2 Dynamic Common Correlated Effects Models

The primary objective of our study is to investigate the effect of financial inclusion on financial stability of the banking sector in SSA countries. Historically, methods like the GMM model, fixed effects, and random effects have been used to estimate Equation 1, but they overlook the possibility of heterogeneity and cross-sectional dependency between groups. This is particularly relevant in globalized financial and economic sectors, where policy decisions can impact multiple nations (De Hoyos and Sarafidis 2006; Dogan *et al.*, 2017; Latif *et al.*, 2018). In this regard, the SSA region is implementing political agreements to facilitate regional financial integration (RFI), aiming to develop financial markets and access to finance, leading to spillover effects like capital account opening and cross-border financial institution liberalization (Lovegrove *et al.*, 2007; Bhatia et al., 2009; Frey and Volz, 2013). This suggests the possible presence of cross-sectional dependence between the SSA countries in our study. To overcome this challenge, we employ the Dynamic Common Correlated Effects (DCCE) model by Chudik and Pesaran (2015) as our baseline model to estimate Equation 1, allowing for cross-sectional dependence among panels due to unobserved common characteristics in regression variables. The DCCE technique is a reliable and effective alternative to conventional methods. It addresses cross-sectional dependence, parameter variability, heterogeneity, and non-stationarity in panel data. It also removes asymptotical bias in estimators due to regressor endogeneity (Chudik and Pesaran, 2015). By using lagged versions of the variables to produce instrumental variables (IVs), the methodology facilitates instrumental variable regression. The IVs are robust to cross-sectional dependence and slope heterogeneity. In dynamic and static panel data models, the DCCE approach is thus robust to endogenous regressors. Furthermore, regardless of whether the regressors are endogenous, strictly exogenous, or weakly exogenous, it considerably enhances the estimator's small sample features in dynamic panel models (Chaudhry *et al.*, 2021). Further, this method can still deliver accurate results even in the presence of structural breaks or unbalanced panel data (Kapetanios *et al.*, 2011; Ditzen 2016).

Our study uses Chaudhry *et al.*, (2021) and Chen *et al.*, (2022) to inform the DCCE model specification. These studies make use of the relative superiority of dynamic panel data models over static models to estimate both short-run and long-run outcomes while also adjusting for the likelihood of cross-sectional dependence among the cross-sectional units. In our investigation, the DCCE model is expressed as follows:

$$L\_FINSTAB_{i,t} = \alpha L\_FINSTAB_{i,t-1} + \beta X_{i,t} + \sum_{p=0}^{P_T} \gamma_{x,i,p} \bar{X}_{t-p} + \sum_{p=0}^{P_T} \gamma_{y,i,p} \bar{X}_{t-p} + \varepsilon_{i,t} \qquad (2)$$

where i, t refer to the cross-sectional characteristics of the data and the time period, respectively. $L\_FINSTAB$ shows a log of financial stability, with its lag used as an independent variable. $X_{i,t}$ represents a set of other independent variables, including the financial inclusion proxy, the unobserved common elements of the model are shown by $\gamma_{x,i,p}$ and $\gamma_{y,i,p}$, while, P_T represents the lag of cross-sectional averages and $\varepsilon_{i,t}$ is the error term.

Both financial stability and financial inclusion will be approximated by a few different single variable measures as well as composite indicators, as was addressed in earlier sections. When using a single variable measure or combining numerous single indicators into one model, which may result in over-parameterization and multicollinearity issues, the choice of composite indicator is made to reduce the possibility of biased and misleading results. The study employs the principal component analysis (PCA) estimation technique to generate the composite indicators of financial stability and inclusion, respectively.

3.3 The Quantile Regression (QREG) Model

Banks are the main source of financial services and products in SSA countries. The stability and development of the banking industry varies among different countries in the region (Anarfo *et al.*, 2022; Mashamba & Gani, 2023). In this regard, another objective of our study is to evaluate financial inclusion's impact at different levels of financial stability. To achieve this, we propose using the fixed effect panel quantile regression model. It enables us to account for unobserved individual country variability in our study while examining the effect of financial inclusion on financial stability in SSA across the conditional distribution. Koenker and Bassett (1978) developed the quantile regression method, which uses a semiparametric approach. In contrast to linear regression, it does not assume the distribution of the errors or call for normally distributed data. This increases its resistance to anomalies and non-normal errors (Porter, 2014; Petscher and Logan, 2014). Additionally, the method is unaffected by monotonic transformations like logarithmic transformations. This is a characteristic that linear regression models lack (Koenker, 2005). Depending on the quantile of the result or dependent variable in a quantile regression model, the relevance of the predictors in the model may change (Koenker and Bassett, 1978). This indicates that, in the context of our investigation, the effects of financial inclusion as a predictive variable (and those of other independent factors) on financial stability may vary across the various quantiles (or levels) of financial stability in our study countries. In other words, depending on whether financial stability is distributed at a low, average, or high level in each country, the impact of the predictor factors will vary.

3.4 The Augmented Mean Group (AMG) Model

We observe that existing studies examining the relationship between financial stability and inclusion in the SSA region currently tend to concentrate on either a single country case, a subgroup within the regional group, or a single income group within the regional group (see Aduda and Kalunda, 2012; Amatus and Alireza, 2015; Leigh and Mansoor, 2016; Arora, 2019; Jungo, *et al.*, 2022). Such research offers conflicting results about the influence of financial inclusion on financial stability across country income levels. Our study also examines the effects of financial inclusion on financial stability across various country income groups in the SSA region, drawing on the tenets of the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983), which contends that greater financial inclusion, especially in developing economies, promotes the growth of markets essential for economic growth, the reduction of poverty, and financial stability. In this regard, we employ the augmented mean group (AMG) method developed by Eberhardt and Teal (2010) and Bond and Eberhardt (2009), which is a model from the same family as the DCCE estimator used as a baseline model in our study. In this regard, we will examine the effects of financial inclusion on financial stability in groupings of SSA countries with low, lower-middle, and upper middle incomes, respectively. This also allows us to adopt an additional analytical layer that compliments the DCCE and quantile regression models. The AMG model also provides an opportunity for us to introduce additional control variables such as external debt stocks, gross savings, and the official exchange rate, which are often linked to financial stability in the literature (see Eichengreen, 1998; Hardy & Pazarbaşioğlu, 1999, Sahminan, 2007; Donath & Cismas, 2008; Obstfeld et al., 2010).

3.5 Data Sources and Variables

The study makes use of an annual panel of data from 2005 to 2019 and a dynamic panel equation to examine the relationship between financial stability and financial inclusion in 37 SSA nations. A list of the study countries is presented in Appendix A1. The number of countries were informed by data availability. The study variables are described in Table 1, together with details on how they were processed and the sources of the data.

Table 1: Description of Variables

Variables	***Symbol***	***Transformation***	***Data Sources***
Bank credit to bank deposits (%)	$FINSTAB\_1$	Percentage	Global Financial Development Database (GFDD)
Bank Z-scores / distance to default	$L\_FINSTAB\_2$	Natural log	GFDD
Liquid assets to deposits & short-term funding (%)	$FINSTAB\_3$	Percentage	GFDD
Financial stability indicator	$FINSTAB\_PCA$	-	Authors' calculation using panel PCA based on data from GFDD
Bank branches per 100,000 adults	L_INCL_1	Natural log	GFDD
ATMs per 100,000 adults	L_INCL_2	Natural log	GFDD
Financial inclusion indicator	$INCL\_PCA$	-	Authors' calculation using panel PCA based on data from GFDD
GDP per capita	L_GDPPC	Natural log	World Development Indicators (WDI)
Private credit by deposit money banks to GDP (%)	PSC	Percentage	GFDD
Consumer prices (annual %)	INF	Percentage	WDI

Notes: $FINSTAB\_PCA$ is the composite indicator of financial stability. $INCL\_PCA$ is the composite indicator of financial inclusion. The two composite indicators are calculated using the PCA technique.

The study variables and choice of proxies for financial inclusion and financial stability were informed by the review of relevant literature and data availability. Financial inclusion and stability are the key study variables. Three distinct proxies and a composite indicator are used to approximate financial stability. First, by the percentage of bank deposits to bank credit. The same indicator has been used by Pal and Bandyopadhyay (2022). Second, Bank Z-scores. This indicator depicts the likelihood that a nation's banking system may fail. Studies that have used the same indicator include Jungo et al., (2022); Hakimi et al., (2022); Abdulkarim and Ali (2019) as well as Saha and Dutta (2021). Third, the percentage of liquid assets and short-term funding. This is the proportion of short-term funding and total deposits to the value of liquid assets (easily convertible to cash). Studies that have used the same indicator include Matsebula and Sheefeni (2022), Siddik et al., (2018) as well as Operana (2016). Two distinct proxies and a composite indicator are used to approximate financial inclusion. According to bank branches per 100,000 adults in the first instance and ATMs per 100,000 adults in the second. Studies that have used the same indicators include Neaime and Gaysset (2018), Khan et al., (2022), Saha and Dutta (2021) as well as Matsebula and Sheefeni (2022). The principal component analysis (PCA) method is used to create the composite indicators for financial inclusion and stability, respectively – in the same way as Jungo et al., (2022).

4 EMPIRICAL RESULTS AND ANALYSIS

The descriptive statistics for each variable and the pair-wise correlation for all the variables are presented in Appendix A2 and A3, respectively. From Appendix A2, the composite measures of financial stability and inclusion in SSA have a mean value of zero and a standard deviation of almost one. The data shows heterogeneity in the panels, with large standard divisions of private sector credit by deposit money banks and standard deviations of bank credit to deposits and liquid assets. This justifies the use of the panel data techniques that control for individual country heterogeneity. From Appendix A3, financial inclusion proxies each have a positive and statistically significant correlation with the financial stability proxies. This suggests that increases in the financial inclusion proxies are anticipated to have a positive impact on the SSA region's financial stability.

Before we proceed to the Dynamic Common Correlated Effects (DCCE) model, we first test for the presence of cross-sectional dependence (or weak cross-sectional dependence) using two tests, namely, tests by Pesaran (2015, 2021), and the power enhancement CD test by Fan *et. al.,* (2015). There is sufficient evidence to reject the null hypothesis of weak cross-sectional dependence in favour of concluding that for each variable in the study, the cross-sectional units exhibit strong cross-sectional dependence, as per both the Pesaran and the CD tests, which are presented in Table 2.

Table 2: Results of Cross-Sectional Dependence Tests

	CD	**CDw+**
FINSTAB_1	9.790	1031.580
	(0.000)	(0.000)
L_FINSTAB_2	99.950	2577.310

	CD	CDw+
	(0.000)	(0.000)
FINSTAB_3	19.530	938.080
	(0.000)	(0.000)
FINSTAB_PCA	29.440	1066.210
	(0.000)	(0.000)
L_INCL_1	73.500	1878.940
	(0.000)	(0.000)
L_INCL_2	68.550	1987.380
	(0.000)	(0.000)
INCL_PCA	59.800	1838.250
	(0.000)	(0.000)
L_GDPPC	22.750	1437.500
	(0.000)	(0.000)
PSC	41.150	1433.680
	(0.000)	(0.000)
INF	13.050	778.010
	(0.000)	(0.000)

Source: Authors' composition using xtcd2 command in STATA 17.
Note: p-values in parenthesis. CD is the cross-sectional dependence test by Pesaran (2015, 2021). CDw+ is the cross-sectional dependence test by with power enhancement by Fan *et. al.* (2015)

4.1 Results of the Dynamic Common Correlated Effects Model

After confirming that the cross-sectional units exhibit strong cross-sectional dependence, we proceed to evaluate how financial inclusion affects financial stability in the SSA region using the Dynamic Common Correlated Effects Mean Group (DCCE-MG). We present three sets of results in separate panels in Table 3, with each capturing several aspects of financial stability. Panel 1, 2 and 3 present results of the DCCE-MG estimator by using the natural log of bank branches per 100,000 adults (i.e., L_INCL_1), the natural log of ATMs per 100,000 adults (i.e., L_INCL_2), and the composite indicator of financial inclusion (i.e., $INCL\_PCA$), respectively.

Table 3: Dynamic Common Correlated Effects – Mean Group Results

Panel 1

Regressors	Model 1 Coefficient	Model 2 Coefficient	Model 3 Coefficient	Model 4 Coefficient	Model 5 Coefficient	Model 6 Coefficient	Model 7 Coefficient	Model 8 Coefficient
	0.466***	0.426***	0.390***	0.437***	0.335***	0.437***	0.379***	0.372**
L.FINSTAB_PCA	(0.057)	(0.066)	(0.061)	(0.062)	(0.066)	(0.007)	(0.067)	(0.072)
	0.488*	0.486	-0.189	0.431	-0.149	0.591	0.009	0.057
L_INCL_1	(0.265)	(0.315)	(0.302)	(0.268)	(0.240)	(0.467)	(0.241)	(0.271)
		-0.901			-0.947	-1.309		-0.653
L_GDPPC		(1.34)			(1.349)	(1.785)		(0.874)
			0.075***		0.075***		0.071***	0.071***
PSC			(0.028)		(0.017)		(0.02)	(0.021)
				0.002		0.008	-0.007	0.000
INF				(0.011)		(0.012)	(0.009)	(0.013)
Observation	518	518	518	518	518	518	518	518
R-Squared	0.76	0.69	0.43	0.72	0.39	0.52	0.31	0.26

Panel 2

Regressors	Model 1 Coefficient	Model 2 Coefficient	Model 3 Coefficient	Model 4 Coefficient	Model 5 Coefficient	Model 6 Coefficient	Model 7 Coefficient	Model 8 Coefficient
	0.345***	0.356***	0.373***	0.427***	0.298***	0.413***	0.355***	0.26***
L.FINSTAB_PCA	(0.068)	(0.067)	(0.053)	(0.063)	(0.059)	(0.065)	(0.063)	(0.056)
	-0.067	-0.178	-0.163	-0.127	-0.316	0.617	-0.057	-0.067
L_INCL_2	(0.279)	(0.214)	(0.151)	(0.163)	(0.288)	(0.792)	(0.146)	(0.361)
		1.085			-1.023	1.678		-0.385
L_GDPPC		(0.771)			(1.676)	(1.404)		(1.136)
			0.083**		0.083**		0.085	0.082**
PSC			(0.346)		(0.037)		(0.037)	(0.038)
				-0.002		0.026	-0.003	0.016
INF				(0.007)		(0.031)	(0.010)	(0.021)
Observation	518	518	518	518	518	518	518	518
R-Squared	0.58	0.48	0.53	0.50	0.38	0.48	0.35	0.32

Panel 3

Regressors	Model 1 Coefficient	Model 2 Coefficient	Model 3 Coefficient	Model 4 Coefficient	Model 5 Coefficient	Model 6 Coefficient	Model 7 Coefficient	Model 8 Coefficient
	0.455***	0.439***	0.382***	0.441***	0.304***	0.405***	0.359***	0.261***
L.FINSTAB_PCA	(0.644)	(0.063)	(0.557)	(0.064)	(0.567)	(0.067)	(0.061)	(0.056)
	-0.160	0.349	-0.026	-0.173	-0.373	0.473	-0.059	-0.075
INCL_PCA	(0.215)	(0.556)	(0.196)	(0.196)	(0.291)	(0.802)	(0.185)	(0.548)
		1.109			-0.653	1.712		-0.01
L_GDPPC		(0.960)			(1.471)	(1.446)		(1.114)
			0.078**		0.088**		0.084**	0.085**
PSC			(0.314)		(0.038)		(0.038)	(0.038)

				0.000		0.019	-0.001	0.015
INF				(0.008)		(0.024)	(0.018)	(0.004)
Observation	518	518	518	518	518	518	518	518
R-Squared	0.55	0.55	0.53	0.52	0.38	0.46	0.35	0.32

Source: Authors' composition using xtdcce2 command in STATA 17.

Note: From Model 2 to Model 4, we sequentially introduce the macroeconomic control variables, _L_GDPPC, PSC, and INF, respectively in that order. In Model 5 and 6 we introduce a combination of the control variables L_GDPPC, PSC and L_GDPPC, INF, respectively. Model 7 introduces a combination of the control variables PSC and INF only. Model 8 includes all the study variables. Coefficients (standard errors) are outside (inside) the parentheses. ***, **, and * denote the statistical significance at 1%, 5% and 10%, respectively. $L.FINSTAB\_PCA$ denotes the lag of the dependent variable.

In Panel 1, 2 and 3 when financial inclusion is measured by the natural log of bank branches per 100,000 adults (i.e., L_INCL_1), the natural log of ATMs per 100,000 adults (i.e., L_INCL_2), and the composite indicator of financial inclusion (i.e. L_INCL_PCA), respectively, the results of model 1 to model 8 show that the lagged dependent variable (i.e., the lag of the composite indicator of financial stability, $L.FINSTAB\_PCA$) has a positive impact on financial stability in the SSA region over the review period (see Table 3). Accordingly, a one percentage point rise in financial stability in the preceding period will, *ceteris paribus*, result in a one percentage point rise in financial stability in the present time. This outcome is congruent with what Morgan and Pontines (2018) and Hakimi *et al.*, (2022) have discovered. A stable financial system and stable policies can mitigate shocks and remain resilient in stressful situations, providing economic actors with the necessary funds to continue their activities in a healthy economy.

We also found that the financial inclusion indicator, L_INCL_1 ,has a positive effect on financial stability in six out of the eight models (i.e., model 1, 2, 4, 6, 7 and 8, respectively). However, this outcome is only statistically significant in model 1. In this regard, a one percent increase in financial inclusion leads to a 0.488 percent increase in financial stability, *ceteris paribus.* These results are in line with those of Hakimi *et al.*, (2022), Vo *et al.*, (2021), Saha and Dutta (2021), and Abdulkarim and Ali (2019). Conversely, when financial inclusion is measured by the natural log of ATMs per 100,000 adults (i.e., L_INCL_2) in panel 2, or by the composite indicator of financial inclusion (i.e., L_INCL_PCA) in panel 3, the impact on financial stability is not statistically significant. One possible reason could be that despite increased proliferation in ATMs, financial sector participants in SSA still prefer to use physical bank branches to access financial services and products. A similar point was made by Maity and Sahu (2022). In this regard, the financial intermediation theory suggests that increased financial inclusion through bank branches reduces information asymmetry and boosts the competitiveness of the banking industry. This reduces operating expenses, increases earnings, and stabilizes the financial system. Building a larger deposit base also provides stronger retail deposit funding, enhancing sector stability (Čihák *et al.*, 2016; Ozili, 2018; Ahamed and Mallick, 2019; Ozili, 2020).

4.2 Quantile Regression Results

We further examine whether financial inclusion affects financial stability differently when levels of financial stability fluctuate in 37 SSA nations by utilizing a fixed effect panel quantile regression model. In this regard, the results of the quantile regression model are presented in three panels in Table 4.

The results here show that the various proxies of financial inclusion across all three panels have a positive impact on financial stability in the SSA region. This finding is similar to that of Kebede (2021). Specifically, L_INCL_1, which is the number of bank branches per 100,000 adults, has the highest overall positive impact on financial stability relative to the number of ATMs per 100,000 adults (L_INCL_2) and the composite indicator of financial inclusion, $INCL\_PCA$, respectively, across the conditional distribution. Maity and Sahu (2022) explain that in the early stages of banks' expansion, bank branches tend to play a greater role in financial inclusion. However, the role played by ATMs in financial inclusion tends to grow and be positive over time. Similar to this, Neaime and Gaysset (2018) draw the conclusion that the ATMs' negligible impact on financial stability may be an indication of the banking sector's underdeveloped access to financial services, which could have a substantial impact on financial inclusion and, consequently, financial stability. Furthermore, Ozili (2021b) makes the point that in some less developed economies, economic agents like using and going to bank branches over ATMs because they appreciate the chance to speak with bank employees since it gives them confidence that their transactions will be handled. They also want to speak with bank employees face-to-face to make sure their issues are addressed.

In all three cases, the positive impact of financial inclusion on financial stability decreases from the 10^{th} to 90^{th} quantile. In line with the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983), countries with lower financial stability benefit most from financial inclusion, as it lowers information asymmetry costs and enhances market efficiency (Hannig and Jansen, 2010; Ozili, 2020; Pham and Doan 2020). Additionally, greater financial inclusion enhances financial supervision and monetary policy transmission, making aggregate demand more sensitive to interest rate changes and encouraging formal, regulated economic engagement (Cull, *et al.*, 2012; Ozili, 2018; Ahamed and Mallick, 2019). Therefore, financial inclusion promotes financial stability by preventing a large informal sector from impeding monetary policy transmission and financial sector supervision (Ozili, 2020; Pham and Doan 2020; Frączek, 2019; Danisman and Tarazi, 2020; Kamal *et al.*, 2021; Ozili, 2021a; Anarfo *et al.*, 2022).

Including the lagged dependent variable in our model may cause under-confidence in the results since it correlates with the dependent variable (Plümper *et al.*, 2005). Noteworthy, when the lagged value of financial stability is dropped as an independent variable in the model, all three indicators of financial inclusion are found to have a positive and statistically significant impact on financial stability across quantiles. This lends credibility to the conclusion that current levels of financial inclusion are important and positive predictors of financial stability in SSA.

Table 4: Quantile Regression Results

Panel 1									
Regressors	**10th Quantile**	**20th Quantile**	**30th Quantile**	**40th Quantile**	**50th Quantile**	**60th Quantile**	**70th Quantile**	**80th Quantile**	**90th Quantile**
	1.012***	0.983***	0.957***	0.939***	0.92***	0.895***	0.872***	0.846***	0.816***
L_INCL_1	(0.170)	(0.134)	(0.112)	(0.102)	(0.988)	(0.11)	(0.132)	(0.162)	(0.203)
	1.019**	0.881**	0.763***	0.679**	0.587**	0.469	0.365	0.239	0.099
L_GDPPC	(0.448)	(0.353)	(0.291)	(0.266)	(0.261)	(0.291)	(0.344)	(0.426)	(0.532)
	0.016	0.010	0.006	0.002	-0.001	-0.006	-0.01	-0.015	-0.021*
PSC	(0.011)	(0.008)	(0.007)	(0.006)	(0.006)	(0.007)	(0.001)	(0.01)	(0.013)
	0.002	0.001	0.000	0.002	-0.001	-0.002	-0.003**	-0.004**	-0.005**
INF	(0.002)	(0.002)	(0.001)	(0.006)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Observation	555	555	555	555	555	555	555	555	555
Panel 2									
Regressors	**10th Quantile**	**20th Quantile**	**30th Quantile**	**40th Quantile**	**50th Quantile**	**60th Quantile**	**70th Quantile**	**80th Quantile**	**90th Quantile**
	0.598***	0.572***	0.552***	0.541***	0.523***	0.504***	0.484***	0.458***	0.436***
L_INCL_2	(0.109)	(0.085)	(0.071)	(0.064)	(0.061)	(0.064)	(0.077)	(0.1)	(0.122)
	0.776	0.639	0.539*	0.481	0.387	0.292	0.185	0.049	-0.064
L_GDPPC	(0.504)	(0.391)	(0.325)	(0.298)	(0.281)	(0.299)	(0.357)	(0.46)	(0.562)
	0.013	0.007	0.004	0.001	-0.002	-0.006	-0.01	-0.012	-0.019*
PSC	(0.010)	(0.008)	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)	(0.012)
	0.002	0.001	-0.000	-0.001	-0.002	-0.003**	-0.004**	-0.005***	-0.006***
INF	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Observation	555	555	555	555	555	555	555	555	555
Panel 3									
Regressors	**10th Quantile**	**20th Quantile**	**30th Quantile**	**40th Quantile**	**50th Quantile**	**60th Quantile**	**70th Quantile**	**80th Quantile**	**90th Quantile**
	0.753***	0.718***	0.695***	0.679***	0.659***	0.635***	0.608***	0.579***	0.549***
INCL_PCA	(0.139)	(0.105)	(0.088)	(0.08)	(0.076)	(0.081)	(0.098)	(0.124)	(0.153)
	0.786	0.637*	0.543*	0.476	0.391	0.291	0.179	0.054	-0.067
L_GDPPC	(0.506)	(0.384)	(0.324)	(0.294)	(0.279)	(0.299)	(0.358)	(0.124)	(0.56)
	0.013	0.007	0.004	0.001	-0.002	-0.006	-0.01	-0.015	-0.019*
PSC	(0.01)	(0.008)	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)	(0.012)
	0.002	0.001	-0.000	-0.001	-0.002	-0.002	-0.004**	-0.005***	-0.006***
INF	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Observation	555	555	555	555	555	555	555	555	555

Source: Authors' composition using xtqreg command in STATA 17.
Note: Coefficients (standard errors) are outside (inside) the parentheses. ***, **, and * denote the statistical significance at 1%, 5% and 10%, respectively.

4.3 Results of the Augmented Mean Group (AMG) Model

We further examine whether the level of economic development in the 37 SSA nations influences financial inclusion differentially. In this context, we examine how financial inclusion affects financial stability in SSA country groups with low, lower-middle, and upper medium incomes[3], respectively, using the AMG technique. The results of the AMG model based on SSA country income groups are presented in three panels in Table 5.

In Panel 1, the impact of financial inclusion as proxied by the number of bank branches per 100,000 adults (L_INCL_1) has a positive impact on financial stability in lower-middle-income countries. In this regard, a one percent increase in *L_INCL_1* increases financial stability by 0.113 percentage points, *ceteris paribus*. A similar finding was discovered by Barik and Lenka (2023). Financial inclusion in lower-middle-income countries boosts job creation, economic growth, and financial sector stability by providing affordable financial services and products, reducing savings withdrawal during crises (Hannig and Jansen 2010; Dienillah *et al.*, 2018). In Panel 2, financial inclusion as proxied by the number of ATMs per 100,000 adults is positive and highly statistically significant in all country income groups. ATMs provide economic agents with reliable, affordable physical banking services in less developed financial sectors, enabling better control of financial activities and tracking of spending, especially when adding bank branches comes at a significant cost (Ozili, 2021b). In Panel 3, the composite indicator of financial inclusion $INCL\_PCA$ also has a positive and highly statistically significant impact on financial stability in all country income groups. This finding is similar to that found by Zhang and Posso (2019) and Aracil et al., (2022), who point out that increased financial inclusion, especially to low-income households reduces income inequality and thus contributes to financial stability. This is also in line with the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983) that suggests that greater financial inclusion, especially in poorer economies, relative to more developed economies, supports the development of markets essential for economic growth, poverty reduction and financial stability (Aracil et al., 2022).

[3] The list of SSA countries by country groups is presented in Appendix A4.

Table 5: Long-Run Augmented Mean Group Results by Country Income Group

Panel 1

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
L_INCL_1	0.407 (0.067)	0.113* (0.064)	0.025 (0.099)
L_GDPPC	0.020 (0.111)	-0.404** (0.179)	-0.227 (0.387)
PSC	-0.190*** (0.005)	-0.003 (0.004)	-0.006** (0.002)
INF	-0.001 (0.001)	0.000 (0.001)	0.000 (0.003)
Observation	255	255	255

Panel 2

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
L_INCL_2	1.794*** (0.031)	2.063*** (0.509)	1.779*** (0.112)
L_GDPPC	-0.162 (0.152)	-0.539** (0.261)	-0.071 (0.204)
PSC	-0.014*** (0.004)	-0.006* (0.004)	-0.003** (0.001)
INF	-0.000 (0.001)	0.001 (0.001)	-0.000 (0.003)
Observation	255	255	255

Panel 3

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
INCL_PCA	2.312*** (0.322)	2.621*** (0.062)	2.327*** (0.807)
L_GDPPC	-0.151 (0.167)	-0.562** (0.267)	-0.052 (0.226)
PSC	-0.015*** (0.004)	-0.006* (0.003)	-0.003*** (0.001)
INF	-0.001 (0.001)	0.001 (0.001)	0.000 (0.003)
Observation	255	255	255

Source: Authors' composition using xtmg command with the amg option, in STATA 17.
Note: Coefficients (standard errors) are outside (inside) the parentheses. ***, **, and * denote the statistical significance at 1%, 5% and 10%, respectively.

4.4 Robustness Check

As a robustness check, we run the Augmented Mean Group (AMG) model and use three different macroeconomic control variables to those used in our research thus far. This was done in accordance with the literature (see Eichengreen, 1998; Hardy and Pazarbaşioğlu, 1999; Sahminan, 2007; Donath and Cismas, 2008; Obstfeld et al., 2010) and the availability of country level data. The variables comprise external debt stocks as a percent of gross national income (DEBT), gross savings as a percent of GDP (SAVE) and the official exchange rate - local currency unit per US$, period average (ER). The results of the AMG model based on SSA country income groups and three different control variables are presented in three panels in Table 6. The results broadly indicate that financial inclusion positively impacts financial stability, especially in low-income countries with low economic development.

Table 6: Long-Run Augmented Mean Group Results by Country Income Group with Different Control Variables

Panel 1

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
L_INCL_1	-0.001 (0.395)	1.116*** (0.279)	0.158 (0.803)
DEBT	-0.034*** (0.009)	0.003 (0.008)	0.014 (0.009)
SAVE	0.186*** (0.05)	0.038 (0.029)	0.072 (0.056)
ER	-5.15e-09*** (9.93e-10)	-1.93r-09*** (5.39e-10)	-7.11e-11 (1.48e-09)
Observation	255	255	255

Panel 2

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
L_INCL_2	0.654** (0.328)	0.576 (0.402)	-0.008 (0.614)
DEBT	0.004 (0.008)	0.007 (0.007)	0.012 (0.009)
SAVE	0.028 (0.244)	0.019 (0.021)	0.087 (0.057)
ER	-1.44e-09*** (4.26e-10)	-1.94e-09*** (7.51e-10)	-6.30e-10 (1.45e-09)
Observation	255	255	255

Panel 3

Regressors	**Lower-Income Countries Coefficient**	**Lower-Middle-Income Countries Coefficient**	**Upper-Middle-Income Countries Coefficient**
INCL_PCA	0.793*** (0.352)	0.622* (0.346)	0.086 (0.586)
DEBT	0.004 (0.009)	0.006 (0.009)	0.011 (0.009)
SAVE	0.018 (0.024)	-0.002 (0.018)	0.086 (0.057)
ER	-1.36e-09*** (4.18e-10)	-1.90e-09** (7.50e-10)	-4.46e-10 (1.142e-09)
Observation	255	255	255

Source: Authors' composition using xtmg command with the amg option, in STATA 17.
Note: Coefficients (standard errors) are outside (inside) the parentheses. ***, **, and * denote the statistical significance at 1%, 5% and 10%, respectively.

5 CONCLUSION AND POLICY RECOMMENDATIONS

This study aimed to investigate the impact of financial inclusion on financial stability across 37 countries in the SSA region using country level data that spans from 2005 to 2019. We first constructed composite indicators of financial inclusion and financial stability using principal component analysis (PCA). Cross-sectional dependence tests showed cross-sectional dependence among 37 SSA countries. The Dynamic Common Correlated Effects (DCCE) model confirms that financial inclusion, proxied by number of bank branches per 100,000 adults positively impacts financial stability in 37 SSA countries. The Quantile Regression (QREG) model and Augmented Mean Group (AMG) estimator confirm that financial inclusion positively impacts financial stability across low-income and upper-middle income SSA countries and in SSA countries with low levels of financial stability, in line with the institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983). Furthermore, the study found that the preceding period's financial stability had a favorable and statistically significant influence on the present period's financial stability. The consequence is that measures taken to advance financial inclusion and stability in one or more countries may have a spillover effect on other nations. A stable financial system is also vital to give nations the financial cushion they need to be robust through shocks and efficiently handle crises.

Given these results, policymakers should improve coordination between pertinent regulatory and supervisory organizations to full enjoy the spillover effect found in our study, as policies and initiatives aimed at enhancing financial inclusion at the national and regional levels, particularly in low-income and lower-middle income countries, have the potential to improve financial stability in the region. Governments, supervisors, and regulators should thus develop and use avenues for cross-fertilization of skills and capacities necessary to rise to the challenge of aligning with international financial regulatory standards such as the Basel Core Principles for Effective Banking Supervision (BCPs), Basel II, Basel III, and International Financial Reporting Standards (IFRS), as well as to meet the increased pressure on financial regulation and supervision in SSA.

Governments should also build on the advancements made in the creation of national financial inclusion strategies (NFIs) and implement intentional policies to target financially excluded populations, such as small businesses, people living in remote locations, and the poor, and increase their access to financial services and products. Likewise, governments might think about stepping up their efforts to promote financial literacy, particularly among low-income groups. By doing this, it will be easier for people to access financial services and products, and financial institutions like banks will have more opportunities to use a larger pool of savings and deposits to finance the additional credit extension required for economic growth.

Appendix

A1: List of 37 sub-Saharan African countries used in this study.

No.	Country	No.	Country
1	Angola	**20**	Mauritius
2	Burundi	**21**	Malawi
3	Benin	**22**	Namibia
4	Burkina Faso	**23**	Niger
5	Botswana	**24**	Nigeria
6	Cote d'Ivoire	**25**	Rwanda
7	Cameroon	**26**	Sudan
8	Capo Verde	**27**	Republic of Congo
9	Chad	**28**	Senegal
10	Eswatini	**29**	Seychelles
11	Gabon	**30**	Sierra Leone
12	Guinea	**31**	South Africa
13	The Gambia	**32**	South Sudan
14	Kenya	**33**	Togo
15	Lesotho	**34**	Tanzania
16	Madagascar	**35**	Uganda
17	Mali	**36**	Zambia
18	Mozambique	**37**	Zimbabwe
19	Mauritania		

A2: Descriptive Statistics

	Mean	Standard Deviation	Minimum	Maximum
FINSTAB_1	69.504	32.988	-1.050	564.576
L_FINSTAB_2	2.578	.052	2.473	2.688
FINSTAB_3	38.861	19.498	-35.302	117.226
FINSTAB_PCA	0	1.218	-3.939	10.546
L_INCL_1	1.385	.936	-1.028	4.009
L_INCL_2	1.543	1.507	-3.054	4.5
INCL_PCA	0	1.355	-3.797	3.366
L_GDPPC	7.218	.952	5.599	9.74
PSC	24.525	31.36	-18.967	187.784
INF	8.595	22.36	-8.975	380

Source: Authors' composition using STATA 17.

A3: Pairwise Correlation with Probabilities

Variables	*FINSTAB_1*	*L_FINSTAB_2*	*FINSTAB_3*	*FINSTAB_PCA*	*L_INCL_1*	*L_INCL_2*	*INCL_PCA*	*L_GDPPC*	*PSC*	*INF*
FINSTAB_1	1.000									
L_FINSTAB_2	0.034	1.000								
	(0.417)									
FINSTAB_3	-0.474	-0.061	1.000							
	(0.000)	(0.151)								
FINSTAB_PCA	0.851	0.169	-0.855	1.000						
	(0.000)	(0.000)	(0.000)							
L_INCL_1	0.141	0.129	-0.265	0.249	1.000					
	(0.001)	(0.002)	(0.000)	(0.000)						
L_INCL_2	0.108	0.51	-0.212	0.242	0.285	1.000				
	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)					
INCL_PCA	0.112	0.481	-0.218	0.245	0.287	0.998	1.000			
	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
L_GDPPC	0.057	0.026	-0.190	0.145	0.688	0.046	0.046	1.000		
	(0.183)	(0.539)	(0.000)	(0.001)	(0.000)	(0.280)	(0.284)			
PSC	0.391	0.018	-0.258	0.375	0.463	0.042	0.043	0.425	1.000	
	(0.000)	(0.681)	(0.000)	(0.000)	(0.000)	(0.322)	(0.314)	(0.000)		
INF	-0.217	0.037	0.234	-0.255	-0.109	0.048	0.045	-0.044	-0.097	1.000
	(0.000)	(0.381)	(0.000)	(0.000)	(0.010)	(0.249)	(0.288)	(0.298)	(0.023)	

Source: Authors' composition using STATA 17.
Note: Probabilities are in parenthesis

A4: List of Sub-Saharan African countries by country groups

Country	Income Classification
Burundi	Low-Income
Burkina Faso	Low-Income
Chad	Low-Income
Guinea	Low-Income
The Gambia	Low-Income
Madagascar	Low-Income
Mali	Low-Income
Mozambique	Low-Income
Malawi	Low-Income
Niger	Low-Income
Rwanda	Low-Income
Sudan	Low-Income
Sierra Leone	Low-Income
South Sudan	Low-Income
Togo	Low-Income
Uganda	Low-Income
Zambia	Low-Income
Angola	Middle-Income
Benin	Middle-Income
Cote d'Ivoire	Middle-Income
Cameroon	Middle-Income
Capo Verde	Middle-Income
Eswatini	Middle-Income
Kenya	Middle-Income
Lesotho	Middle-Income
Mauritania	Middle-Income
Nigeria	Middle-Income
Republic of Congo	Middle-Income
Senegal	Middle-Income
Tanzania	Middle-Income
Zimbabwe	Middle-Income
Botswana	Upper-Middle Income
Gabon	Upper-Middle Income
Mauritius	Upper-Middle Income
Namibia	Upper-Middle Income
South Africa	Upper-Middle Income

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