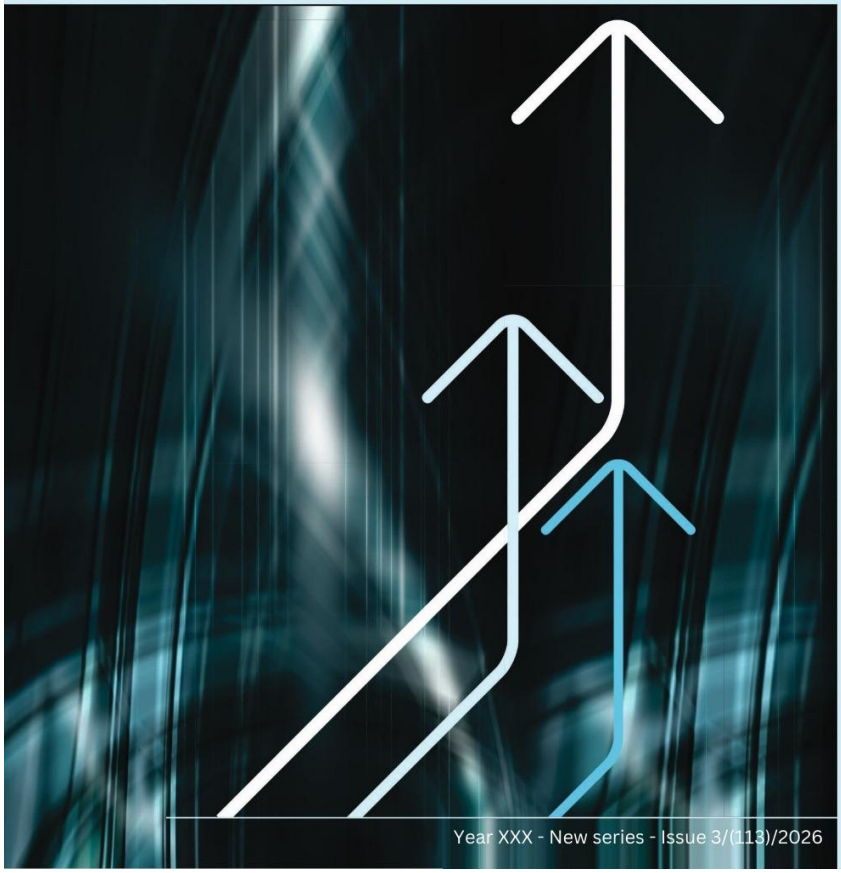
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THE NEXUS BETWEEN FINANCIAL INCLUSION, FINANCIAL STABILITY AND ECONOMIC GROWTH IN THE COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA REGION: A CS-ARDL APPROACH

Elhame Derese ADEME, PhD Student*
Patricia L. MAKONI, PhD**

Abstract

This study examines the long-run relationship among financial inclusion, financial stability and economic growth in the Common Market for Eastern and Southern Africa (COMESA) region, utilising panel data from 2007 to 2022. To account for the multidimensional nature of financial inclusion and financial stability, we constructed composite indices for each variable using Principal Component Analysis (PCA). We employed second-generation unit root tests to determine the order of integration of the variables and the Cross-Sectional Augmented Autoregressive Distributed Lag (CS-ARDL) model, which accounts for cross-sectional dependence and mixed levels of integration. The test results indicate the presence of slope heterogeneity and cross-sectional dependence in the panel dataset. The error-correction model confirms strong long-run cointegration among financial inclusion, financial stability, and economic growth in the COMESA region. The results indicate that financial stability and economic growth enhance financial inclusion in the long run. Specifically, we state that the COMESA region's economic growth increased by 1.7% for every 1% increase in financial inclusion. Overall, the findings confirm that enhancing financial inclusion improves financial sector stability and that a stable financial system increases economic growth. Therefore, since both are necessary to improve financial inclusion in COMESA, we advise policymakers to focus on policies and strategies that strengthen the financial system and enhance economic growth in the region.

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1. Introduction

Financial inclusion is considered a key catalyst for achieving the African Union's Agenda 2063 and eight of the seventeen Sustainable Development Goals (SDGs) by 2030. Thus, sustainable financial inclusion practices that serve deprived groups are an inexcusable task for developing countries to undertake to alleviate current economic development shortfalls. Moreover, the role of inclusive finance in achieving the Sustainable Development Goals has received due consideration in the research literature (Ozili, 2022). Likewise, an inclusive financial system will help developing countries to reduce poverty and income inequality; enhance the innovation and investment capacity of small and medium enterprises (Omar & Inaba, 2020). Additionally, an inclusive financial system has a profound ripple effect on the socio-economic aspects of developing countries, and it is reported in several empirical studies, which include women's empowerment, increased savings, starting up businesses, and supporting innovation (Swamy, 2014; Mishra et al., 2024).

There are two conflicting views in the literature on the link between inclusive finance and financial stability. The first view argues that financial inclusion enhances financial stability; for instance, increasing access to and use of financial services by small and medium enterprises (SMEs) will increase bank deposits, diversify credit and risk, and enhance social integrity. The other view holds that financial inclusion undermines financial stability, as it entails financial service costs and exposes financial institutions to the risk of credit default (Mehrotra & Yetman, 2015; Čihák et al., 2016). Likewise, financial stability could hamper financial inclusion by prioritising profit and avoiding risky customers. Conversely, financial stability can build confidence in the financial system, leading to increased use of financial services and products (Mehrotra & Yetman, 2015).

The relationship between financial inclusion and economic growth can be explained by the demand-following and supply-leading theories. A previous study showed a long-term relationship among economic growth, financial inclusion, and control factors in the full

panel, income-level, and regional-level economies using the panel cointegration test (Azimi, 2022). Using an empirical study, a positive long-run relationship between inclusive finance and economic growth has been reported (Sethi & Sethy, 2019; Singh & Stakic, 2020). Conversely, a negative linkage between financial inclusion and economic growth has been presented in other studies (Menyelim et al., 2021; Odame et al., 2024).

Lastly, the present study highlights the long-run association between financial inclusion, financial stability and economic growth in the COMESA region. The empirical estimation has been carried out employing a strong methodological approach. The presence of ambiguous findings and the lack of thorough regional and national studies examining the linkages among financial inclusion, financial stability, and economic growth are the main gaps identified for conducting this study in the COMESA region, where there are attempts at economic integration and varying levels of financial inclusion. The cross-sectionally augmented ARDL (CS-ARDL) approach, suggested by Chudik et al. (2016), has been employed to examine the long-run relationship between financial inclusion, financial stability and economic growth since it considers a) mixed order of integration, b) heterogeneity, and c) cross-sectional dependence.

The remainder of the paper is structured as follows: Section 2 reviews the literature; Section 3 outlines the methodological approaches; and Section 4 presents and discusses the findings. Section 5 concludes the paper with conclusions and recommendations.

2. Literature Review

To develop long-run, coordinated financial and economic policy in the COMESA region, it is essential to understand and examine how financial inclusion, financial stability, and economic growth interact and evolve on a theoretical foundation. Therefore, we use demand-following and supply-leading theory, endogenous growth theory, financial intermediation theory, and monetarist and cyclical theories as the theoretical foundation for this investigation.

The demand-following and supply-leading theories explain the relationship between financial inclusion and economic growth. On the one hand, the demand-following hypothesis argues that the financial system will be improved given that there is an economic expansion (Robinson, 1952). This means the need for financial services or products is realised during economic expansion. On the other hand,

the supply-leading theory hypothesises that financial development leads to economic expansion (Schumpeter, 1911; Patrick, 1966). Past studies also reaffirmed the concept of Schumpeter (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973).

Previous studies have supported the widely accepted view that financial structure accelerates economic growth (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973). In this view, financial intermediation plays a pivotal role in economic growth by efficiently allocating financial resources to boost economic activity, despite information asymmetry (Levine et al., 2000). The presence of effective financial intermediation allows access to financial services, especially for disadvantaged populations, thereby promoting inclusive economic growth. This means that by widening access to financial services for firms and individuals, it is possible to address their financial constraints and, consequently, enhance firm productivity and secure individual welfare.

Numerous studies have also shown the positive influence of financial inclusion on economic growth (Demirgüç-Kunt et al., 2017; Kim et al., 2018; Makina & Walle, 2019). In a related concept, access to financial services helps to minimise inequality and poverty (Omar & Inaba, 2020). Conversely, a lack of access to formal financial services creates obstacles to entrepreneurship, investment, and innovation in a given economy; consequently, firms facing financial constraints will experience limited growth and productivity, which, in turn, affects aggregate economic growth (Claessens & Perotti, 2007).

The positive role of financial inclusion on the economy has been discussed, considering the role of human capital (Boachie & Adu-Darko, 2024). Endogenous growth theory argues that financial inclusion supports long-run economic expansion by improving human capital, innovation, and entrepreneurship (Chirwa & Odhiambo, 2018).

Basically, financial inclusion contributes to economic expansion mainly in two ways:

(a) offering low-cost financial services to poor people, it helps improve their livelihoods. This means poor people can engage in small-scale businesses, become economically independent, and contribute to aggregate economic growth.

(b) promoting savings and insurance services, inclusive finance can increase funds available in the financial sector to be utilised for investment and reduce liquidity problems (Sethi & Sethy, 2019).

According to the financial intermediation theory, financial sectors play a significant role in mobilising savings, facilitating credit

and minimising information asymmetry. This intermediation role is reinforced by a stable financial system, which gives households and small businesses confidence and enables financial institutions to offer loans. Thus, this theory argues that financial stability promotes financial inclusion.

There are two theories which are usually recalled to explain financial instability. The first thought belongs to the monetarists' view, which emphasises that instability arises due to errors in monetary policy, which disrupt the money supply (Friedman & Schwartz, 1963). In order to get the desired outcome from implementing a given monetary policy, it is required to understand the ways (e.g. interest rate effects, exchange rate effects, and the credit channel) by which the policy influences the economy (Mishkin, 1995). The second school of thought is the cyclical theories, which state that financial instabilities come from the presence of information asymmetry, irrational behaviour and market imperfections (Minsky, 1977; Kindleberger, 1978/1996). Information asymmetry between borrowers and lenders can lead to adverse selection and moral hazard before and during financial market transactions. Moreover, aggressive financial inclusion practices may lead to adverse selection and moral hazard, which also explain behaviours that risk the interests of lenders in a given contract due to information asymmetry.

There are mixed findings on the relationship between financial inclusion and financial stability in the literature (Damane & Ho, 2024), while others showed that there is a synergy that requires the presence of strong institutions (Meyer & Rowan, 1977). Likewise, financial inclusion cannot be achieved in the presence of financial instability, and conversely, financial stability cannot be achieved in the presence of significant financial exclusion (Khan, 2011). Another study also discussed that synergies between financial inclusion and financial stability can be generated in the presence of an enabling regulatory framework, lower transaction costs and technological innovations (Khan, 2011). In the presence of high institutional quality, the practice of inclusive finance has a favourable effect on financial stability (Pham & Doan, 2020; Hakimi et al., 2022; Antwi et al., 2024). In a similar vein, enhanced financial inclusion practice requires regulatory and supervisory frameworks (Sethy & Goyari, 2022; Koudalo & Toure, 2023).

The negative influence of financial inclusion on financial stability mainly arises due to aggressive financial inclusion practices,

which result in information asymmetry, increased financial service costs, and risks of credit default during attempts to reach out to the deprived individuals and firms found in new and remote locations (Mehrotra & Yetman, 2015; Sahay, 2015; Čihák et al., 2016). Table 1 summarises recent empirical findings on the link between financial inclusion (FI) and financial stability (FS).

Table 1

Summary of empirical findings on FI and FS links

Authors	Sample	Financial stability proxy	Method	Effect of FI and FS
Pham & Doan (2020)	42 countries, Asian countries 2011, 2014, 2017	Bank Z-score	Fixed effects regression and random effects regression	+
Hakimi et al. (2022)	38 banks from 10 Middle East and North Africa (MENA) countries	Bank Z-score	Two-step system GMM	+
Antwi et al. (2024)	60 selected developing countries 2002-2019	ratio of capital, credit risk, and liquidity	System GMM	+ and -
Sethy & Goyari (2022)	Seven South Asian countries 2004-2018	Z-score	FMOLS and DOLS	+
Koudalo & Toure (2023)	54 African countries 2000-2020	Z-score	GMM	+

Note: FI stands for financial inclusion, and FS stands for financial stability

Source: authors' compilation

Schularick and Taylor (2012) reported that rapid credit expansions are often precursors to financial crises. In addition, the practice of excessive inclusive finance may cause adverse selection and moral hazard issues since the underserved portion of the population lacks credit history and collateral requirements (Kebede et al., 2024). On the other hand, financial stability can increase people's confidence in the financial system, which will improve financial inclusion (Mehrotra & Yetman, 2015) and the probability that people will utilise formal services. Past studies also remarked that the presence of long-run links between financial inclusion and financial stability (Anarfo et al., 2019; Jungo et al., 2024).

Table 2

Summary of empirical findings of FI and EG links

Authors	Sample	Financial inclusion proxy	Method	Effect of FI on EG
Kim et al. (2018)	51 Organisation of Islamic Cooperation (OIC) countries 1990–2013	Financial inclusion index	Panel VAR, IRFs	+
Ifediora et al. (2022)	22 Sub-Saharan Africa (SSA) countries 2012 -2018	Composite index of financial inclusion	System GMM	+
Jima & Makoni (2023)	26 SSA countries 2000–2019	Financial inclusion index	System GMM and ARDL	+
Odame et al. (2024)	Ghana 2005–2016	Access, usage and penetration (depth)	FMOLS and DOLS	-
Mir et al. (2023)	53 Developing nations	FII using 10 variables	CS-ARDL	+
Hussain et al. (2024)	21 Asian countries 2004-2019	Five proxies (supply-side proxies) to construct the index		+
Singh & Stakic (2020)	8 countries from the South Asian Association for Regional Cooperation (SAARC) member states 2004- 2013	FII (demographic, geographic and usage	FMOLS and DOLS	+
Gebrehiwot & Makina (2019)	27 African countries	Financial inclusion index	GMM	+
Makina & Walle (2019)	42 African Countries 2004- 2014	Number of commercial bank branches per 100,000 people	System GMM	+
Adedokun & Ağa (2021)	36 SSA countries 2004–2017	FI index considering penetration, availability and usage dimensions	GMM	+

Note: FI stands for financial inclusion, and EG stands for economic growth

Source: authors' compilation

There are two contrasting pieces of empirical evidence, with most scholars supporting a positive link, while a few studies showed the presence of a negative relationship between financial inclusion and

economic growth (Table 2). Previous findings showed that financial inclusion has a positive long-term effect on economic growth (Kim et al., 2018; Ifediora et al., 2022; Jima & Makoni, 2023). Negative links between financial inclusion and economic growth have been reported in previous studies (Menyelim et al., 2021; Odame et al., 2024). Previous studies applied the CS-ARDL model to examine the long-run links between financial inclusion and economic growth across various regions (Mir et al., 2023; Hussain et al., 2024).

3. Methodology

3.1. Research approach, data and data sources

To empirically examine the relationships among financial inclusion, financial stability, and economic growth, this study adopts a quantitative research approach. The approach supports reliable, broadly applicable results and enables objective hypothesis testing. The study uses panel data for 17 COMESA member countries from 2007 to 2022 to examine the cointegration among financial inclusion, financial stability, and economic growth. However, due to data unavailability in our study area, we decided to consider only 17 out of the 21 member countries of the COMESA region. The choice of the panel data set mainly depends on the availability of data in the study area. The data for the study variables are obtained mainly from the World Development Indicators (WDI), International Financial Statistics (IFS), Global Financial Development (GFD), and Financial Access Survey (FAS) databases of the International Monetary Fund (IMF).

Table 3

Variables and other abbreviations

Abbreviation	Full term	Type
FII	Financial inclusion index	Variable
FSI	Financial stability index	Variable
EG	Economic growth	Variable
CS-ARDL	Cross-Sectionally Augmented Autoregressive Distributed Lag	Methodology
MG	Mean group	Methodology
PMG	Pooled mean group	Methodology
CIPS	Cross-sectional Im, Pesaran, and Shin test	Methodology
CADF	Cross-sectional augmented Dickey-Fuller test	Methodology
PCA	Principal components analysis	Methodology

Source: authors' work

The main study variables are financial inclusion, financial stability, and economic growth. Economic growth is measured by GDP per capita (in constant 2015 US dollars). This study employed indices constructed through principal component analysis to measure financial inclusion and financial stability variables, as discussed in the following section.

3.2. Principal Component Analysis

Principal Component Analysis (PCA) has been employed to develop the indices for financial inclusion and financial stability. The method allows us to avoid multicollinearity and measurement errors and to obtain robustness in estimation (Sarma, 2016). In this study, the financial inclusion index has been constructed using a two-step PCA that accounts for geographic, demographic, and usage dimensions (Singh & Stakic, 2020). Thus, the study considers two indicators (number of ATMs per 1000 km² area and number of bank branches per 1000 km² area) for geographic penetration, three indicators (number of ATMs per 100,000 adults, number of bank branches per 100,000 adults, and number of bank accounts per 1000 adults) for demographic penetration, and two indicators (outstanding deposits as a percentage of GDP and outstanding loans as a percentage of GDP) for the bank usage dimension. Similarly, the index of financial stability has been determined based on bank Z-scores, bank credit-to-deposit ratios, liquid assets-to-deposits ratios, and short-term funding measures of stability.

3.3. Test for slope heterogeneity

The slope homogeneity test is a test used to verify whether the impact of the independent variable is identical or consistent across the panel. Thus, before estimating the long-term links between the study variables, it is essential to examine whether the slope coefficients are homogeneous or consistent across the COMESA member countries. Therefore, to assess slope homogeneity, this study has employed the Pesaran and Yamagata (2008) and Blomquist and Westerlund (2013) tests. Moreover, the slope homogeneity test employed herein was discussed in a previous study (Pesaran & Yamagata, 2008), which is essentially derived from the test developed by Swamy (1970). In both tests, the null hypothesis assumes that the slope coefficients are homogeneous across panel units, whereas the alternative hypothesis assumes they are heterogeneous.

3.4. Test for cross-sectional dependence

Strong cross-sectional dependence occurs when economic shocks affect multiple sectors in a panel dataset. Nowadays, due to the effect of globalisation, countries are highly dependent on each other, especially in regional economic groups like COMESA, characterised by regional economic, financial, and trade integration. Thus, it is appropriate to check for cross-sectional dependence in our panel data. Moreover, traditional econometric techniques yield biased results when cross-sectional dependence is not properly accounted for. Thus, it is crucial to evaluate the cross-sectional dependence of the panel data before proceeding to estimation techniques (Pesaran, 2015).

3.5. Panel unit root tests

Before evaluating cointegration and causality tests, it is essential to define the order of integration of the considered study variables. The time series behaviour of macroeconomic variables shows a trend that is attributed to non-stationary observations. Since there is cross-sectional dependency, the first-generation unit root test is not applicable. Thus, this study applied second-generation unit root tests such as cross-sectional Im, Pesaran, and Shin (CIPS) and cross-sectional augmented Dickey-Fuller (CADF) unit root tests to evaluate cross-sectional dependency (Im et al., 2003; Pesaran, 2007).

$$Y_{i,t} = a_i + b_i Y_{it-1} + c_i \overline{Y}_{t-1} \sum_{j=0}^{s} d_{ij} \Delta \overline{Y}_{t-j} + \sum_{j=1}^{s} \delta_{ij} \Delta \overline{Y}_{it-j} + \varepsilon_{it} \quad (1)$$

In addition, Pesaran (2007) suggests a cross-sectional augmented version of the IPS test, which is presented in the framework of Im, Pesaran and Shin (2003). The CADF regression model is used to calculate the CIPS in equation (2).

$$CIPS = N^{-1} \sum_{i=1}^{N} CADF_i \quad (2)$$

where CADF denotes the cross-sectionally augmented Dickey-Fuller statistic for the i^{th} cross-sectional unit given by the t-ratio of b_i in the CADF regression equation (2).

3.6. Empirical model specification

The panel cross-sectionally augmented ARDL model suggested in previous studies (Chudik et al., 2016) has been proposed herein after preliminary studies since it considers a) mixed order of integration, b) heterogeneity, and c) cross-sectional dependence. This

model has been employed to estimate both short- and long-run links among financial inclusion, financial stability, and economic growth in the COMESA region. The cross-sectionally augmented ARDL (CS-ARDL) approach estimates both the short-and long-run coefficients (Chudik et al., 2016).

Therefore, equation (3) shows the specification of the panel CS-ARDL model, which is stated based on a previous study by Chudik et al. (2016).

$$y_{i,t} = \sum_{l=1}^{k_y} \varphi_{i,l} y_{i,t-l} + \sum_{l=0}^{k_x} \beta'_{i,l} x_{i.t-l} + \sum_{l=0}^{k_w} \lambda'_{i,l} w_{i.t-l} + \sum_{l=0}^{k_z} \delta'_{i,l} \overline{z}_{t-l} + \alpha_i + \omega_i \tau + \varepsilon_{i,t} \quad (3)$$

By substituting y = *FI; x = FS and w = EG*, we can rewrite equation (3) as:

$$FI_{i,t} = \sum_{l=1}^{k_y} \varphi_{i,l} FI_{i,t-l} + \sum_{l=0}^{k_x} \beta'_{i,l} FS_{i.t-l} + \sum_{l=0}^{k_w} \lambda'_{i,l} EG_{i.t-l} + \sum_{l=0}^{k_z} \delta'_{i,l} \overline{z}_{t-l} + \alpha_i + \omega_i \tau + \varepsilon_{i,t} \quad (3a)$$

$$FS_{i,t} = \sum_{l=1}^{k_y} \varphi_{i,l} FS_{i,t-l} + \sum_{l=0}^{k_x} \beta'_{i,l} FI_{i.t-l} + \sum_{l=0}^{k_w} \lambda'_{i,l} EG_{i.t-l} + \sum_{l=0}^{k_z} \delta'_{i,l} \overline{z}_{t-l} + \alpha_i + \omega_i \tau + \varepsilon_{i,t} \quad (3b)$$

$$EG_{i,t} = \sum_{l=1}^{k_y} \varphi_{i,l} EG_{i,t-l} + \sum_{l=0}^{k_x} \beta'_{i,l} FS_{i.t-l} + \sum_{l=0}^{k_w} \lambda'_{i,l} FI_{i.t-l} + \sum_{l=0}^{k_z} \delta'_{i,l} \overline{z}_{t-l} + \alpha_i + \omega_i \tau + \varepsilon_{i,t} \quad (3c)$$

where $\overline{z}_{t-l}$ refers to lagged cross-sectional averages given as $\left[\overline{z}_{t-l} = \left(\overline{y}_{i,t-l}, \overline{x}_{i,t-l}, \overline{w}_{i,t-l}\right)\right]$.

In addition, δ refers to the set of parameters related to country-specific factor loadings, α_i is the country-specific intercept, τ represents the linear time trend, and $\varepsilon_{i,t}$ is the idiosyncratic error term. Note that the parameters φ and ω, as well as the sets of parameters β, λ and δ are heterogeneous coefficients randomly distributed around a common mean with unit-specific noise. The lag term is selected based on the Akaike Information Criterion (AIC).

Moreover, the mean group and pooled mean group estimators are used directly to estimate the coefficients (Chudik et al., 2016). The Mean group (MG) estimator assumes heterogeneous slope coefficients by performing panel-level time-series regressions and then averaging the coefficients. Whereas a combination of pooled and

heterogeneous estimations has been assumed by the pooled mean group (PMG) estimator. This means the pooled mean group (PMG) estimator assumes heterogeneity in the short-run and homogeneity in the long-run; it is also the most widely used estimator (Pesaran et al., 1999).

The Hausman (1978) test can be used to test for the homogeneity of long-run coefficients. Additionally, a previous study found that the pooled mean group estimator outperforms the MG estimator under the null hypothesis of no systematic variation across coefficients. Moreover, the CS-ARDL model can be rewritten into an error correction model (ECM) version, keeping its inferential behaviours (Ditzen, 2021). Thus, equations (3a) to (3c) can be restated as in equations (4a) to (4c).

$$\begin{aligned}\Delta FI_{i,t} = {} & \xi_i\left[FI_{i,t-l} - \theta_i^{'} FS_{i,t-1} - \phi_i^{'} EG_{i,t-1}\right] + \sum_{l=1}^{k_y-1} \vartheta_{i,l}\Delta_l FI_{i,t-1} \\ & + \sum_{l=0}^{k_x-1} \beta^{'}_{i,l}\Delta_l FS_{i.t} + \sum_{l=0}^{k_w-1} \lambda^{'}_{i,l}\Delta_l EG_{i,t-1} + \sum_{l=0}^{k_z} \delta_{il}^{'}\overline{z}_{t-1} + \omega_i\tau \\ & + u_{i,t}\end{aligned} \tag{4a}$$

$$\begin{aligned}\Delta FS_{i,t} = {} & \xi_i\left[FS_{i,t-l} - \theta_i^{'} FI_{i,t-1} - \phi_i^{'} EG_{i,t-1}\right] + \sum_{l=1}^{k_y-1} \vartheta_{i,l}\Delta_l FS_{i,t-1} \\ & + \sum_{l=0}^{k_x-1} \beta^{'}_{i,l}\Delta_l FI_{i.t} + \sum_{l=0}^{k_w-1} \lambda^{'}_{i,l}\Delta_l EG_{i,t-1} + \sum_{l=0}^{k_z} \delta_{il}^{'}\overline{z}_{t-1} + \omega_i\tau \\ & + u_{i,t}\end{aligned} \tag{4b}$$

$$\begin{aligned}\Delta EG_{i,t} = {} & \xi_i\left[EG_{i,t-l} - \theta_i^{'} FS_{i,t-1} - \phi_i^{'} FI_{i,t-1}\right] + \sum_{l=1}^{k_y-1} \vartheta_{i,l}\Delta_l EG_{i,t-1} \\ & + \sum_{l=0}^{k_x-1} \beta^{'}_{i,l}\Delta_l FS_{i.t} + \sum_{l=0}^{k_w-1} \lambda^{'}_{i,l}\Delta_l FI_{i,t-1} + \sum_{l=0}^{k_z} \delta_{il}^{'}\overline{z}_{t-1} + \omega_i\tau \\ & + u_{i,t}\end{aligned} \tag{4c}$$

The individual long-run coefficients are calculated as shown in the equation below.

$$\hat{\theta}_i = \frac{\sum_{l=0}^{k_x}\widehat{\beta_{i,l}}}{1-\sum_{l=1}^{k_y}\widehat{\varphi}_{i,l}},\ \widehat{\phi}_i = \frac{\sum_{l=0}^{k_w}\widehat{\lambda_{i,l}}}{1-\sum_{l=1}^{k_y}\widehat{\varphi}_{i,l}},\ \text{and}\ \hat{\theta}_{MG} = \frac{1}{N\sum_{i=1}^{N}\hat{\theta}_i} \tag{5}$$

where $\hat{\theta}_i$ denotes individual estimations of each cross-section. The parameter φ and the sets of parameters β and λ represent the short-run behaviour; Δ stands for the first difference operator; the square brackets have the error correction term; and i refers to the speed of

adjustment towards the long-run equilibrium. This means the parameter ξ_i indicates the speed at which the model converges to the long-run equilibrium state due to a shock. This requires that the estimated coefficient associated with the error correction term be negative.

Moreover, the CS-ARDL bound testing approach was selected mainly because it accounts for cross-sectional dependence, in addition to the following reasons (Carvelli, 2023): First, it allows the incorporation of lag terms for both the dependent and independent variables. Second, it applies to variables that are stationary at I(0), I(1), or any combination of the two. Third, CS-ARDL overcomes endogeneity difficulties and produces unbiased results. Fourth, this model is superior to other tests and yields consistent results even with small sample sizes.

3.7. Robustness check

To examine the robustness of the long-run estimates based on the CS-ARDL, this study employs the dynamic common correlated effects (DCCE) estimator, which is more robust because it accounts for cross-sectional dependence and heterogeneity across countries. The CS-ARDL has been employed to determine the ECM and to estimate short- and long-run relationships among the variables, and the DCCE estimator has been used to verify the consistency of the estimation. Thus, the DCCE estimator has been applied as a robustness check for the main estimator, CS-ARDL, and the results have been compared to evaluate the stability of the findings.

4. Data analysis and discussion

4.1. Summary of the descriptive statistics

Table 4 presents the summary of descriptive statistics (mean, standard deviation, minimum and maximum values) of each variable and it indicates that the maximum and minimum values of the two composite indices (i.e. FII and FSI) are between 0 and 1 since they are normalised using the min-max normalisation method. The summary statistics showed that financial stability and economic growth vary across countries, with financial stability ranging from 0 to 1 and economic growth from 5.57 to 9.73. This variation generally indicates that, in the COMESA region, economic and financial systems differ,

which may lead to varying levels of financial inclusion across the region.

Table 4

Summary of statistics

Variable	Obs	Mean	SD	Min.	Max.
Financial inclusion index	272	0.28	0.25	0	1
Financial stability index	272	0.43	0.21	0	1
Economic growth	272	7.39	1.16	5.57	9.73

Source: authors' computation

The results of both Pesaran and Yamagata (2008) and Blomquist and Westerlund (2013) slope homogeneity test reports are shown in Table 5 below. As it is confirmed by both Δ and adjusted Δ, the null hypothesis of slope homogeneity is rejected. This indicates that the relationships among financial inclusion, financial stability and economic growth are not uniform across the COMESA region.

4.2. Pre-diagnostic tests

Table 5

Slope homogeneity test

Homogeneity test	Pesaran & Yamagata (2008)	Blomquist & Westerlund (2013)
	Statistic	*Statistic*
Δ	4.220^{***}	7.413^{***}
$\Delta_{adjusted}$	5.168^{***}	9.079^{***}

Note: *** indicates significance at the 1% level

Source: authors' computation

After slope heterogeneity has been confirmed, we proceed to test for cross-sectional dependence to examine whether the long-run relationship among financial inclusion, financial stability and economic growth is affected by common crises across COMESA member countries. The cross-sectional dependency test results presented in Table 6 below show that the null hypothesis of no cross-sectional dependence is rejected at the 1% significance level. This implies that financial inclusion, financial stability, and economic growth are affected by common shocks that have occurred in the region, indicating that second-generation panel estimators are advisable for unit root tests and for estimating long-run relationships among the study variables.

Table 6

Cross-sectional dependency test

No	List of variables	CD test	CDW+ test
1	Financial inclusion index	5.02***	165.54***
2	Financial stability index	4.79***	186.99***
3	Economic growth	13.62***	312.26***

NB: The cross-sectional dependency test results confirm cross-sectional dependency across the panels. Thus, we conclude that cross-sectional dependency is strong in the study area.

Source: authors' computation

Once the presence of cross-sectional dependency has been confirmed, the next step is to test the stationarity of the study variables using second-generation unit root tests. The order of integration is tested using two second-generation unit root tests: the Cross-sectionally Augmented Im-Pesaran-Shin (CIPS) and the Cross-sectionally Augmented CADF tests (Pesaran, 2015). The unit root tests are determined based on two specification assumptions, with (a) constant only, and (b) constant and trend term. The results include both the level and the first difference across the two specifications, along with a conclusion on the order of integration, clearly indicating whether the variable is I(1) or I(0). As presented in Table 7, the variables used in this study are stationary in levels and in first differences. A complementary estimation technique that accounts for cross-sectional dependence and mixed orders of integration is required to estimate the long-run relationship among the study variables.

Table 7

Unit root test

Variables	CIPS		CADF		CIPS		CADF		
	Stationarity of variables in levels				Stationarity of variables in first difference				
	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	Remark
FII	-1.371	-2.109	-1.108	-2.27	-3.75***	-4.02***	-2.52***	-2.89***	I(1)
L. FII	-0.95	-1.92	-1.41	-2.25	-3.57***	-3.72***	-3.57***	-3.72***	I(1)
FSI	-2.76***	-3.37***	-2.51***	-3.26***	-4.29***	-4.21***	-3.12***	-2.83**	I(0)
lnEG	-1.82	-2.25	-1.53	-2.00	-3.05***	-3.10***	-2.21**	-2.43	I(1)

*NB: ***, **, * denote the levels of significance at 1%, 5% and 10%, respectively. Variable abbreviations are as in Table 3. Panel unit test statistics are: CIPS and CADF with a maximum lag of 1.*

Source: authors' computation

Finally, the study must determine the optimal lag length for the model and variables before testing for cointegration among the variables. Thus, in this study, we determine the optimal lag length using the unrestricted error-correction model (UECM) and the Akaike Information Criterion (AIC). Accordingly, when financial inclusion is the dependent variable, we use a (1,0,0) lag length; when financial stability is the dependent variable, we use a (0,1,0) lag length; and when economic growth is the dependent variable, we use a (0,0,1) lag length.

4.3. Panel cointegration test: CS-ARDL model results

The cointegration among financial inclusion, financial stability, and economic growth has been examined using a cross-sectional augmented autoregressive distributed lag (CS-ARDL) model. This method has been selected for the following three reasons. First, the study variables have mixed orders of integration: I(0) and I(1*)*. Second, the study period is 16 years. Third, there is strong cross-sectional dependence in the dataset. Noting the above justifications, the three standard panel cointegration tests, such as the Pedroni test (1999, 2004), the Kao test (1999), and the Westerlund test (2005), are not appropriate methods for testing cointegration among the study variables. Thus, the previously developed CS-ARDL model (Chudik et al., 2016) is the best approach for our examination of the long-term relationship among financial inclusion, financial stability, and economic growth in the study area because it is robust to cross-sectional dependence and mixed orders of integration in the data set.

The CS-ARDL model employs a dynamic panel structure, incorporating a lagged dependent variable and an error correction term (ECM) to assess the speed of adjustment and the presence of long-run relationships among the study variables. Both the mean group (MG) and pooled mean group (PMG) CS-ARDL estimators are employed, and a Hausman test is conducted to select between them.

Moreover, the findings from both the MG and PMG estimators have been presented, revealing a notable discrepancy in short-term estimates between the two specifications. This discrepancy arises from the PMG estimator limiting heterogeneity to the long run, whereas the MG estimator permits heterogeneity in both the short- and long-run estimations. Thus, the disparity in the short-term estimate suggested a heterogeneous response and country-specific adjustment.

Table 8 below presents the CS-ARDL results, considering financial inclusion as the dependent variable and financial stability and

economic growth as regressors. The model is estimated using both the mean-group and pooled-mean-group CS-ARDL.

Table 8

CS-ARDL estimation results for financial inclusion

Variables	Dependent variable-Financial inclusion	
Short-run	**CS-ARDL (MG)**	**CS-ARDL (PMG)**
ECM	-0.8245***	-0.630***
L.FII	0.176	0.370***
	(0.123)	(0.108)
FSI	0.429**	0.12
	(0.1714)	(0.157)
lnEG	-0.127	0.019
	(0.099)	(0.031)
ΔFSI	0.075	0.260***
	(0.0854)	(0.069)
ΔlnEG	-0.055	0.015
	(0.157)	(0.143)
Long-run		
FSI	0.684***	0.575**
	(0.219)	(0.238)
lnEG	-0.128	0.089**
	(0.128)	(0.037)
Number of observations	255	255
Number of Groups	17	17
Hausman	16.57	
P-value	(0.0204)	

*Note: The variables are measured on a yearly basis. ***, **, and * indicate a 1%, 5% and 10% significance level, respectively. The standard errors are in parentheses.*

Source: authors' computation

Based on the findings in Table 8 above, both the mean group and the pooled mean group estimators indicate a significant negative error-correction mechanism (ECM). This confirms the existence of long-run cointegration among the study variables. Additionally, the ECM is around -0.825 under the mean group estimator, which confirms that around 82% of disequilibrium is corrected within one year and also indicates a faster speed of adjustment than the PMG estimator, which is around 63%.

Moreover, the estimation depicts that financial stability has a positive and significant impact on financial inclusion in the short run. Particularly, under PMG CS-ARDL estimates, the coefficient of FSI (0.260) portrays that there is a strong impact on financial inclusion. This indicates that improvements in the financial system enhance financial inclusion. However, neither of the aforementioned models shows that economic growth has a substantial impact on financial inclusion, suggesting that economic growth does not immediately improve financial inclusion in the area. Moreover, the long-run estimates revealed that financial stability has a positive and significant influence on financial inclusion, emphasising the importance of a stable financial system for expanding financial inclusion in the study area. This can be justified as the stability of the financial system increases, the confidence among households in the financial system improves, and consequently it raises their demand towards various financial services or products. Additionally, this finding supports the endogenous growth theory, which emphasises the role of financial systems in mobilising savings, allocating resources efficiently, and reducing transaction costs, thereby promoting inclusive growth. Moreover, a stable financial system improves the efficiency and effectiveness of financial intermediaries by reducing the cost of financial products and services, which in turn broadens access to financial services. This finding is consistent with the previous empirical studies (Fungáčová & Weill, 2015; Anarfo et al., 2020). Contrary to this, other scholars argued that financial stability negatively affect financial inclusion due to tight financial regulation (Khan, 2011; Čihák et al., 2016).

Economic growth has an insignificant coefficient in the mean group, whereas a significant and positive coefficient under the PMG estimator. On the basis of these findings, economic growth enhances financial inclusion when pooling across countries. This supports the demand-following theory of financial inclusion and the endogenous theory. Moreover, this finding is aligned with the findings of previous scholars (Gebrehiwot & Makina, 2019). The Hausman test supports PMG estimates, suggesting that long-term homogeneity among COMESA nations is plausible for this relationship. In general, the above findings confirm the existence of long-run equilibrium relationships and support the hypothesis that financial stability and economic growth are essential determinants of long-term financial inclusion.

The result presented in Table 9 shows that the error correction mechanism (ECM) is negative and significant at 1% significant level, suggesting the existence of a long-run relationship between financial stability, financial inclusion and economic growth. The magnitude of speed of adjustment is -0.93 in the mean group and -0.78 under the pooled mean group, which is significant and negative.

Table 9

CS-ARDL estimation results for financial stability

Variables	Dependent variable-Financial Stability	
Short-run	**CS-ARDL (MG)**	**CS-ARDL (PMG)**
ECM	-0.925***	-0.783***
	(0.100)	(0.081)
L. FSI	0.075	0.217***
	(0.100)	(0.081)
FII	0.299***	0.105
	(0.174)	(0.126)
lnEG	0.162	0.022
	(0.251)	(0.078)
Δ FII	0.353	0.509**
	(0.236)	(0.237)
Δ lnEG	0.477***	0.261*
	(0.157)	(0.154)
Long-run		
FII	0.741*	0.165***
	(0.381)	(0.023)
lnEG	-0.069	0.035***
	(0.310)	(0.005)
Number of observations	255	255
Number of Groups	17	17
Hausman test	3.13	
P-value	0.00	

*Note: The variables are measured on a yearly basis. ***, **, and * indicate a 1%, 5% and 10% significance level, respectively. The standard errors are in parentheses.*

Source: authors' computation

In the short run, financial inclusion and the differenced financial inclusion influence the stability of the financial system positively under the MG and PMG models, respectively. This supports expansion in access to and use of financial products and services, strengthening the

financial system by broadening the financial sector's deposit base, diversifying risk, and enhancing liquidity. Moreover, economic growth facilitates financial stability in the short run, supporting the idea that economic expansion reduces nonperforming loans by improving borrowers' repayment capacity. In the long run, financial inclusion enhances financial stability regardless of the estimator, suggesting that widening financial access and services improve financial stability by reducing systemic risk and promoting a diversified financial portfolio. This is consistent with previous findings (Čihák et al., 2016), which argue that financial inclusion is the best tool to expand financial institutions' deposit bases and thereby enhance their resilience during crises. Similarly, it is consistent with the concept of institutional theory (Meyer & Rowan, 1977). Based on this theory, stability of a system is achieved when it is implemented under a n institutional framework and norms. Thus, financial inclusion plays a crucial role in reducing reliance on informal financial services and enhancing households' and firms' participation in the formal financial system. This finding also supported previous work by Pham and Doan (2020) who argued that financial inclusion facilitates financial stability by removing information asymmetry. Other studies suggested that financial stability is achieved by improving financial inclusion and minimising a substantial informal sector that hinders the implementation of monetary policy and the supervision of the financial sector (Anarfo et al., 2020). Contrary to this empirical finding, the financial sector may compromise on its regulatory framework, resulting in an increase in non-performing loans of the financial sector, which consequently causes the financial system to become unstable (Khan, 2011; Boachie et al., 2023).

On the other hand, the long-run impact of economic growth on financial stability is negative but insignificant under mean-group estimation, whereas it is positive and significant when we account for heterogeneity across countries. Thus, economic growth improves households' income level and forms profitability, which leads to reduced credit risk, a stable funding base and capital formation and this ultimately creates a stable financial system. Generally, to create a stable financial system in COMESA, it is necessary to increase financial inclusion and maintain economic growth. The Hausman test supports the MG estimator, suggesting that policy variation within the region causes long-run effects to vary across countries.

As presented in the error correction mechanism (ECM), the coefficient under both MG and PMG estimation is negative and strongly significant, suggesting the existence of a strong long-run relationship among the study variables. Furthermore, under the short-run estimates, the coefficients of both financial inclusion and financial stability are statistically insignificant in either estimator, indicating that it takes time for financial inclusion and stability improvements to have any economic impact. On the other hand, the long-run coefficient of both financial inclusion and financial stability is positive and statistically significant only under PMG estimation, suggesting that financial inclusion creates a conducive environment for households and firms to invest in education, health, and the diversification of production through increasing access to financial services. Consequently, all of this leads to economic growth in the particular countries. This finding is consistent with previous studies conducted in SSA countries, which found a positive relationship between access to finance, measured by the number of commercial bank branches per 100,000 people, and economic growth (Makina & Walle, 2019). Similar studies also reported a positive relationship between financial inclusion and economic growth (Kim et al., 2018; Adedokun & Ağa, 2021). Furthermore, this finding aligns with the finance-growth theory (Patrick, 1966), which says that financial inclusion comes before and drives economic growth by getting households to save and invest. Financial stability has a positive and strong impact on economic growth in the long run, supporting the idea that a sustainable financial system is essential to improve economic growth. The Hausman test favours the PMG estimator, indicating the assumption of long-run homogeneity across the COMESA region.

Generally, the findings show that both financial inclusion and financial stability contribute more to economic growth in the long run than in the short run. This emphasises how crucial consistent and well-coordinated financial sector reforms are for achieving long-term growth in COMESA.

Table 10

CS-ARDL estimation results for economic growth

Variables	Dependent variable-Economic growth	
Short-run	**CS-ARDL (MG)**	**CS-ARDL (PMG)**
ECM	-0.639***	-0.456***
	(0.102)	(0.054)
L. lnEG	0.3614	0.544***
	(0.102)	(0.054)
FII	0.092	0.003
	(0.349)	(0.410)
FSI	0.596	0.154
	(0.525)	(0.348)
Δ FII	-0.039	-0.197
	(0.313)	(0.454)
Δ FSI	-0.213	0.296
	(0.271)	(0.284)
Long Run		
FII	-0.410	0.017**
	(0.387)	(0.008)
FSI	0.599	0.985**
	(0.669)	(0.484)
Number of observations	255	255
Number of Groups	17	17
Hausman	8.13	
P-value	0.13	

*Note: The variables are measured on a yearly basis. ***, **, and * indicate a 1%, 5% and 10% significance level, respectively. The standard errors are in parentheses.*

Source: authors' computation

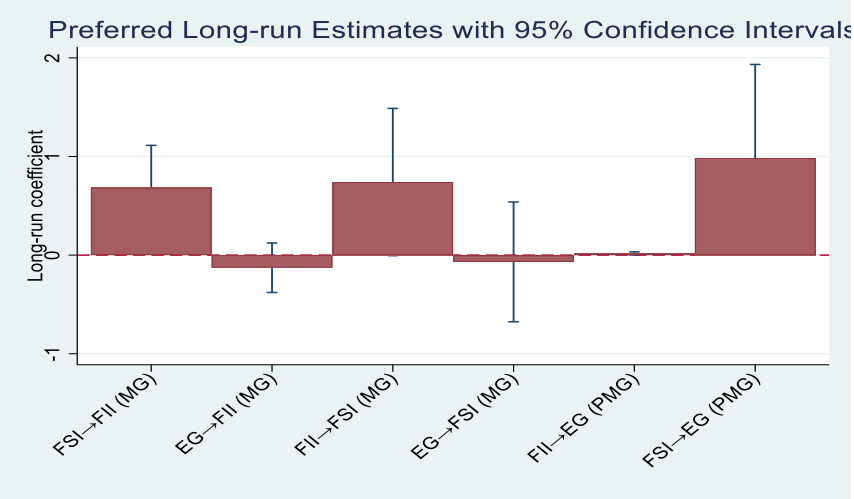
To improve readability, the next graphical representation of the long-run relationship is presented below.

Figure 1 illustrates the long-run elasticity between financial inclusion, financial stability, and economic growth employing the selected CS-ARDL specification. The figure clearly indicates a strong long-run relationship between financial inclusion and financial stability. Similarly, financial stability has a strong and positive influence on economic growth. Generally, the graphical presentation confirms the

existence of the financial inclusion, financial stability, and economic growth nexus in COMESA member countries, and the finding strongly indicates that creating a stable financial system is important to enhance an inclusive financial system and economy in the COMESA region.

Figure 1

Graphical Representation of Long-Run Effects (CS-ARDL)



Source: authors' work

4.4. Dynamic common correlated effect findings for robustness

To verify the CS-ARDL estimation results, the DCCE estimator has been employed as a robustness check. The results of DCCE presented in Table 11 are consistent with the CS-ARDL results.

Table 11

Dynamic common correlated effect- mean group results

Variables	Financial inclusion	Financial stability	Economic growth
FII		0.4494***	0.1755
		(0.1504)	(0.5083)
L. FII	0.2005**		
	(0.1037)		
FSI	0.5798***		0.4135
	(0.1471)		(0.3207)
L. FSI		-0.0190	
		(0.0749)	

Variables	Financial inclusion	Financial stability	Economic growth
LnEG	-0.0948 (0.1075)	0.1297 (0.1928)	
L .lnEG			0.3371*** (0.0889)
Number of observations	255	255	255
CD p-value	0.982	0.378	0.609

*Note: ***, **, and * indicate a 1%, 5% and 10% significance level, respectively. The standard errors are in parentheses.*

Source: authors' computation

First, the DCCE robustness results confirm the main CS-ARDL estimator findings when financial inclusion is the dependent variable. Specifically, financial stability has a positive and statistically significant coefficient across all estimators. The consistency in sign and coefficient strongly confirms that the long-run relationship between financial stability and financial inclusion is robust to alternative estimation techniques. Similarly, regarding the long-run relationship between financial inclusion and economic growth, using the CS-ARDL based on the MG estimator and the DCCE models yielded consistent results, confirming the robustness of the finding.

Second, the DCCE robustness results for the financial stability model are also consistent with the CS-ARDL findings. Specifically, in the DCCE results, financial inclusion has a positive, statistically significant coefficient, consistent with the CS-ARDL results under both the MG and PMG estimators. This suggests that the long-run positive contribution of financial inclusion to financial stability is robust to alternative estimation approaches. Regarding economic growth, the DCCE estimator yielded a positive but statistically insignificant coefficient, consistent with the CS-ARDL finding using the MG estimator.

Thirdly, the findings from the economic growth model using the DCCE estimator were partially consistent with those from the main estimator, the CS-ARDL estimator. The positive coefficients for both financial inclusion and financial stability based on DCCE are consistent with PMG's long-run estimates; however, neither coefficient is statistically significant under the DCCE specification. Thus, the direction of the relationships remains consistent, whereas the statistical significance is sensitive to the estimation technique used.

5. Conclusion and recommendations

This study explores the dynamic and long-run cointegration among financial inclusion, financial stability, and economic growth in 17 COMESA member countries for 2007-2022, using the CS-ARDL estimator. The testing procedures verified cross-sectional dependence, slope heterogeneity, and mixed orders of integration, supporting the use of a second-generation estimator.

The results revealed an error-correction mechanism (ECM) with a significant, negative coefficient in all models under each estimator. This consistent significance of ECM confirms the presence of strong and stable long-run equilibria. Moreover, financial stability increases both financial inclusion and long-run economic growth, while financial inclusion also enhances long-run economic growth and strengthens the region's financial system. Economic growth significantly contributes to enhancing financial inclusion in the long run, though it has a less pronounced impact in the short run.

The findings of this study reveal strong theoretical implications for the long-run interconnection among financial inclusion, financial stability and economic growth. The significant long-run impact observed across all estimated models confirms both the supply-leading and demand-following theories, demonstrating that increased financial participation enhances stability (i.e., stable financial systems encourage financial inclusion). Additionally, the study's findings align with endogenous growth theory, demonstrating that a stable and inclusive financial system increases long-run economic growth.

Based on the findings, we recommend the following for policymakers and government bodies in the COMESA region.

- It is advisable for policymakers to develop policies and strategies that support agricultural, industrial and other projects that foster economic growth while safeguarding the financial system in the region so as to enhance financial inclusion.
- The governments should consider financial inclusion as one of the main development goals, support financial technologies, and encourage cooperation among financial sectors.
- The government or central bank should revise and strengthen regulations, strengthen banking practices, support the crisis management framework and facilitate stress testing practices in the financial sectors.

The study period was restricted to 2007-2022 due to data availability constraints. Moreover, data for all variables were not available in all COMESA member countries; therefore, only 17 were selected for this study. Additionally, the long-run relationship among the study variables was examined using PCA-based indices for both financial inclusion and financial stability. Thus, we suggest that future researchers examine this long-run relationship using individual indicators of both financial inclusion and financial stability. Additionally, we did not account for structural breaks caused by the 2007 global financial crisis and the COVID-19 pandemic. Moreover, to better capture the dynamic structural changes in the financial inclusion, financial stability and economic growth nexus, we suggest that future researchers consider non-linear techniques, consider country-level heterogeneity among COMESA member countries and incorporate digital financial inclusion metrics.

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References

1. Adedokun, M.W., & Ağa, M. (2021). Financial inclusion: A pathway to economic growth in Sub-Saharan African economies. *International Journal of Finance & Economics, 28*(3), pp. 2712–2728. https://doi.org/10.1002/ijfe.2559
2. Anarfo, E.B., Abor, J.Y., & Osei, K.A. (2020). Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role? *Research in International Business and Finance, 51*, 101070. https://doi.org/10.1016/j.ribaf.2019.101070
3. Anarfo, E.B., Abor, J.Y., Osei, K.A., & Gyeke-Dako, A. (2019). Monetary policy and financial inclusion in Sub-Sahara Africa: A panel VAR approach. *Journal of African Business, 20*(4), pp. 549–572. https://doi.org/10.1080/15228916.2019.1580998
4. Antwi, F., Kong, Y., & Gyimah, K.N. (2024). Financial inclusion, competition and financial stability: New evidence from developing economies. *Heliyon, 10*(13), e33723. https://doi.org/10.1016/j.heliyon.2024.e33723
5. Azimi, M.N. (2022). New insights into the impact of financial inclusion on economic growth: A global perspective. *PLoS One, 17*(11), e0277730. https://doi.org/10.1371/journal.pone.0277730
6. Boachie, C., & Adu-Darko, E. (2024). The effect of financial inclusion on economic growth: The role of human capital development. *Cogent*

Social Sciences, 10(1), 2346118. https://doi.org/10.1080/23311886.2024.2346118

7. Boachie, R., Aawaar, G., & Domeher, D. (2023). Relationship between financial inclusion, banking stability and economic growth: A dynamic panel approach. *Journal of Economic and Administrative Sciences, 39*(3), pp. 655–670. https://doi.org/10.1108/JEAS-05-2021-0084
8. Carvelli, G. (2023). The long-run effects of government expenditure on private investments: A panel CS-ARDL approach. *Journal of Economics and Finance, 47*(3), 620–645. https://doi.org/10.1007/s12197-023-09617-y
9. Chirwa, T.G., & Odhiambo, N. M. (2018). Exogenous and endogenous growth models: A critical review. https://doi.org/10.2478/cer-2018-0027
10. Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2016). Long-run effects in large heterogeneous panel data models with cross-sectionally correlated errors. In *Essays in Honor of Aman Ullah* (Vol. 36). Emerald Group Publishing.
11. Čihák, M., Mare, D.S., & Melecky, M. (2016). *The nexus of financial inclusion and financial stability: A study of trade-offs and synergies*. https://ssrn.com/abstract=2811371
12. Claessens, S., & Perotti, E. (2007). Finance and inequality: Channels and evidence. *Journal of Comparative Economics, 35*(4), pp. 748–773. https://doi.org/10.1016/j.jce.2007.07.002
13. Damane, M., & Ho, S. Y. (2024). The impact of financial inclusion on financial stability: Review of theories and international evidence. *Development Studies Research, 11*(1), 2373459. https://doi.org/10.1080/21665095.2024.2373459
14. Demirgüç-Kunt, A., Klapper, L., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *Policy Research Working Paper, 8040*. Washington, D.C.: World Bank Group.
15. Ditzen, J. (2021). Estimating long-run effects and the exponent of cross-sectional dependence: An update to xtdcce2. *The Stata Journal: Promoting Communications on Statistics and Stata*, *21*(3), pp. 687-707. https://doi.org/10.1177/1536867X211045560
16. Friedman, M., & Schwartz, A.J. (1963). *A monetary history of the United States, 1867–1960*. Princeton, NJ: Princeton University Press.
17. Fungáčová, Z., & Weill, L. (2015). Understanding financial inclusion in China. *China Economic Review, 34*, pp. 196–206.

18. Gebrehiwot, K.G., & Makina, D. (2019). Macroeconomic determinants of financial inclusion: Evidence using dynamic panel data analysis. In D. Makina (Ed.), *Extending financial inclusion in Africa*, pp. 167–191. London: Academic Press.
19. Goldsmith, R. W. (1969). *Financial structure and development*. New Haven, CT: Yale University Press..
20. Hakimi, A., Boussaada, R., & Karmani, M. (2022). Are financial inclusion and bank stability friends or enemies? Evidence from MENA banks. *Applied Economics, 54*(21), pp. 2473–2489. https://doi.org/10.1080/00036846.2021.1992342
21. Hussain, S., Rehman, A. ur, Ullah, S., Waheed, A., & Hassan, S. (2024). Financial Inclusion and Economic Growth: Comparative Panel Evidence from Developed and Developing Asian Countries. *Sage Open*, *14*(1). https://doi.org/10.1177/21582440241232585
22. Ifediora, C., Offor, K.O., Eze, E.F., Takon, S.M., Ageme, A.E., Ibe, G.I., & Onwumere, J.U.J. (2022). Financial inclusion and its impact on economic growth: Empirical evidence from sub-Saharan Africa. *Cogent Economics & Finance, 10*(1). https://doi.org/10.1080/23322039.2022.2060551
23. Im, K.S., Pesaran, M.H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), pp. 53–74. https://doi.org/10.1016/S0304-4076(03)00092-7
24. Jima, M.D., & Makoni, P.L. (2023). Financial inclusion and economic growth in Sub-Saharan Africa—A panel ARDL and Granger non-causality approach. *Journal of Risk and Financial Management, 16*(6), 299. https://doi.org/10.3390/jrfm16060299
25. Jungo, J., Madaleno, M., & Botelho, A. (2024). The role of financial inclusion and institutional factors on banking stability in developing countries. *International Journal of Development Issues, 23*(3), pp. 361–377. https://doi.org/10.1108/IJDI-09-2023-0233
26. Kebede, J., Selvanathan, S., & Naranpanawa, A. (2025). Financial stability and financial inclusion: A non-linear nexus. *Journal of Economic Studies*, *52*(4), pp. 742-761. https://doi.org/10.1108/JES-09-2023-0488
27. Khan, H.R. (2011). *Financial inclusion and financial stability: Are they two sides of the same coin?* Speech at BANCON 2011, Indian Bankers Association & Indian Overseas Bank, Chennai, India, 4 November.
28. Kim, D.-W., Yu, J.-S., & Hassan, M.K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International*

Business and Finance, 43, pp. 1–14. https://doi.org/10.1016/j.ribaf.2017.07.178

29. Kindleberger, C.P. (1996). *Manias, panics, and crashes: A history of financial crisis* (3rd ed.). New York, NY: Wiley.
30. Koudalo, Y.M.A., & Toure, M. (2023). Does financial inclusion promote financial stability? Evidence from Africa. *Cogent Economics & Finance, 11*(2). https://doi.org/10.1080/23322039.2023.2225327
31. Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics, 46*(1), pp. 31–77. https://doi.org/10.1016/S0304-3932(00)00017-9
32. Makina, D., & Walle, Y.M. (2019). Financial inclusion and economic growth: Evidence from a panel of selected African countries. In D. Makina (Ed.), *Extending financial inclusion in Africa*, pp. 193–210. London: Academic Press.
33. McKinnon, R.I. (1973). *Money and capital in economic development*. Washington, DC: Brookings Institution.
34. Mehrotra, A., & Yetman, J. (2015). Financial inclusion: Issues for central banks. *BIS Quarterly Review*, pp. 83–96.
35. Menyelim, C.M., Babajide, A.A., Omankhanlen, A.E., & Ehikioya, B.I. (2021). Financial inclusion, income inequality and sustainable economic growth in Sub-Saharan African countries. *Sustainability, 13*(4), 1780. https://doi.org/10.3390/su13041780
36. Meyer, J.W., & Rowan, B. (1977). Institutionalised organisations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), pp. 340–363.
37. Minsky, H.P. (1977). A theory of systemic fragility. *Hyman P. Minsky Archive*. 231. https://digitalcommons.bard.edu/hm_archive/231
38. Mir, T.A., Gopinathan, R., & Joshi, D.P.P. (2023). Revisiting long-run dynamics between financial inclusion and economic growth in developing nations: Evidence from CS-ARDL approach. *Journal of Financial Economic Policy, 16*(2), pp. 176–193. https://doi.org/10.1108/JFEP-07-2023-0186
39. Mishkin, F.S. (1995). Symposium on the monetary transmission mechanism. *Journal of Economic Perspectives, 9*(4), pp. 3–10. https://doi.org/10.1257/jep.9.4.3
40. Mishra, D., Kandpal, V., Agarwal, N., & Srivastava, B. (2024). Financial inclusion and its ripple effects on socio-economic development: A comprehensive review. *Journal of Risk and Financial Management, 17*(3). https://doi.org/10.3390/jrfm17030105

41. Odame, C., Appiah, K.O., & Gyimah, P. (2024). The financial inclusion–economic growth nexus: What is new now? *Journal of Money and Business, 4*(2), pp. 121–137. https://doi.org/10.1108/JMB-05-2023-0026
42. Omar, M.A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of Economic Structures, 9*(1). https://doi.org/10.1186/s40008-020-00214-4
43. Ozili, P.K. (2022). Financial inclusion and sustainable development: An empirical association. *Journal of Money and Business, 2*(2), pp. 186–198. https://doi.org/10.1108/JMB-03-2022-0019
44. Patrick, H.T. (1966). Financial development and economic growth in underdeveloped countries. *Economic Development and Cultural Change, 14*(2), pp. 174–189. https://doi.org/10.1086/450153
45. Pesaran, M.H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), pp. 265–312. https://doi.org/10.1002/jae.951
46. Pesaran, M.H. (2015). Testing weak cross-sectional dependence in large panels. *Econometric Reviews, 34*(6–10), pp. 1089–1117. https://doi.org/10.1080/07474938.2014.956623
47. Pesaran, M.H., Shin, Y., & Smith, R.P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association, 94*(446), pp. 621–634.
48. Pesaran, M.H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics, 142*(1), pp. 50–93. https://doi.org/10.1016/j.jeconom.2007.05.010
49. Pham, M.H., & Doan, T.P.L. (2020). The impact of financial inclusion on financial stability in Asian countries. *The Journal of Asian Finance, Economics and Business, 7*(6), pp. 47–59. https://doi.org/10.13106/jafeb.2020.vol7.no6.047
50. Robinson, J. (1952). *The rate of interest and other essays*. London: Macmillan.
51. Sahay, R., Čihák, M., N'Diaye, P., Barajas, A., Mitra, S., Kyobe, A., Mooi, Y.N., & Yousefi, S.R. (2015). Financial inclusion: Can it meet multiple macroeconomic goals? *IMF Staff Discussion Note* No. 15/17.
52. Schularick, M., & Taylor, A. M. (2012). Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870–2008. *American Economic Review, 102*(2), pp. 1029–1061. https://doi.org/10.1257/aer.102.2.1029
53. Schumpeter, J. (1911). *The theory of economic development*. Cambridge, MA: Harvard University Press.

54. Sethi, D., & Sethy, S. K. (2019). Financial inclusion matters for economic growth in India. *International Journal of Social Economics, 46*(1), pp. 132–151. https://doi.org/10.1108/ijse-10-2017-0444
55. 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), pp. 674–693. https://doi.org/10.1108/jfep-07-2021-0195
56. Shaw, E.S. (1973). *Financial deepening in economic development*. New York, NY: Oxford University Press.
57. Singh, D., & Stakic, N. (2020). Financial inclusion and economic growth nexus: Evidence from SAARC countries. *South Asia Research, 41*(2), pp. 238–258. https://doi.org/10.1177/0262728020964605
58. Swamy, V. (2014). Financial inclusion, gender dimension, and economic impact on poor households. *World Development, 56*, pp. 1–15. https://doi.org/10.1016/j.worlddev.2013.10.019

EFFECT OF BUDGETING DIMENSION ON FINANCIAL MANAGEMENT OF PUBLIC SECONDARY SCHOOLS. A CASE STUDY FROM NYAMIRA, KENYA

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Abstract

The primary aim was to determine the effect of budgeting dimensions on the financial management of public secondary schools in Nyamira County, Kenya. This study utilised a descriptive research design. The study population consisted of all 130 Extra County secondary schools in Nyamira County. A sample of 172 respondents was drawn from 43 Extra County secondary schools. The study employed simple random sampling and purposive sampling techniques to select the necessary respondents, who were the Principals, Deputy Principals, Procurement Officers/Store Keepers and Accountants/ Account Clerks. Data were gathered through questionnaires. The study revealed that the budget dimension had a positive and statistically significant effect on financial management. The study concluded that budgeting practices in public secondary schools are moderately implemented but weak in strategic financial planning and control. The study recommended that schools should consider setting up an active budget committee that meets regularly to review spending patterns and track progress.

Keywords: financial planning, expenditure monitoring, resource utilisation, school administration, fiscal accountability

JEL Classification: M41, I22, H83

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1. Introduction

Inflation and economic growth have a complex relationship, which has been the subject of much debate and research in the field of macroeconomics. As two of the most crucial macroeconomic variables, the interplay between inflation and growth has far-reaching implications for the overall well-being and development of an economy (Barro, 1995; Dornbusch et al., 1996). Understanding this relationship is of paramount importance for policymakers as it informs the formulation of effective monetary and fiscal policies aimed at fostering price stability and sustainable economic growth.

Effective budgeting is a key component of financial management in public secondary schools because it helps institutions plan, allocate, and control the use of financial resources in line with their objectives (Manei & Omagwa, 2019). Through budgeting, schools can identify their income and expenditure needs, prioritize development projects, and ensure that available resources are used efficiently. Sound budgeting practices also promote accountability, transparency, and proper financial planning, which are essential for achieving educational goals and maintaining financial sustainability (Kiriza et al., 2015; Waihenya, 2019).

Despite its importance, many schools continue to experience challenges in budget implementation and control, including weak monitoring systems, inaccurate forecasting, and ineffective budget reviews (Eloundou & Chi, 2023). These weaknesses can lead to poor resource utilization and financial management problems. Therefore, examining the effect of the budgeting dimension on financial management is important in understanding how budgeting practices influence the ability of public secondary schools in Nyamira County to manage their finances effectively, meet their obligations, and support long-term institutional development.

Budgeting also provides a framework for monitoring and evaluating financial performance. By comparing planned expenditures with actual spending, school administrators can identify variances, control unnecessary costs, and make timely corrective decisions. Effective budget monitoring ensures that financial resources are used for their intended purposes and helps schools avoid financial mismanagement, wastage, and accumulation of debts. As a result, schools are better positioned to achieve their operational and development objectives while maintaining financial discipline.

Furthermore, participatory budgeting, which involves department heads and other stakeholders in the budgeting process, enhances ownership and accountability in financial management. When different departments contribute to budget preparation, the resulting budget is more likely to reflect the actual needs and priorities of the school. This promotes efficient resource allocation and improves the overall management of school finances. Therefore, effective budgeting is expected to have a positive influence on the financial management of public secondary schools in Nyamira County by strengthening planning, accountability, expenditure control, and financial sustainability.

Accounting practices are meant to help schools use their resources wisely, keep clear and honest financial records, reduce waste, and make sure everyone is accountable for the money they manage (Manei & Omagwa, 2019; Muhaswa, 2022). Most governments allocate significant financial resources to educational institutions in order to improve their financial management. The Kenyan government has made significant investments in education, allocating between 13.5% and 16.5% of the national budget to the Ministry of Education. Within the ministry's budget, 23% is allocated to public secondary schools (Muthanga, 2017).

Despite the significant financial resources allocated by the Kenyan government to public secondary schools, many schools in Nyamira County continue to experience financial management challenges such as accumulated debts, delayed payments to suppliers, and inadequate funding for essential school operations. Effective budgeting is expected to promote proper financial planning, resource allocation, expenditure control, and accountability. However, the persistence of these financial challenges raises concerns about the effectiveness of budgeting practices in managing school finances and achieving institutional objectives.

Although previous studies have established a positive relationship between accounting practices and financial management, most have focused on general accounting practices rather than the specific role of budgeting in public secondary schools. Furthermore, limited empirical evidence exists on how budgeting influences financial management in public secondary schools in Nyamira County. This knowledge gap necessitates an investigation into the effect of budgeting on financial management to establish whether effective

budgeting practices contribute to improved financial management in public secondary schools within the county.

This study was based on Stewardship Theory, which was proposed by Davis, Schoorman, and Donaldson (1997). The theory posits that managers, rather than being self-interested agents requiring strict control, are actually stewards who are intrinsically motivated to act in the best interests of the organisation (Salomonsen et al., 2024). It explains how school administrators and finance officers can contribute to effective financial management through responsible budgeting practices. The theory assumes that individuals entrusted with managing organisational resources are motivated to act in the best interests of the institution by prioritising organisational goals over personal interests. In the context of public secondary schools, this means that school leaders are expected to prepare realistic budgets, allocate resources efficiently, and ensure that expenditures align with the schools' objectives.

2. Literature review

Mulani et al. (2015) identified the need to investigate the impact of the budgetary process on the performance of small and medium enterprises (SMEs) in India. The study employed a descriptive research approach and selected a sample of 268 enterprises from the small and medium-sized enterprise (SME) sector in India. The sample was chosen from three districts: Mumbai, Pune, and Solapur. The required information was collected via a questionnaire. The study found a direct correlation between company success and budgeting procedures among the small and medium-sized enterprises (SMEs) examined. The study found that setting challenging yet attainable goals enhances employee motivation in achieving budget objectives and improves the performance of small and medium-sized enterprises (SMEs). Additionally, implementing a formal and stringent control mechanism for the budgetary process tends to increase firm performance in the Indian SME sector.

Fauzan et al. (2019) examined the impact of budgeting quality and human resource competency on school financial performance in Indonesia, with information technology serving as a moderating variable. This study employed a quantitative method and utilized a descriptive research design. The data were examined using inferential statistics with the assistance of SPSS. The study provided compelling evidence to support the notion that the quality of budgeting, financial

human resources competence in the school, and information system all have a significant positive impact on the school's financial performance, either independently or in combination. Additionally, the study found that information technology plays a crucial role in moderating the influence of budget quality on school financial performance. However, it was also noted that information technology does not have a substantial impact on mitigating the influence of budget quality on school financial performance.

In their study, Mahroqi and Matriano (2021) investigated the impact of budgetary controls on the financial performance of Oman Telecommunication Company. The study aimed to evaluate the impact of budgetary control on the financial performance of the Oman Telecommunications Company. Additionally, it sought to confirm the efficacy of budgetary control techniques within the company, taking into account the support and involvement of top management in implementing these techniques. The study employed a survey research design. The data was collected by a questionnaire and evaluated utilizing methods such as frequency distribution, correlations, and regression analysis. The findings demonstrated a direct correlation between budgetary control and the financial performance of the company. Additionally, the study revealed the varying effects of different budgetary control techniques, the company's utilization of variance analysis and accounting responsibility, and the significance of budgetary control procedures.

Agbenyo et al. (2018) studied the impact of budgeting on the financial performance of manufacturing firms listed on the Ghana Stock Exchange. They used evidence from these enterprises to support their conclusions. The study aimed to analyse the functions of budgeting in manufacturing companies and determine the impact of budgeting on the financial performance of manufacturing enterprises in Ghana. The study utilised a cross-sectional research design and employed accessible sampling approaches to choose a sample of 51 respondents. The data were collected using a structured questionnaire. Correlation was utilised to determine the connection between budgeting and financial performance. The study revealed a robust positive association between budgeting and financial performance.

In their study, Wamungu (2023) examined how budgeting methods impact the financial performance of the hospitality sector in Rwanda. The study aimed to analyse the impact of participatory budgeting, corporate budgeting, incremental budgeting, and activity-

based budgeting on the financial performance of Nobleza Hotel & Shami Appart's Hotel. This study employed a descriptive research design, focusing on a sample of 60 employees. The study utilised the Statistical Package for Social Sciences (SPSS) to gather and analyse both primary and secondary data. The findings of the study revealed that The study revealed that budget control is a process that acknowledges the necessary budgeting skills for making better decisions. It identifies crucial financial indicators for the business and determines how and when to monitor them. Budget control also recognises sources of financial and business information that provide insights into business and financial strategies when converted into budgets. It helps interpret budgets and performance measurements as communication tools and ultimately assists in thinking proactively beyond budgeting. Additionally, budget control saves management time by utilizing exceptional guidance.

Mutungi (2017) conducted an empirical study that examined the impact of budgeting and budgetary management on the financial performance of devolved government. The study aimed to examine the impact of budgeting and budgetary control, managerial performance, and county regulation on the financial performance of county governments. A descriptive research design was implemented. An investigation was conducted on a sample of 29 counties, and the resulting data were evaluated using SPSS. The study expressed concern over the difficulties faced by County governments in implementing their budgets. These challenges included a failure to adhere to the specified timelines outlined in the Public Finance Management Act of 2012. Additionally, the study highlighted that the office of the controller of budgets conducts a review of budget implementation every three months to assess performance. Furthermore, it was noted that the county government's budget at the planning stage takes into account the priorities of stakeholders for the upcoming year and aligns budget activities with set goals and targets. The study found a robust positive correlation between budgeting, budgetary management, and financial performance.

Mbogo et al. (2021) conducted a study on the impact of budgeting procedures on the financial performance of small and medium manufacturing firms in Nairobi County, Kenya. The study aimed to strategically plan for cash flows, effectively control cash flows, allocate resources, coordinate activities, and monitor the financial position in order to enhance the financial performance of small and

medium manufacturing enterprises. In order to accomplish this, the study employed a descriptive research design to gather data from a sample of 156 small and medium-sized enterprises (SMEs) that were chosen through the use of a simple random sampling procedure. Data were collected via a questionnaire and subsequently analysed using structural equation modelling. The findings showed that implementing budgeting methods has a favourable and significant impact on the financial performance of small and medium-sized enterprises (SMEs) in the manufacturing sector.

Ngumi and Njogo (2017) sought to determine the impact of budgeting procedures on the financial performance of insurance companies in Kenya. The study utilised a descriptive research design. Among the 45 insurance and reinsurance companies registered by 2010, a sample of 23 insurance companies was chosen for analysis. Convenience sampling was used, and their secondary data were analysed using the Statistical Package for the Social Sciences (SPSS Version 17.0) and Stata version 13 to analyse the panel data. The study found that capital expenditure variation, operations expenditure variance, and human resource variance had a negative relationship with performance, but income variance and performance (ROI) had a positive and significant relationship.

Okotchi et al. (2020) examined how the financial process impacts the performance of County Governments in Kenya. The study aimed to assess the impact of budgetary participation, budgetary control, and budget planning on the performance of Trans Nzoia County. The study utilised a descriptive survey research approach and included all 72 employees in the survey. The study collected data through a survey and analysed it using descriptive and inferential statistics. The study's findings indicate that participation increases a subordinate's trust, sense of control, and ego-involvement with the organisation. This, in turn, leads to greater acceptance and commitment to the budget decisions, resulting in improved performance. Additionally, the study suggests that opinions and proposals from members of the public regarding the budget are taken into consideration during its development. The results also indicated that budgeting offers insights into funding and accountability. Additionally, a majority of the participants agreed that senior management should take into account other factors that affect the connection between budget participation and managers' performance in order for it to have a meaningful and significant effect.

Financial management is widely seen as an important factor in how well organisations perform across different sectors, including schools, businesses, NGOs, healthcare institutions, and government agencies. Research shows that when organisations apply good financial practices such as budgeting, proper record-keeping, strong internal controls, and effective cash flow management, they tend to use their resources more efficiently and remain accountable (Adeyemi & Oboh, 2018; Mukulu et al., 2015; Karanja & Mwangi, 2017). In public secondary schools, this means good financial management helps schools meet their financial needs and run operations smoothly, while weak systems often lead to wasted funds, delayed payments, and overall poor performance (Kamau & Muthoni, 2019).

Even with this understanding, many organizations still struggle with financial management due to challenges such as limited financial skills, weak control systems, and poor monitoring of funds (Mensah & Adjei, 2020; Mwila, 2018). Most of the available studies also tend to focus on general financial management practices rather than looking closely at specific accounting areas like inventory management in secondary schools. This leaves a gap in understanding how these specific practices affect financial management in schools. As a result, there is need for further research to better understand how different accounting practices influence financial management in public secondary schools.

3. Methodology and data

This study adopted a descriptive research design to examine the effect of the budgeting dimension on the financial management of public secondary schools in Nyamira County, Kenya. The target population comprised 130 Extra County public secondary schools registered by the Ministry of Education. Respondents included principals, deputy principals, accountants, and procurement/store officers because of their direct responsibility for budgeting and financial management within their schools. A sample of 172 respondents was selected from 43 schools using appropriate sampling procedures. Data were collected through a structured questionnaire developed from previous studies and adapted to the public secondary school context. All questionnaire items were rated on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The questionnaire captured two main constructs: budgeting and financial management. Budgeting was assessed through eight

statements covering departmental involvement in budget preparation, consideration of departmental priorities, preparation of departmental budgets, inclusion of both development and recurrent expenditures, existence of short- and long-term budget plans, budget spending controls, budget variance analysis, and regular review of budget performance by a budget committee. Financial management was measured using seven statements relating to alignment of budgets with school development plans, growth of the school's asset base, adequacy of school fees to meet operating costs, use of well-prepared budgets, collection of school fees, timely recovery of outstanding fees, and availability of sufficient cash to meet financial obligations. Before the main survey, the questionnaire was piloted in schools outside the study sample. Reliability was evaluated using Cronbach's alpha, with all constructs recording values above 0.70, while content and construct validity were established through expert review, the Content Validity Index, and factor analysis.

The data were coded and analysed using SPSS version 22. Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarised the findings. Pearson's correlation and simple linear regression analyses were then performed to examine the relationship between budgeting and financial management and to determine the influence of budgeting on financial management at a 5% level of significance.

4. Results

4.1 Demographic characteristics

The study achieved a very strong response rate of 97.1%, which is more than adequate for analysis and drawing reliable conclusions. Based on Babbie (2013), this is considered an excellent response rate, meaning the findings are dependable. The respondents were fairly balanced by gender, with 56% female and 44% male, showing that both men and women participated in providing views on the topic.

In terms of age, most respondents were 50 years and above (64.7%), followed by those aged 40-49 years (25.1%), while only a small number were aged 30-39 years (7.2%) and 20-29 years (3.0%). This shows that the study mainly reflects the views of older and more experienced individuals. In terms of education level, most respondents had a Bachelor’s degree or higher (68.1%), followed by Diploma

holders (17.5%), CPA holders (9.0%), and Certificate holders (5.4%), indicating that participants were generally well educated and likely knowledgeable about financial matters.

Finally, most respondents had long working experience, with 70.1% having worked for more than 9 years, while smaller proportions had 7-9 years (15.0%), 1-3 years (6.6%), 4-6 years (5.4%), and less than 1 year (3.0%). Overall, this shows that the study was based on respondents who were not only well educated but also highly experienced, making the findings more reliable and grounded in real school financial management practice.

4.2 Budgeting dimension

The descriptive statistics on budgeting assessed respondents' views on budgeting practices and procedures used in schools. The findings are shown in Table 1.

Table 1

Respondents' Perception on Budgeting Dimension

Budgeting	Mean	Std.Dev.
All the heads of departments involved in the preparation of budgeting plans for the next period	4.096	.3511
The school's budget at planning level factors in the priorities of different departments	4.07	.321
Each department in the school prepares budget plans prior to budget periods	4.01	.310
The school incorporates both development and recurrent plans in their budgets	3.98	.554
The school has both short- and long-term budget plans.	2.29	.714
The school has budget policies that help in monitoring budget spending limits	1.98	.432
At the end of the budget cycle, the school compares actual and budgeted performance and tabulates variance	1.97	.431
There exist a budgetary committee that periodically meets to review budget performance	1.88	.377
Average	**3.03**	

Source: authors' Work

The findings indicate that budgeting practices in public secondary schools in Nyamira County are moderately implemented, as reflected by the overall mean score of 3.03. This suggests that while schools have adopted several important budgeting practices, there are

still gaps that need to be addressed to enhance financial planning, accountability, and effective utilisation of resources. Respondents generally agreed that schools embrace participatory budgeting approaches, with the involvement of all heads of departments in the preparation of budgeting plans recording the highest mean score (M = 4.10, SD = 0.35). This finding demonstrates that schools recognise the value of involving key stakeholders in financial decision-making. The participation of departmental heads allows budget proposals to reflect actual departmental needs, promotes transparency, and enhances ownership of budget decisions among those responsible for implementation. Similarly, respondents agreed that school budgets consider the priorities of different departments during the planning stage (M = 4.07, SD = 0.32) and that each department prepares budget plans before the budget period (M = 4.01, SD = 0.31). These findings indicate that budgeting processes in public secondary schools are largely structured and consultative, with departments given opportunities to identify their financial requirements. Such practices are important because they support more realistic budget estimates and improve the alignment between allocated resources and institutional priorities. In addition, respondents agreed that schools incorporate both development and recurrent expenditures in their budgets (M = 3.98, SD = 0.55), suggesting that schools attempt to balance daily operational demands with investments aimed at improving future institutional performance.

However, the findings reveal weaknesses in strategic budgeting practices. Respondents disagreed that schools have both short-term and long-term budget plans, as indicated by the low mean score (M = 2.29, SD = 0.71). This suggests that many schools focus mainly on immediate financial needs rather than developing comprehensive financial plans to guide future activities. The variation in responses, as shown by the standard deviation, suggests that some schools may have adopted long-term planning approaches, but such practices are not consistently implemented across the county.

The study further established weaknesses in budget monitoring and control mechanisms. Respondents disagreed that schools have budget policies for monitoring spending limits (M = 1.98, SD = 0.43), compare actual and budgeted performance and analyse variances at the end of the budget cycle (M = 1.97, SD = 0.43), and that budgetary committees regularly meet to review budget performance (M = 1.88, SD = 0.38). These findings suggest that although schools demonstrate

strength in budget preparation, they face challenges in monitoring implementation, evaluating financial performance, and enforcing expenditure controls.

Overall, the findings show that budgeting contributes positively to financial management by promoting participation and improving resource allocation. However, limited attention to long-term planning, monitoring, and evaluation reduces the effectiveness of budgets as continuous financial management tools. This may be attributed to limited financial management capacity, inadequate follow-up after budget preparation, and competing administrative responsibilities. The findings agree with Mbogo et al. (2021), who established that effective budgeting practices enhance resource management, expenditure control, and overall financial performance. Therefore, strengthening budgeting systems in public secondary schools requires greater emphasis on strategic planning, regular budget reviews, and effective monitoring mechanisms.

4.3 Financial management

The descriptive statistics on financial performance and budgeting practices aimed to assess respondents' perceptions regarding the financial stability and financial management capacity of schools. The findings were as depicted in Table 2.

Table 2

Respondents' perception on financial management dimension

Financial Management	Mean	Std.Dev.
The school budget is aligned to the school's development plans	4.32	.527
The school asset base has generally increased over time	4.13	.375
The fees charged by the school are appropriate to cover the running costs	4.02	.289
The school operates on well-prepared budgets	3.78	.945
All fees are duly collected	3.28	.826
Outstanding fees are duly collected in time	2.18	.876
The school has enough cash to meet its obligations when they fall due	1.87	.664
Average	**3.37**	

Source: authors' work

The findings indicate that financial management in public secondary schools in Nyamira County is moderately effective, as reflected by the overall mean score of 3.37. Respondents confirmed

that school budgets are closely aligned with development plans (M = 4.32, SD = 0.53), school assets have generally grown over time (M = 4.13, SD = 0.38), and the fees charged are adequate to support school operations (M = 4.02, SD = 0.29). They further agreed that schools prepare and operate within well-structured budgets (M = 3.78, SD = 0.95). These findings suggest that schools have established practical financial planning and budgeting approaches that support efficient resource use and help achieve both short-term operational needs and long-term development goals.

However, the findings also highlight challenges in fee collection and cash flow management. While respondents moderately agreed that fees are collected as required (M = 3.28, SD = 0.83), they indicated concerns regarding the timely collection of outstanding fees (M = 2.18, SD = 0.88) and the availability of sufficient cash to meet obligations when they fall due (M = 1.87, SD = 0.66). This shows that delayed payments and cash shortages remain key issues affecting school financial stability. Strengthening fee collection practices and improving cash flow management strategies would therefore enhance financial sustainability and promote effective financial management in public secondary schools.

4.4 Regression analysis

A simple regression analysis was conducted to examine the influence of budgeting on the dependent variable. Table 3 below presents the results.

Table 3

Model summary for budgeting

Model	R	R square	Adjusted R square	Std. error of estimate
1	.480[a]	.230	.219	.219549

a. Predictors: (Constant), Budgeting

The regression results indicate a moderate positive relationship between budgeting and the dependent variable, as reflected by the correlation coefficient (R = 0.480). The coefficient of determination (R^2 = 0.230) shows that budgeting explains 23.0% of the variation in the dependent variable, suggesting a meaningful influence on the outcome.

4.5 ANOVA for budgeting

The ANOVA results were used to assess the overall significance of the regression model examining the effect of budgeting on financial management (see Table 4).

Table 4

ANOVA for budgeting

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.841	1	1.841	49.30	.000[b]
Residual	6.164	165	.037		
Total	8.005	166			

a. Dependent Variable: Financial Management

b. Predictors: (Constant), Budgeting

The p-value (p=.000) shows that the overall model is statistically significant. This means the relationship between budgeting and financial management is strong enough that it is unlikely to have occurred by chance. In other words, budgeting does play a real role in financial management.

4.6 Model coefficients for budgeting

To determine the effect of budgeting on financial management, a simple linear regression analysis was conducted with financial management as the dependent variable and budgeting as the independent variable. The results are presented in Table 5.

Table 5

Model coefficients for budgeting

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.029	.330		9.185	.000
Budgeting	.112	.108	.080	3.035	.032

a. Dependent Variable: Financial Management

According to Table 5, the unstandardized coefficient (B = 0.112) means that a one-unit increase in budgeting is associated with a 0.112-unit increase in financial management. In simple terms, better budgeting is linked with slightly better financial management. The t-

value (3.035) and the significance level (p = 0.032) show that this relationship is statistically meaningful. This means the effect of budgeting on financial management is unlikely to be due to chance, so we can confidently say there is a real relationship. Overall, the results suggest that budgeting has a real but modest positive effect on financial management. It helps improve financial management, but it is not the only factor involved, meaning other influences are also important.

5. Conclusion

The study concludes that budgeting practices in public secondary schools are moderately implemented but weak in strategic financial planning and control. While schools demonstrate strength in participatory budgeting and inclusion of departmental priorities, there is limited evidence of long-term budgeting, budget monitoring systems, variance analysis, and active budget committees. This indicates that budgeting processes are not fully developed as a financial management tool. However, budgeting still significantly influences financial management, meaning that improvements in budgeting practices would lead to better financial discipline and resource allocation.

As far as budgeting is concerned, although schools involve departmental heads in budgeting, the process still appears to be more routine than strategic. Schools are encouraged to move beyond basic annual budgeting and begin planning more deliberately for both the short and long term. Each school should consider setting up an active budget committee that meets regularly to review spending patterns and track progress. Schools should also start comparing actual spending with planned budgets to understand where money is being overused or underused. When budgeting is treated as a continuous process rather than a one-time activity, schools are better able to control spending and plan ahead with confidence. The findings add to existing literature by showing that effective budgeting is not just about preparing annual budgets but also about regularly reviewing, monitoring, and adjusting them to support better financial management in public secondary schools. While the study confirms earlier findings on the importance of budgeting, it also highlights that continuous budget monitoring, expenditure tracking, and long-term planning can help schools make better financial decisions, use resources more efficiently, and strengthen accountability.

Future research should include other levels of education such as primary schools, colleges, and universities to determine whether financial management challenges are similar or different across institutions. Further studies should also examine how digital tools like accounting software, mobile payments, and inventory systems improve efficiency and accountability in school financial management.

References

1. Adeyemi, T.O., & Oboh, B.E. (2018). Financial management practices and accountability in Nigerian public secondary schools. *International Journal of Educational Administration and Policy Studies*, 10(5), pp. 45-53.
2. Agbenyo, W., Danquah, F.O., & Shuangshuang, W. (2018). Budgeting and its effect on the financial performance of listed manufacturing firms: Evidence from manufacturing firms listed on Ghana Stock Exchange. *Research Journal of Finance and Accounting*, *9*(8), pp. 12-22. https://iiste.org/Journals/index.php/RJFA/article/view/42008
3. Babbie, E.R. (2013). *The practice of social research (13th ed.).* Wadsworth Cengage Learning.
4. Davis, J.H., Schoorman, F.D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review,* *22*(1), pp. 20-47. https://doi.org/10.5465/amr.1997.9707180258.
5. Eloundou, E.F., & Chi, C.P. (2023). The Effects of Budgetary Management Practices on the Performance of SMEs in Cameroon. *American International Journal of Business Management, 6*(1), 1-09. https://www.aijbm.com/wp-content/uploads/2023/01/A610109.pdf
6. Fauzan, S., Prajanti, S.D.W., & Wahyudin, A. (2019). The Effect of Budgeting Quality and Human Resource Competency of School Financial Performance with Information Technology as a Moderating Variable. *Journal of Economic Education*, *8*(2), pp. 159-166. https://doi.org/10.15294/jeec.v8i2.34926
7. Kamau, J., & Muthoni, R. (2019). Financial management practices and public service delivery in Kenyan county governments. *Journal of Public Administration and Policy Research*, *11*(3), pp. 28-37.
8. Karanja, N., & Mwangi, P. (2017). Financial management practices and performance of public health facilities in Kenya. *Journal of Public Health Management*, *12*(3), pp. 112-120.
9. Kiriza, R.K., Walela, K.B., & Kukubo, D.W. (2015). Financial management in public secondary schools in Kenya: A case study of

Lurambi Sub-County, Kakamega County. *International Journal of Scientific & Technology Research, 4*(9), pp. 167-178.

10. Mahroqi, R.M., & Matriano, M. (2021). Examining the Effect of Budgetary Controls on the Financial Performance of Oman Telecommunication Company. *International Journal of Research in Entrepreneurship & Business Studies*, *2*(3), pp. 37-46. https://doi.org/10.47259/ijrebs.234
11. Manei, B.O., & Omagwa, J. (2019). Accounting practices and financial performance of public secondary schools in Makueni County, Kenya. *Journal of Economics and Finance*, *10*(3), pp. 26-33. https://doi.org/10.9790/5933-1003052633
12. Mbogo, M., Jimmy, M., & Olando, C. (2021). Effect of budgeting practices on financial performance of manufacturing small and medium enterprises in Nairobi County, Kenya. *Journal of Language, Technology & Entrepreneurship in Africa*, *12*(1), pp. 84-110. https://doi.org/10.4314/jolte.v12i1
13. Mensah, S., & Adjei, E. (2020). Impact of financial management practices on the performance of SMEs in Ghana. *Journal of Small Business and Enterprise Development*, *27*(4), pp. 567-582.
14. Muhaswa, A. (2022). *The State of Financial Records Management in Public Secondary Schools in Lusaka District, Zambia (Master's Thesis,* University of Zambia).
15. Mukulu, E., Ndungu, J., & Kombo, C. (2015). Financial management practices and performance of public secondary schools in Kenya. *International Journal of Education and Research*, *3*(7), pp. 45-56.
16. Mulani, J., Chi, G., & Yang, J. (2015). Effects of the budgetary process on SME's performance: An Exploratory study based on Selected SME's in India. *Research Journal of Finance and Accounting*, *6*(14), pp. 135-153.
17. Muthanga, R.W. (2017). *The Effect of Accounting Practices On The Management of Funds in Public Secondary Schools in Nairobi County* (Doctoral dissertation, University of Nairobi). Available at: https://erepository.uonbi.ac.ke
18. Mutungi, Z.W. (2017). *Effects of budgeting and budgetary control on financial performance of devolved government in Kenya* (Doctoral dissertation, University of Nairobi). Available at: https://erepository.uonbi.ac.ke
19. Mwila, C. (2018). Financial management challenges among NGOs in Zambia. *Journal of Nonprofit Management*, *9*(2), pp. 75-84.

20. Ngumi, D. K., & Njogo, M. M. (2017). Effect of budgeting practices on the financial performance of insurance companies in Kenya. *International Journal of Economics*,*2*(3), pp. 14-30.
21. Okotchi, C. J., Makokha, E. N., & Namusonge, G. (2020). Effect of Budgetary Process on Performance of County Governments In Kenya. *International Journal of Recent Research in Social Sciences and Humanities*, *7*(2), pp. 11-21.
22. Salomonsen, H. H., Schillemans, T., & Brummel, L. (2024). Aligning the steering of governmental organizations: A comparative mixed-methods study in Denmark using stewardship theory. *Public Management Review,* *26*(11), pp. 3320–3341. https://doi.org/10.1080/14719037.2024.2332778.
23. Waihenya, C. (2019). *Effects of Managerial Accounting Practices on Financial Performance: A Case of Manufacturing Firms in Industrial Area, Nairobi* (Masters Thesis, United States International University-Africa).
24. Wamungu, T. (2023). Effect of Budgeting Practices on Financial Performance of Hospitality Sectors of Rwanda: A Case Study of Nobleza Hotel & Shami Appart's Hotel. *GSJ, 11*(2), pp. 89-100.

FINANCIAL DEVELOPMENT AND DOMESTIC INVESTMENT DYNAMICS IN EMERGING MARKETS

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Abstract

This study investigates the direct, moderating, and threshold effects of financial development on domestic investment in 15 emerging economies, focusing on whether human capital and technological development strengthen the finance-investment relationship and whether a critical level of financial development is required to maximise investment. The study employs an advanced dynamic panel framework using the Double-D System, Full GMM, CSD-Robust GMM, and Dynamic Fixed-Effects Threshold estimators on panel data covering 15 emerging economies from 2005 to 2024. The results reveal that financial development significantly promotes domestic investment. Moreover, human capital and technological development positively moderate this relationship, while threshold analysis identifies a financial development threshold of 0.524, beyond which the investment-enhancing effect of financial development becomes substantially stronger. The findings remain robust across alternative dynamic estimators. The findings imply that financial sector reforms should extend beyond financial deepening by simultaneously strengthening human capital, technological capability, and institutional quality to maximise domestic investment in emerging economies.

Keywords: absorptive capacity, sustainable development, human capital, technological development, dynamic threshold

JEL Classification: C23, E22, G20, O16, O43

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1. Introduction

Domestic investment is a fundamental driver of long-term economic growth, structural transformation, and productivity enhancement in emerging economies. Thus, expanding productive capacity, fostering technological progress, and improving labour productivity, sustained domestic capital accumulation creates the foundation for sustainable economic development (Shi & Xu, 2023). Unlike foreign capital inflows, which are often vulnerable to external shocks and sudden reversals, domestic investment provides a relatively stable source of growth through infrastructure expansion, industrial diversification, and innovation (Pal, 2024). Economies capable of sustaining higher levels of domestic investment are therefore better positioned to strengthen macroeconomic resilience, improve competitiveness, and achieve inclusive development. Despite extensive financial liberalisation and structural reforms in recent decades, many emerging economies continue to experience persistent investment deficits owing to inadequate financial intermediation, limited access to long-term finance, weak technological capability, and insufficient human capital development (Ediagbonya & Tioluwani, 2023).

Financial development has long been recognised as a critical mechanism for addressing these constraints. Thus, beyond increasing the availability of credit, efficient financial systems mobilise savings, reduce information asymmetries, diversify risk, and allocate capital towards its most productive uses. Therefore, by lowering financing costs, relaxing credit constraints, and improving investment project selection, financial development increases the expected returns to productive investment and enhances capital accumulation (Lyu *et al*., 2025). Consequently, its contribution to domestic investment extends beyond expanding financial resources to improving the efficiency of financial intermediation. Recent evidence supports this proposition, showing that improvements in financial depth, access, and efficiency strengthen capital formation by expanding access to finance, reducing transaction costs, and improving resource allocation (Khan *et al*., 2020; Shen & Lee, 2022; Nguyen *et al*., 2022; Nasir et al., 2023; Konstantakopoulou, 2023; Fengju & Wubishet, 2024). Likewise, more developed financial systems strengthen investor confidence and reduce uncertainty surrounding investment decisions (Pham *et al*., 2022; Ibrahim *et al*., 2024). Nevertheless, this study argues that the

inconsistent evidence reported in the literature stems largely from existing studies that overlook the multidimensional nature of financial development, the mechanisms by which it influences investment, and the possibility that its effects are inherently nonlinear**.**

Although the finance-investment nexus has been widely examined, empirical findings remain inconclusive. Much of this inconsistency reflects conceptual and methodological limitations rather than conflicting economic relationships. First, most studies rely on individual banking indicators, such as domestic credit to the private sector or broad money supply, which capture only isolated dimensions of financial systems. These proxies inadequately represent financial development as a multidimensional construct encompassing financial institutions and markets across the dimensions of depth, access, and efficiency (Montes & Oliveira, 2025; Iheonu & Odhiambo, 2025; He & Yoo, 2024; Khan, 2023). Second, the literature generally assumes that financial development exerts a homogeneous and linear influence on domestic investment. Such an assumption is restrictive for emerging economies, where substantial heterogeneity in financial market maturity, institutional capacity, technological readiness, and macroeconomic conditions implies that similar improvements in financial development may produce markedly different investment outcomes (Khan *et al*., 2020; Shen & Lee, 2022; Nasir *et al*., 2023). Consequently, existing evidence provides only a partial understanding of the conditions under which financial development effectively stimulates domestic investment.

Another important limitation is the limited attention devoted to the transmission mechanisms linking financial development to domestic investment. Existing studies predominantly estimate direct effects while overlooking the complementary processes through which financial development enhances productive capacity (Montes & Oliveira, 2025; Iheonu & Odhiambo, 2025). The endogenous growth theory suggests that financial development increases investment not only by easing financing constraints but also by facilitating investment in human capital and technological capabilities, thereby raising the productivity of physical capital (Romer, 1994; Dinh Su & Phuc Nguyen, 2022). Financial systems that efficiently allocate financial resources expand opportunities for education, workforce training, research and development, technological adoption, and innovation. These investments improve labour productivity, strengthen firms' absorptive capacity, and increase the expected returns to capital, thereby

encouraging further investment (Kato, 2020). Accordingly, this study contends that financial development influences domestic investment indirectly through complementary improvements in human capital and technological development, an argument that has been insufficiently examined in recent empirical literature.

A further weakness of the literature is its implicit assumption that the marginal effect of financial development remains constant across different levels of financial sector development. Theoretically, this assumption is difficult to justify. At low levels of financial development, weak financial institutions, limited financial inclusion, and inefficient credit allocation constrain financial systems' ability to channel resources towards productive investment (Danquah & Osei Adu, 2025). As financial systems mature, however, improvements in financial depth, accessibility, and efficiency reduce financing frictions, improve credit screening, and enhance resource allocation, thereby amplifying investment. Beyond a certain point, excessive financial expansion may instead generate diminishing returns through credit misallocation and financial instability (Whited & Zhao, 2021). This suggests that the finance-investment relationship is fundamentally nonlinear and that identifying the threshold at which financial development begins to generate stronger investment effects is essential for effective policy design. However, relatively few studies explicitly investigate this possibility.

Against this background, this study advances the literature in three important respects. First, it employs the International Monetary Fund's Financial Development Index to capture the multidimensional nature of financial development, thereby overcoming the limitations associated with conventional single-indicator proxies. Second, it investigates whether human capital development and technological advancement constitute the principal transmission channels through which financial development influences domestic investment. Third, it explicitly introduces a multi-threshold framework to test whether the finance-investment relationship exhibits threshold effects, recognising that the investment benefits of financial development may depend on reaching a critical level of financial maturity, technological capability, and human capital. These contributions provide a more integrated explanation for the mixed findings in the literature and offer a richer understanding of the conditions under which financial development promotes domestic investment.

Methodologically, this study analyses a panel of 15 emerging economies using a complementary empirical framework comprising the Double-D Dynamic Panel Generalised Method of Moments (Double-D GMM), Cross-Sectional Dependence (CSD)-Robust GMM, and Dynamic Fixed-Effects Threshold (DFET) estimators. This framework addresses the principal econometric challenges characterising the financial development-domestic investment nexus, including dynamic persistence, endogeneity arising from reverse causality and simultaneity, unobserved heterogeneity, and cross-sectional dependence resulting from financial integration and common macroeconomic shocks. The Double-D GMM estimator provides consistent estimates by controlling for dynamic persistence and endogeneity, while the CSD-Robust GMM estimator ensures robust inference in the presence of cross-sectional dependence. The DFET model complements these estimators by identifying whether the effect of financial development on domestic investment changes once financial development exceeds a critical threshold, thereby capturing nonlinear dynamics that conventional linear models overlook. These complementary approaches provide a rigorous evaluation of the direct effect of financial development, the moderating roles of human capital development and technological advancement, and the threshold conditions under which financial development most effectively promotes domestic investment. Consequently, this study develops an integrated framework demonstrating that the investment-enhancing effects of financial development operate through complementary transmission mechanisms and vary with the level of financial sector development, providing robust evidence to inform financial sector reforms in emerging economies.

The remaining sections of the paper are structured as follows: Section 2 reviews relevant literature, both theoretical and empirical, on financial development and domestic investment. Section 3 details the methodology, including data collection and analytical techniques used. Section 4 presents the findings and discusses their implications. Section 5 concludes the paper and offers policy recommendations based on the results.

2. Literature Review

2.1 Theoretical underpinnings

Understanding how financial development influences domestic investment requires a theoretical perspective that explains not only the direct finance-investment relationship but also the mechanisms by which it operates and the conditions under which its effects vary. Accordingly, this study integrates endogenous growth theory, financial intermediation theory, and the Keynesian theory of investment into a unified framework to explain the direct, transmission, and nonlinear effects of financial development on domestic investment.

Fundamentally, the study is anchored in endogenous growth theory, which posits that sustained economic growth is driven by productivity-enhancing factors, including financial development, human capital, and technological progress (Romer, 1994). Within this framework, financial development promotes domestic investment by mobilising savings, improving capital allocation, and facilitating investments in human capital and technological innovation that enhance the productivity of physical capital. However, endogenous growth theory also recognises that the productivity gains from human capital accumulation and technological progress are not automatic (Jones, 2022). Their contribution depends on the economy's absorptive capacity, institutional quality, and the efficiency with which financial systems allocate resources. In financially underdeveloped economies, investments in innovation and skills may generate limited or delayed returns, weakening or even constraining contemporaneous domestic investment.

This limitation is addressed by financial intermediation theory, which explains how efficient financial institutions reduce information asymmetries, mobilise savings, diversify risk, and allocate capital more efficiently, thereby relaxing financing constraints and facilitating investment in productive activities (Diamond, 1984). Conversely, where financial markets remain shallow or inefficient, credit constraints, information asymmetries, and weak institutional capacity may prevent firms from transforming investments in technology and human capital into productive capital formation. Under such conditions, resources devoted to innovation may crowd out short-term physical investment, producing weak or even negative investment responses (Tang *et al*., 2020). Nevertheless, improved financial intermediation alone may not translate into higher investment if firms remain uncertain

about future returns. The Keynesian theory of investment, therefore, complements this perspective by emphasising that investor confidence, expectations, and financing conditions shape investment decisions, with well-developed financial systems reducing uncertainty and encouraging long-term capital formation (Keynes, 1936). From a Keynesian perspective, investment decisions depend on expectations regarding future profitability rather than technological progress alone. Consequently, firms may postpone or reduce physical investment despite increasing expenditures on innovation or human capital if uncertainty, financing constraints, or weak market confidence limit expected returns (Peng *et al*., 2020).

Building on these complementary perspectives, this study argues that the influence of financial development on domestic investment is conditional rather than uniform. Human capital development and technological advancement may either reinforce or constrain domestic investment depending on the level of financial development. Where financial systems remain underdeveloped, investments in technology and skills may entail adjustment costs, financing constraints, or delayed productivity gains, thereby suppressing contemporaneous investment. As financial development deepens, however, improved financial intermediation enhances resource allocation, enabling innovation and human capital accumulation to translate into productive capital formation. This nonlinear proposition provides the theoretical basis for examining both moderation and threshold effects in emerging economies.

2.2. Empirical Studies

Empirical evidence generally supports the proposition that financial development enhances domestic investment by improving financial intermediation, facilitating access to external finance, and allocating capital more efficiently. Across both developed and developing economies, more efficient financial systems reduce financing constraints, lower transaction costs, and improve firms' capacity to undertake long-term productive investment. Recent cross-country studies largely corroborate this proposition, although the magnitude and persistence of the relationship vary considerably across countries and levels of development.

Using a global panel of 152 economies, He and Yoo (2024) report that financial development significantly promotes domestic investment, particularly in low- and middle-income countries, although

the positive effect weakens beyond a critical level of financial development. Similarly, Montes and Oliveira (2026) demonstrate that higher levels of financial development increase investment across 88 countries, with financial institution depth and financial market access exerting the strongest effects, particularly following the Global Financial Crisis. At the country level, Sinha and Shastri (2023) likewise find that both bank-based and market-based financial development significantly stimulate domestic investment in India, highlighting the importance of financial intermediation efficiency rather than credit expansion alone. Collectively, these studies suggest that well-developed financial systems enhance investment by improving both the availability and allocation of financial resources.

Despite this broad consensus, empirical findings remain far from uniform. Cross-country evidence increasingly indicates that the finance-investment relationship is highly context-dependent. For example, Dinga *et al*. (2025), analysing 119 countries across different income groups, find that financial development significantly promotes domestic investment only in lower-middle- and high-income economies, while the relationship remains statistically insignificant in low-income and upper-middle-income countries. Likewise, studies focusing on African economies report contrasting results depending on the financial development indicator employed. Using the augmented mean group estimator, Iheonu *et al*. (2020) find that domestic credit has an insignificant effect on domestic investment in ECOWAS countries, whereas banking efficiency and broad money have a negative effect on investment. Similarly, Salakpi *et al*. (2024) show that broad money positively affects domestic investment, while private credit exerts a negative effect, and domestic credit remains insignificant across African economies. In contrast, Keho (2023) reports a positive long-run effect of domestic credit on investment in West Africa, but an insignificant short-run relationship, using pooled mean group regression. In contrast, evidence from South Africa presented by Muyambiri and Odhiambo (2018) indicates a negative short-run association between financial development and domestic investment when the ARDL method was applied.

Rather than indicating theoretical inconsistency, these divergent findings point to important conceptual and methodological differences across existing studies. Most notably, the estimated relationship appears highly sensitive to the measure of financial development. The overwhelming majority of studies rely on single

banking indicators such as domestic credit to the private sector, bank credit, liquid liabilities, or broad money, each capturing only one dimension of increasingly complex financial systems. Consequently, differences in empirical findings may reflect measurement limitations rather than genuine differences in the finance-investment relationship. This concern is particularly relevant for emerging economies, where financial systems differ substantially in institutional quality, financial inclusion, market sophistication, and access to formal finance. Such heterogeneity implies that identical improvements in financial development may yield markedly different investment outcomes across countries, suggesting that evidence from individual indicators or broad global samples may not adequately capture the finance-investment nexus in emerging economies.

Beyond the mixed evidence on the direct relationship, recent studies increasingly suggest that the effect of financial development on domestic investment is nonlinear rather than uniformly positive. This emerging perspective argues that the investment-enhancing benefits of financial development depend on the maturity of financial systems and the broader institutional environment. He and Yoo (2024) find that financial development promotes domestic investment only up to a threshold; beyond that point, additional financial deepening yields diminishing returns on investment. Similarly, Abdulai *et al*. (2024) report that financial development initially constrains private investment in Sub-Saharan Africa but becomes investment-enhancing once financial development exceeds a critical threshold. Extending this argument, Iheonu and Odhiambo (2025) demonstrate that the effects of different financial development indicators vary across countries with low and high levels of domestic investment, reinforcing the view that the finance-investment relationship is inherently heterogeneous. Finally, Alsubaie (2026) examined the relationship between financial development and capital investment in emerging economies, with particular attention to macroeconomic conditions and institutional quality as transmission factors. In all, these studies challenge the conventional assumption of linearity and suggest that the effectiveness of financial development depends on prevailing financial and economic conditions.

Although these studies represent an important advance, three important gaps remain unresolved. First, most nonlinear analyses continue to rely on isolated banking indicators, particularly domestic credit to the private sector, despite growing recognition that financial

development encompasses financial institutions and financial markets across the dimensions of depth, access, and efficiency. Consequently, existing evidence provides only a partial assessment of how overall financial development influences domestic investment. Second, the literature overwhelmingly estimates the direct effect of financial development while devoting limited attention to the mechanisms through which finance translates into productive investment. Although theoretical arguments suggest that financial systems stimulate investment by facilitating human capital accumulation and technological advancement, these transmission channels remain largely unexplored empirically. This omission limits understanding of whether financial development directly promotes investment or operates indirectly by strengthening complementary productive capabilities.

A third and equally important limitation concerns the contextual relevance of the existing evidence. As highlighted by Ofosu-Mensah ***et al***. (2022), research on domestic investment remains considerably less developed than the broader finance and foreign investment literature. Moreover, most cross-country studies combine economies with markedly different institutional structures, financial architectures, and stages of development, implicitly assuming that similar improvements in financial development generate comparable investment responses. Such an assumption is particularly restrictive for emerging economies, where substantial differences in financial sector maturity, institutional quality, technological readiness, human capital, and financial inclusion may fundamentally alter the effectiveness of financial development. Consequently, evidence from globally or regionally heterogeneous samples provides limited guidance on understanding the finance-investment nexus in emerging economies.

To address these gaps, the present study extends the literature in three important respects. First, it employs the IMF Financial Development Index, thereby capturing the multidimensional nature of financial development rather than relying on individual banking indicators. Second, it advances existing knowledge by examining whether human capital development and technological advancement serve as the transmission mechanisms by which financial development stimulates domestic investment. Third, it integrates Double-D Dynamic Panel GMM, CSD-Robust GMM, and the Dynamic Fixed-Effects Threshold (DFET) model to account simultaneously for dynamic persistence, endogeneity, cross-sectional dependence, and nonlinear

threshold effects. Finally, focusing on 15 emerging economies, the study provides new evidence on how financial development influences domestic investment under different levels of financial sector development, thereby offering a more comprehensive and context-specific understanding of the finance-investment nexus than previous research.

3. Methodology

3.1 Empirical strategy

This study employs complementary dynamic panel estimators to examine the effect of financial development on domestic investment across 15 emerging economies while addressing dynamic persistence, endogeneity, structural breaks, unobserved heterogeneity, cross-sectional dependence, moderation, and nonlinear threshold effects. Thus, domestic investment exhibits considerable persistence, whereas financial development is potentially endogenous due to reverse causality, simultaneity, and omitted country-specific characteristics (Shahbazi, 2026). Consequently, conventional static panel estimators are inconsistent when a lagged dependent variable and endogenous regressors are present.

Following the pre-diagnostic tests and model selection, the principal analysis employs the System Double-D Dynamic Panel Generalised Method of Moments (Double-D GMM) estimator proposed by Chowdhury and Russell (2017) (Appendix, Figure B1). Compared with conventional Difference and System GMM estimators, Double-D GMM applies an additional differencing transformation to eliminate structural shifts, thereby improving instrument relevance and finite-sample efficiency in highly persistent panel data.

To examine robustness, the analysis further employs the Full Variant Double-D GMM and the Cross-Sectional Dependence Robust GMM (CSD-Robust GMM) estimator of Sarafidis (2009), which explicitly accommodates unobserved common factors and cross-country spillover effects (Sarafidis & Wansbeek, 2012).

Finally, potential nonlinearities are investigated using the Dynamic Fixed-Effects Threshold (DFET) model following Wang (2015).

The baseline dynamic investment model is specified as:

$$DI_{it} = \alpha + \rho DI_{i,t-1} + \beta_1 FD_{it} + \sum_{k=1}^{K} \delta_k X_{k,it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where DI_{it} denotes domestic investment, FD_{it} represents financial development, $X_{k,it}$denotes the vector of control variables, $\mu_i$captures country-specific effects, λ_t denotes time effects, and ε_{it} is the idiosyncratic error term.

To examine whether human capital development and technological development strengthen or weaken the finance-investment relationship, the following dynamic moderation model is estimated:

$$DI_{it} = \alpha + \rho DI_{i,t-1} + \beta_1 FD_{it} + \beta_2 M_{it} + \beta_n (FD_{it} \times M_{it}) + \sum_{k=1}^{K} \delta_k X_{k,it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where M_{it}alternatively represents human capital development (HC) and technological development (TECH). The coefficient $\beta_3$measures whether these structural factors moderate the marginal effect of financial development on domestic investment. The conditional marginal effect is

$$\frac{\partial DI}{\partial FD} = \beta_1 + \beta_n HC + \beta_n TECH \quad (3)$$

Following Chowdhury and Russell (2017), the Double-D GMM estimator accommodates structural breaks by applying a second-difference transformation to the disturbance term. The underlying dynamic process is expressed as

$$DI_{it} = \rho DI_{i,t-1} + \eta_i + \mu_{it} + \varepsilon_{it} \quad (4)$$

where $\eta_i$denotes country-specific effects and μ_{it}captures deterministic structural shifts. Eliminating these structural breaks yields the orthogonality conditions.

$$\mathbb{E}\left[\Delta DI_{i,t-s}\, \Delta^2 \varepsilon_{it}\right] = 0, t \geq 4,\ 2 \leq s \leq t-2, \quad \text{where } \Delta^2 \varepsilon_{it} = \varepsilon_{it} - 2\varepsilon_{i,t-1} + \varepsilon_{i,t-2} \quad (5)$$

The corresponding Double-D GMM estimator is obtained by minimising the quadratic moment objective,

$$\hat{\theta}_{DD} = \left(\sum_{i=1}^{N} \Delta^2 \, \mathrm{X}_i' \mathrm{Z}_i \mathrm{W}_N \mathrm{Z}_i' \Delta^2 \mathrm{X}_i \right)^{-1} \left(\sum_{i=1}^{N} \Delta^2 \, \mathrm{X}_i' \mathrm{Z}_i \mathrm{W}_N \mathrm{Z}_i' \Delta^2 \mathrm{DI}_i \right) \tag{6}$$

here $\mathrm{Z}_i$denotes the internal instrument matrix constructed from lagged first differences, while $\mathrm{W}_N$is the optimal GMM weighting matrix.

To evaluate the robustness of the estimated coefficients under pervasive cross-sectional dependence, the study additionally employs the CSD-Robust GMM estimator of Sarafidis (2009), where the disturbance term is decomposed as

$$u_{it} = \eta_i + \lambda_i' \mathrm{f}_t + \varepsilon_{it} \tag{7}$$

with f_t representing unobserved common factors and λ_i denoting heterogeneous factor loadings. Valid orthogonality conditions are obtained from cross-sectionally demeaned instruments,

$$\mathbb{E}\left[\left(DI_{i,t-s} - \bar{DI}_{t-s} \right) \Delta u_{it} \right] = 0, s \geq 2 \tag{8}$$

which produces the robust estimator

$$\hat{\theta}_{CSD} = \left(\widetilde{\mathrm{G}}' \mathrm{Z}_R \Omega_N^{-1} \mathrm{Z}_R' \widetilde{\mathrm{G}} \right)^{-1} \left(\widetilde{\mathrm{G}}' \mathrm{Z}_R \Omega_N^{-1} \mathrm{Z}_R' \Delta \mathrm{DI} \right) \tag{9}$$

where $\Omega_N$denotes the robust variance-covariance matrix.

Finally, potential nonlinearities are examined using the dynamic fixed-effects threshold model (Wang, 2015):

$$\begin{aligned} DI_{it} = \rho DI_{i,t-1} + \beta_1 FD_{it} \, \mathbb{I}(FD_{it} \leq \gamma) + \beta_2 FD_{it} \, \mathbb{I}(FD_{it} \\ > \gamma) + \sum_{k=1}^{K} \delta_k \, X_{k,it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{10}$$

where $I(\cdot)$is an indicator function that equals one when the specified condition holds and zero otherwise, and γ is the endogenously estimated threshold parameter. This specification determines whether the effect of financial development differs across low- and high-financial-development regimes.

The validity of all dynamic GMM estimators is assessed using the Hansen over-identification test together with the Arellano-Bond AR(1) and AR(2) serial correlation tests. The absence of second-order serial correlation and failure to reject the Hansen test confirm

instrument validity and estimator consistency, while the DFET threshold estimates are evaluated using the concentrated residual sum-of-squares criterion and corresponding threshold significance tests. This complementary estimation framework enables robust inference on the direct, moderating, and nonlinear effects of financial development on domestic investment while accounting for the principal econometric challenges inherent in dynamic macro-panel data.

3.2 Data

Data are obtained from three internationally recognised sources: the International Monetary Fund (IMF) Financial Development Database, the Penn World Table (PWT 11.0), and the World Bank's World Development Indicators (WDI). These databases provide harmonised and internationally comparable macroeconomic and financial indicators, ensuring data consistency and reliability. The sample period captures the evolution of financial systems during an era of financial deepening while encompassing major global shocks, including the 2008-2009 Global Financial Crisis and the COVID-19 pandemic. The sample is restricted to countries with consistent data availability for the IMF Financial Development Index and all study variables over the study period, thereby minimising measurement inconsistencies and enhancing the robustness of the empirical analysis. The final sample comprises Argentina, Brazil, China, Colombia, the Czech Republic, India, Indonesia, Malaysia, Mexico, Peru, the Philippines, the Republic of Korea, South Africa, Thailand, and Türkiye, which collectively provide substantial variation in financial development and domestic investment.

Table 1 provides the description, measurement and sources of each variable employed.

Table 1

Description, measurement and sources of variables

Variable	Measurement	Expected sign	Source
Domestic Investment (DI)	Gross fixed capital formation (% of GDP)		World Development Indicators (WDI)
Financial Development (FD)	IMF FDI, a composite index capturing the depth, access and efficiency of financial institutions and financial markets	+	IMF, Financial Development Database

Variable	Measurement	Expected sign	Source
Human Capital Development (HC)	Human Capital Inde (Penn World Table 10.0)	+	Penn World Table (PWT 11.0)
Technological Development (TECH)	R&D expenditure (% of GDP)	+ / -	WDI
Urbanisation (URB)	Urban population (% of total population)	+	WDI
Tax Revenue (TAX)	Tax revenue (% of GDP)	+ / -	WDI
Trade Openness (TO)	(exports + imports of goods and services) as percentage of GDP	+	WDI
Foreign Direct Investment (FDI)	Net FDI inflows (% of GDP)	+	WDI
Personal Remittances (REM)	Personal remittances received (% of GDP)	-	WDI
Economic Growth (GDPG)	Annual GDP growth rate (%)	+	WDI
Global Financial Crisis (GFC)	Dummy variable equal to 1 for 2008-2009, and 0 otherwise	-	Authors' construction
COVID-19 Pandemic (COVID)	Dummy variable equal to 1 for 2020-2021, and 0 otherwise	-	Authors' construction

Note: authors' work

3.3 Rationale for variables

The theoretical framework and empirical literature on the finance-investment nexus guide variable selection. Domestic investment, measured by gross fixed capital formation, serves as the dependent variable because it captures productive capital accumulation and long-term economic expansion (Alsubaie, 2026; Iheonu & Odhiambo, 2025; He & Yoo, 2024). Financial development is the principal explanatory variable and is measured using the IMF Financial Development Index, which comprehensively captures the depth, access, and efficiency of financial institutions and markets. This multidimensional measure is preferred to conventional single-indicator proxies because it better reflects the overall functioning of the financial system (Alsubaie, 2026; He & Yoo, 2024). Human capital development and technological development are incorporated as moderating variables, reflecting the proposition that financial development enhances investment indirectly by improving labour productivity, innovation, and firms' absorptive capacity (Awode & Oduola, 2025).

Furthermore, urbanisation, tax revenue, trade openness, foreign direct investment, remittances, and economic growth are included as control variables because they influence investment through market expansion, fiscal capacity, external financing, technology transfer, capital mobility, and macroeconomic performance (Iheonu & Odhiambo, 2025; He & Yoo, 2024; Alsubaie, 2026). Finally, dummy variables for the Global Financial Crisis and the COVID-19 pandemic control for major exogenous shocks that disrupted financial intermediation and investment activity (De Crescenzio & Lepers, 2025). These variables provide a comprehensive framework for isolating the direct, indirect, and nonlinear effects of financial development on domestic investment while minimising omitted-variable bias.

4. Findings and discussions

4.1 Preliminary analysis

Table 2 reveals substantial cross-country heterogeneity in domestic investment and its determinants across the 15 emerging economies, justifying the use of dynamic panel estimators that accommodate heterogeneous economic structures. Domestic investment averages 25.87% of GDP, reflecting differences in capital accumulation arising from varying levels of industrialisation, infrastructure development, and investment policies. The mean financial development index of 0.485 indicates moderate but unequal financial sector development, consistent with differences in financial market reforms and institutional quality. Also, human capital averages 2.741, while technological development records the largest dispersion, averaging 20.13, reflecting unequal investment in education, innovation, and research capabilities. For the controls, urbanisation averages 68.06%, illustrating different stages of structural transformation. Tax revenue averages 14.42%, signifying varying fiscal capacities to finance productive public investment. Likewise, trade openness (65.3%), FDI (2.52%), and remittances (1.68%) exhibit considerable variation owing to differences in external integration, investment attractiveness, and migrant inflows. The wide GDP growth range (-10.93% to 14.15%) captures episodes of economic expansion and contraction associated with commodity price cycles, domestic macroeconomic reforms, the 2008-2009 Global Financial Crisis, and

the 2020-2021 COVID-19 pandemic, both of which are explicitly controlled for in the empirical analysis.

Table 2

Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
DI	25.869	7.482	12.346	46.27
FD	0.485	0.153	0.226	0.849
TECH	20.129	17.426	1.888	67.045
HC	2.741	0.446	1.857	3.874
URB	68.055	16.76	29.095	92.274
TAX	14.417	3.777	6.934	26.02
TO	0.653	0.387	0.22	1.681
FDI	2.522	1.485	-.858	10.003
REM	1.677	2.462	0.07	12.784
GDPG	3.859	3.814	-10.933	14.151
GFC	0.1	0.301	0	1
COVID	0.1	0.301	0	1

Note: Number of observations is 300

Source: authors' computations using data from the International Monetary Fund Financial Development Database, Penn World Table version 11.0 and World Development Indicators (World Bank).

Furthermore, Table A1 presents the pairwise correlation coefficients between domestic investment and the explanatory variables, providing preliminary evidence on the direction of their associations. Domestic investment is positively and significantly correlated with financial development (0.192), suggesting that more developed financial systems are associated with higher levels of capital formation in emerging economies. Similarly, human capital (0.156) and foreign direct investment (0.123) are positively associated with domestic investment, indicating that skilled labour and external capital complement domestic investment. Stronger positive correlations are observed for urbanisation (0.412) and economic growth (0.436), reflecting the importance of expanding markets and favourable macroeconomic conditions in stimulating investment. Conversely, tax revenue (-0.400) and remittances (-0.132) are negatively associated with domestic investment, suggesting that higher tax burdens may discourage private investment, while remittance inflows may be channelled predominantly towards household consumption rather than productive capital formation. Although technological development

exhibits a weak negative correlation with domestic investment (-0.057), the association is very weak, indicating that higher technological development is not systematically associated with higher domestic investment. This may reflect the need for complementary conditions, such as financial deepening and skilled human capital, to translate technological progress into increased domestic investment. Trade openness, the Global Financial Crisis, and the COVID-19 pandemic display statistically insignificant bivariate relationships, suggesting that their effects may be conditional on other factors. The modest correlation coefficients indicate limited risks of severe multicollinearity while reinforcing the need for multivariate dynamic estimation to identify the net effects of financial development on domestic investment.

4.2 Pre-estimation diagnostic tests

Before estimation, a comprehensive set of pre-estimation diagnostic tests was conducted to evaluate the statistical properties of the panel data. These included panel unit root tests using the Pesaran CADF procedure, cross-sectional dependence tests, slope heterogeneity tests, and panel cointegration tests to verify the suitability of the econometric framework. The results confirm that the adopted estimation strategy, comprising the Double-D GMM, CSD-Robust GMM, and Dynamic Fixed-Effects Threshold estimators, is appropriate for the underlying data characteristics. To enhance the readability of the manuscript, the detailed diagnostic results are reported in Appendix B (Tables B1-B6), while only the principal estimation results are presented in the main text. The preliminary diagnostics confirm the use of the Double D GMM and the CSD-Robust GMM.

4.3 Financial development on domestic investment using Double -D GMM and CSD -Robust GMM Results

Table 3 presents the baseline estimates from the Double-D System GMM alongside the Double-D Full GMM and CSD-Robust GMM robustness estimators. The consistency of coefficient signs and statistical significance across all specifications confirms that the results are robust to alternative estimation strategies after accounting for endogeneity, dynamic persistence, and cross-sectional dependence.

The lagged dependent variable is positive and highly significant (0.472-0.757), indicating strong persistence in domestic investment.

This suggests that investment decisions in emerging economies are path-dependent because capital accumulation entails substantial adjustment costs, long planning horizons, and irreversible expenditures. The significant negative second lag reported by the Double-D estimators further indicates convergence towards long-run equilibrium through gradual cyclical adjustment.

Financial development exerts a positive and highly significant effect on domestic investment across all estimators, with coefficients ranging from 0.0237 to 0.0356. The findings indicate that improvements in the depth, access, and efficiency of financial systems stimulate capital formation by allocating resources to more productive investments, easing financing constraints, and expanding firms' access to long-term finance. The results support Financial Intermediation Theory (Diamond, 1984) and Endogenous Growth Theory, which emphasise that efficient financial systems facilitate the accumulation of productive capital. They are also consistent with recent evidence reported by He and Yoo (2024), Sinha and Shastri (2023), Keho (2023), and Montes and Oliveira (2026). Unlike previous studies that rely primarily on banking indicators, the IMF Financial Development Index shows that the multidimensional quality of financial systems is a stronger predictor of domestic investment.

Among the control variables, urbanisation positively influences domestic investment (0.131-0.429), suggesting that expanding urban centres create agglomeration economies, larger markets, and improved infrastructure that increase investment opportunities. Conversely, tax revenue negatively affects domestic investment (-0.143 to -0.977), implying that higher tax burdens and administrative inefficiencies may discourage private capital formation. Foreign direct investment remains positive and significant (0.178-0.256), indicating that foreign capital complements domestic investment through technology transfer, productivity spillovers, and stronger integration into global production networks.

Trade openness exhibits only weak, significant effects in the CSD-GMM model, implying that greater external integration alone is insufficient to stimulate investment without supportive domestic financial institutions. Similarly, remittances display a negative association with domestic investment, although the effect is not robust across all estimators, suggesting that remittance inflows were directed primarily towards household consumption and income smoothing rather than productive investment.

Economic growth is the strongest determinant of domestic investment (4.442-8.988), confirming that stronger macroeconomic performance raises expected profitability, strengthens investor confidence, and stimulates capital accumulation, consistent with the accelerator hypothesis. Finally, both the Global Financial Crisis and the COVID-19 pandemic significantly reduced domestic investment, reflecting the adverse effects of heightened uncertainty, tighter financial conditions, and weaker aggregate demand. These findings underscore emerging economies' continued vulnerability to external shocks despite ongoing financial sector development.

The diagnostic tests confirm that Double-D GMM and the CSD-Robust GMM estimators satisfy the Hansen over-identification test, exhibit significant AR(1) but insignificant AR(2) serial correlation, and employ robust variance-covariance estimators, confirming instrument validity and the overall reliability of the estimated models. Additional diagnostic tests are reported in Supplementary Appendix A (Table A7). The Wooldridge test rejects the null hypothesis of no first-order serial correlation ($F(1,14) = 34.261$, $p < 0.001$), confirming dynamic persistence and supporting the use of dynamic panel estimators. The mean Variance Inflation Factor (VIF = 3.086) indicates no evidence of harmful multicollinearity.

Table 3

Financial development on domestic investment using Double-D GMM and CSD-Robust GMM results

Variables	(1) DD System GMM	(2) DD Full GMM	(3) CSD-Robust GMM
Domestic Investment. = Lag1,	0.757***	0.732***	0.472***
	(0.0639)	(0.0664)	(0.165)
Domestic Investment = Lag2,	-0.692***	-0.334***	
	(0.0689)	(0.0525)	
Financial Development	0.0237***	0.0273***	0.0356***
	(0.00655)	(0.00691)	(0.0110)
Urbanisation	0.131***	0.149***	0.4291***
	(0.0265)	(0.0272)	(0.0524)
Tax revenue	-0.143**	-0.168**	-0.977***
	(0.0727)	(0.0765)	(0.450)
Trade openness	0.0124	0.0145	0.0590*
	(0.0113)	(0.0117)	(0.0321)
FDI	0.251*	0.256*	0.178***
	(0.146)	(0.151)	(0.0445)
Remittance	-0.189**	-0.215***	-1.094

Variables	(1) DD System GMM	(2) DD Full GMM	(3) CSD-Robust GMM
	(0.0776)	(0.0820)	(4.485)
GDP Growth	4.442***	5.109***	8.988***
	(1.014)	(0.949)	(1.26)
Global Financial Crises	-0.6537***	-0.7656***	-
	(0.0518)	(0.0565)	
COVID-19 pandemic	-0.0901***	-0.1917***	-
	(0.0313)	(0.0441)	
Hansen J *p-value*	0.7699	0.8152	0.7992
AR (1) *p-value*	0.0019	0.0014	0.0075
AR (2) *p-value*	0.5391	0.2488	0.4705
VCE	robust	robust	WC - robust
Observations	300	300	300
Number of panel_id	15	15	15

*Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. WC- robust is Windmeijer bias-corrected robust (Windmeijer, 2005). The Global Financial Crisis (2008-2009) and COVID-19 (2020-2021) dummy variables are included in the Double-D GMM specifications to control for major global macroeconomic shocks. They are omitted from the CSD-Robust GMM estimations because the estimator explicitly accounts for common cross-sectional shocks through latent common factors, rendering these time-specific event dummies redundant.*

4.4 The complementary role of human capital development and technology in the financial development influence on domestic investment

The moderation results in Table A2 indicate that the investment-enhancing effect of financial development is contingent on complementary human capital and technological capabilities, confirming that financial deepening alone is insufficient to maximise domestic investment in emerging economies. Across the main and robustness estimators, financial development remains positive and significant, while the interaction terms (FD × HC and FD × TECH) are consistently positive and statistically significant. The stability of these estimates across alternative estimators demonstrates that the moderating effects are robust to endogeneity, alternative instrument specifications and cross-sectional dependence.

In models 1-3, human capital exerts a positive direct effect on domestic investment (2.023-3.183), while the positive FD × HC interaction shows that the marginal effect of financial development strengthens as human capital improves. This means that financial systems generate larger investment gains when firms possess the

skills and absorptive capacity required to evaluate projects, adopt new technologies and utilise financial resources efficiently. Rather than acting as an independent growth factor, human capital enhances the productivity of financial intermediation by increasing the expected returns to irreversible capital investment. This extends endogenous growth theory by demonstrating that the effectiveness of financial development depends on complementary investments in workforce capabilities, consistent with the broader evidence of He and Yoo (2024) and Montes and Oliveira (2026).

Also, technology in models 4-6 exhibits a similar complementary role. Although technological development directly promotes domestic investment, the positive FD × TECH interaction indicates that financial development becomes increasingly effective as technological capability improves. Thus, efficient financial systems facilitate investment in innovation, digital infrastructure and research and development, but these investments generate higher capital formation only where firms possess the technological capacity to transform finance into productivity-enhancing activities. The results therefore suggest that technological capability increases the marginal productivity of finance, supporting recent evidence emphasising innovation as a complementary driver of investment (Nasir *et al*., 2023; Fengju & Wubishet, 2024).

Finally, the double-moderation models 7-9 provide the study's principal contribution. When human capital and technology are incorporated simultaneously, both interaction terms remain positive and significant, demonstrating that the finance-investment relationship is jointly conditioned by multiple structural capabilities rather than a single transmission mechanism. This supports the findings of Awode and Oduola (2025), which revealed a positive individual and combined effect of technological innovation and human capital development on industrial competitiveness in Africa, although not specifically on domestic investment. Also, the marginal-effect estimates in Tables C1-C3 reinforce this conclusion; for instance, under the CSD-Robust GMM estimator, the effect of financial development increases from 14.219 when both moderators are low to 44.515 when both are high. These findings advance the finance-investment literature by showing that the returns to financial development are endogenous to an economy's absorptive capacity. Accordingly, financial sector reforms are likely to yield substantially larger investment gains when implemented

alongside policies that strengthen education, skills development, innovation and technological upgrading.

4.5 Threshold effects in the financial development-domestic investment nexus

The threshold estimates in Table 4 provide robust evidence that the finance-investment nexus is inherently nonlinear, with the effect of financial development depending on critical levels of financial maturity, technological capability and human capital. The highly precise threshold estimates, reflected by the narrow confidence intervals, indicate clear regime shifts and reject the conventional assumption of a homogeneous linear relationship.

The estimated financial development threshold of 0.5240 represents the point beyond which financial development begins to generate substantial investment gains. Below this threshold, the coefficient of financial development is statistically insignificant, suggesting that financial deepening alone is insufficient to stimulate domestic investment when financial systems remain relatively shallow and inefficient. Weak financial intermediation, limited access to long-term finance, and imperfect capital allocation constrain firms' ability to transform financial resources into productive capital formation. Once the threshold is exceeded, however, the coefficient becomes positive and highly significant (3.356), indicating that improvements in financial development yield disproportionately larger investment gains. These findings support the emerging "too little finance" hypothesis advanced by Abdulai et al. (2024) and extend the nonlinear evidence of He and Yoo (2024) by identifying a precise level of financial maturity at which finance becomes an effective driver of domestic investment in emerging economies.

The technology- and human capital-based threshold models reveal that broader productive capabilities equally condition the returns to financial development. The technology threshold (3.6640) indicates that financial development exerts a significantly stronger influence on domestic investment once economies attain sufficient innovative and technological capacity. Similarly, the human capital threshold (2.6170) demonstrates that the investment returns to financial development increase after economies accumulate adequate workforce skills and productive capabilities. These findings suggest that technology and human capital enhance firms' absorptive capacity, enabling financial resources to be converted more efficiently into productive capital rather

than remaining underutilised. Consequently, financial development exhibits increasing marginal productivity as complementary structural capabilities improve.

Unlike previous studies that focus exclusively on financial thresholds, this analysis demonstrates that the effectiveness of financial development is jointly constrained by financial maturity, technological capability and human capital. The findings advance the finance-investment literature by proposing a multiple-threshold framework, in which the returns to financial development are state-dependent rather than universal. This framework provides a stronger explanation for the heterogeneous evidence reported across emerging economies and implies that financial sector reforms are unlikely to maximise domestic investment unless accompanied by sustained investments in education, skills development and technological upgrading.

Table 4

Threshold effect in the financial development-domestic investment nexus

Variables	(1) Financial Development Threshold Model	(2) Technology-Based Regime Heterogeneity Model	(3) Human Capital-Based Regime Heterogeneity Model
Threshold ($\hat{\gamma}$)	0.5240	3.6640	2.6170
Thresh C.I	[0.5230 – 0.5250]	[3.4361 – 3.7092]	[2.6100 – 2.6180]
DI = Lag,	0.645***	0.655***	0.630***
	(0.0411)	(0.0412)	(0.0407)
$FD(q \leq \gamma)$	1.668	9.236**	8.456**
	(3.941)	(3.991)	(3.599)
$FD(q > \gamma)$	3.356***	4.135***	2.782*
	(1.562)	(1.472)	(1.494)
TECH	0.0108	0.0252**	0.0258**
	(0.0111)	(0.0101)	(0.0102)
HC	1.732***	0.503***	3.348***
	(0.162)	(0.133)	(0.286)
URB	0.116***	0.112***	0.0653***
	(0.0251)	(0.0335)	(0.0239)
TAX	-0.899***	-0.559*	-0.854**
	(0.331)	(0.322)	(0.330)
TO	0.00631	0.00432	0.00561
	(0.0107)	(0.0106)	(0.0107)
FDI	0.372***	0.361***	0.333***
	(0.113)	(0.113)	(0.113)
REM	-0.713***	-0.669**	-0.643**
	(0.265)	(0.260)	(0.260)
GDPG	0.301***	0.301***	0.299***
	(0.0314)	(0.0312)	(0.0311)

Variables	(1) Financial Development Threshold Model	(2) Technology-Based Regime Heterogeneity Model	(3) Human Capital-Based Regime Heterogeneity Model
GFC	-0.351***	-0.448***	-0.384***
	(0.142)	(0.140)	(0.139)
COVID	-1.245***	-1.235***	-1.157***
	(0.342)	(0.339)	(0.338)
Constant	5.963*	5.485*	5.456*
	(3.085)	(2.998)	(2.919)
Observations	285	285	285
R-squared	0.631	0.636	0.638
Number of panel_id	15	15	15

*Note: trim(0.05) grid(400) bs(500). is the threshold variable: Model 1: $q = FD$; Model 2: $q = TECH$; Model 3: $q = HC$. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The relatively long time dimension ($T = 20$) substantially reduces the potential Nickell bias associated with the lagged dependent variable.*

5. Conclusion and recommendations

This study demonstrates that financial development significantly promotes domestic investment in emerging economies, but its effectiveness depends on complementary human capital and technological capabilities, and it becomes substantially stronger once a critical level of financial development is attained. These findings confirm that financial deepening alone is insufficient to maximise domestic capital formation without broader structural transformation.

Building on these findings, this study makes three important contributions. Theoretically, it develops a unified framework that integrates financial intermediation, endogenous growth, financial intermediation theory, and the Keynesian theory of investment by demonstrating that human capital and technology strengthen the investment effects of financial development. At the same time, threshold analysis identifies the critical level at which these effects intensify. Empirically, it extends the finance-investment literature by simultaneously estimating direct, moderation, and nonlinear effects using Double-D System and Full GMM, CSD-Robust GMM, and Dynamic Fixed-Effects Threshold estimators, thereby addressing endogeneity and cross-sectional dependence. Practically, the findings provide evidence that financial reforms generate the greatest investment gains only when accompanied by investments in skills development, innovation, and technological upgrading.

Given these contributions, several policy implications emerge. First, policymakers should prioritise reforms that raise financial development beyond the estimated threshold (0.524), as financial deepening below this level generates relatively weak investment responses. Accordingly, reforms should improve financial depth, accessibility, and efficiency rather than simply expanding credit. Second, financial sector reforms should be complemented by sustained investments in education, technical skills, research, innovation, and digital infrastructure, since human capital and technological capability substantially amplify the benefits of financial investment. Finally, governments should strengthen macroeconomic and institutional stability through efficient tax administration, predictable regulations, and policies that attract productivity-enhancing foreign investment. Together, these complementary reforms will maximise domestic investment while improving resilience to future external shocks.

Notwithstanding these contributions and policy implications, the study has some limitations. The analysis is restricted to 15 emerging economies because of data availability, which may limit generalisability. Future research should examine broader samples, sectoral investment dynamics, institutional quality, digital and green finance, and multiple-threshold nonlinearities over longer periods.

References

1. Abdulai, M.G., Sekyi, S., & Brafu-Insaidoo, W.G. (2024). Regarding the finance-investment nexus in sub-Saharan Africa: An issue of too little or too much finance? *Managerial Finance, 50*(12), pp. 2115-2134. https://doi.org/10.1108/MF-05-2024-0372
2. Alsubaie, A. (2026). Financial development and investment in emerging economies: The role of macroeconomic and institutional conditions. *International Journal of Economics and Financial Issues, 16*(3), 1. https://doi.org/10.32479/ijefi.23403
3. Awode, S.S., & Oduola, M.O. (2025). The interplay between technological innovation and human capital development in driving industrial productivity and competitiveness in Africa. *Journal of Economics and Development, 27*(1), pp. 56-71. https://doi.org/10.1108/JED-03-2024-0079
4. Chowdhury, R.A., & Russell, B. (2017). The difference, system and 'Double-D' GMM panel estimators in the presence of structural

breaks. *Scottish Journal of Political Economy, 65*(3), pp. 271-292. https://doi.org/10.1111/sjpe.12142

5. Danquah, D.A., & Osei Adu, K. (2025). Effects of lending rates and financial development on loan portfolio in sub-Saharan Africa. *Future Business Journal, 11*(1), 227. https://doi.org/10.1186/s43093-025-00653-0
6. De Crescenzio, A., & Lepers, E. (2025). Extreme capital-flow episodes from the global financial crisis to COVID-19: An exploration using monthly data. *Open Economies Review, 36*(1), pp. 105-136. https://doi.org/10.1007/s11079-023-09745-2
7. Diamond, D. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies, 51*(3), pp. 393-414. https://doi.org/10.2307/2297430
8. Dinga, G.D., Fonchamnyo, D.C., Ongo, N.B.E., & Bekun, F.V. (2025). Dynamic common correlation effects of financial development, foreign direct investment, market size and trade openness on domestic investment: An income-level prognosis. *Journal of Economic and Administrative Sciences, 41*(3), pp. 927-948. https://doi.org/10.1108/JEAS-04-2022-0099
9. Dinh Su, T., & Phuc Nguyen, C. (2022). Foreign financial flows, human capital and economic growth in African developing countries. *International Journal of Finance & Economics, 27*(3), pp. 3010-3031. https://doi.org/10.1002/ijfe.2310
10. Ediagbonya, V., & Tioluwani, C. (2023). The role of fintech in driving financial inclusion in developing and emerging markets: Issues, challenges and prospects. *Technological Sustainability, 2*(1), pp. 100-119. https://doi.org/10.1108/TECHS-10-2021-0017
11. Fengju, X., & Wubishet, A. (2024). Analysis of the impact of financial development on economic growth in East Africa: How do the institutional qualities matter? *Economic Analysis and Policy, 82*, pp. 1177-1189. https://doi.org/10.1016/j.eap.2024.04.002
12. He, Y., & Yoo, T.H. (2024). Financial development impact on domestic investment: Does income level matter? *Cogent Economics & Finance, 12*(1), 2321811. https://doi.org/10.1080/23322039.2024.2321811
13. Ibrahim, R., Alomair, A., & Al Naim, A. (2024). How financial development heterogeneity, macroeconomic volatility, domestic investment, and digital economy are driving sustainable economic growth in Africa. *Sustainability, 16*(21), 9281. https://doi.org/10.3390/su16219281
14. Iheonu, C.O., & Odhiambo, N. (2025). Bank-based financial development and investment nexus in Africa: Evidence from quantile

regression. *Journal of International Economics and Management, 25*(3), pp. 166-183. https://doi.org/10.1108/JIEM-07-2025-0058

15. Iheonu, C.O., Asongu, S.A., Odo, K.O., & Ojiem, P.K. (2020). Financial sector development and investment in selected countries of the Economic Community of West African States: Empirical evidence using the heterogeneous panel data method. *Financial Innovation, 6*(1), 29. https://doi.org/10.1186/s40854-020-00195-0
16. Jones, C.I. (2022). The past and future of economic growth: A semi-endogenous perspective. *Annual Review of Economics, 14*(1), pp. 125-152.https://doi.org/10.1146/annurev-economics-080521-012458
17. Kato, M. (2020). Founders' human capital and external knowledge sourcing: Exploring the absorptive capacity of start-up firms. *Economics of Innovation and New Technology, 29*(2), pp. 184-205. https://doi.org/10.1080/10438599.2019.1598670
18. Keho, Y. (2023). Impact of financial development on domestic investment: Evidence from West African countries. *African Development Review, 35*(3), pp. 270-281. https://doi.org/10.1111/14678268.12709
19. Keynes, J. (1936). *The general theory of employment, interest, and money*. Macmillan.
20. Khan, H., Khan, S., & Zuojun, F. (2020). Institutional quality and financial development: Evidence from developing and emerging economies. *Global Business Review, 23*(4), pp. 971-983. https://doi.org/10.1177/0972150919892366
21. Konstantakopoulou, I. (2023). Financial intermediation, economic growth, and business cycles. *Journal of Risk and Financial Management, 16*(12), 514. https://doi.org/10.3390/jrfm16120514
22. Lyu, Y., Zhang, J., Qing, X., & Bai, Y. (2025). The influence of non-financial enterprises' financialisation on total factor productivity of enterprises: Promotion or inhibition? *International Journal of Finance & Economics, 30*(1), 172-189. https://doi.org/10.1002/ijfe.2912
23. Montes, G.C., & Oliveira, V. (2026). Effects of financial development on investments: New evidence considering different aspects of financial development. *International Journal of Finance & Economics, 31*(1), pp. 905-935. https://doi.org/10.1002/ijfe.3175
24. Muyambiri, B., & Odhiambo, N. (2018). South Africa's financial development and its role in investment. *Journal of Central Banking Theory and Practice, 7*(1), pp. 101-120. https://doi.org/10.2478/jcbtp-2018-0005
25. Nasir, M.A., Huynh, T.L.D., & Nguyen, S.P. (2023). Financial development and capital allocation efficiency: Evidence from

emerging economies. *Journal of International Financial Markets, Institutions and Money, 82*, 101673.

26. Nguyen, C.P., Schinckus, C., & Su, T.D. (2022). Financial development and investment dynamics in emerging markets. *Economic Modelling, 108*, 105748.
27. Ofosu-Mensah Ababio, J., Aboagye, A.Q., Barnor, C., & Agyei, S.K. (2022). Foreign and domestic private investment in developing and emerging economies: A review of literature. *Cogent Economics & Finance, 10*(1), 2132646. https://doi.org/10.1080/23322039.2022.2132646
28. Pal, S. (2024). The international capital flows and domestic savings-domestic investment nexus: A comparative evidence between heterogeneous developing regions. *South Asian Journal of Macroeconomics and Public Finance, 13*(2), pp. 169-212. https://doi.org/10.1177/22779787241245779
29. Peng, H., Tan, H., & Zhang, Y. (2020). Human capital, financial constraints, and innovation investment persistence. *Asian Journal of Technology Innovation, 28*(3), pp. 453-475. https://doi.org/10.1080/19761597.2020.1770616
30. Pesaran, M.H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, *22*(2), pp. 265-312.
31. Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*(1), pp. 50-93.
32. Pham, H., Gan, C., & Hu, B. (2022). Causality between financial development and foreign direct investment in Asian developing countries. *Journal of Risk and Financial Management, 15*(5), 195. https://doi.org/10.3390/jrfm15050195
33. Romer, P.M. (1994). The origins of endogenous growth. *Journal of Economic Perspectives, 8*(1), pp. 3-22. https://doi.org/10.1257/jep.8.1.3
34. Salakpi, A., Nasse, T., & Nangpiire, C. (2024). Exploring the relationship between financial sector development and domestic investment in Africa. *Academy of Accounting and Financial Studies Journal, 28*(S3), pp. 1-13.
35. Sarafidis, V. (2009). GMM estimation of short dynamic panel data models with error cross-sectional dependence. *MPRA 36154(January)*. https://mpra.ub.uni-muenchen.de/36154/
36. Sarafidis, V., & Wansbeek, T. (2012). Cross-sectional dependence in panel data analysis. *Econometric Reviews, 31*(5), pp. 483-531. https://doi.org/10.1080/07474938.2011.611458

37. Shahbazi, K. (2026). Does financial development contribute to the nonlinear relationship between innovation and export diversification? *Competitiveness Review: An International Business Journal, 36*(4), pp. 721-747. https://doi.org/10.1108/CR-04-2024-0074
38. Shen, C.H., & Lee, C.C. (2022). Financial development and investment efficiency: International evidence. *Journal of International Financial Markets, Institutions and Money, 76*, 101475. https://doi.org/10.1016/j.intfin.2021.101490
39. Shi, L., & Xu, J. (2023). Capital accumulation and sustainable development in developing economies: the role of natural resources development. *Resources Policy, 86*, 104098. https://doi.org/10.1016/j.resourpol.2023.104098
40. Sinha, N., & Shastri, S. (2023). Does financial development matter for domestic investment? Empirical evidence from India. *South Asian Journal of Business Studies, 12*(1), pp. 104-126. https://doi.org/10.1108/SAJBS-09-2020-0332
41. Tang, J.J., Quayes, S., & Joseph, G. (2020). Microfinance institutions, financial intermediation and the role of deposits. *Accounting & Finance, 60*(2), pp. 1635-1672. https://doi.org/10.1111/acfi.12506
42. Wang, Q. (2015). Fixed-effect panel threshold model using Stata. *The Stata Journal, 15*(1), pp. 121-134. https://doi.org/10.1177/1536867X1501500108
43. Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, *126*(1), pp. 25-51.
44. Whited, T.M., & Zhao, J. (2021). The misallocation of finance. *The Journal of Finance, 76*(5), pp. 2359-2407. https://doi.org/10.1111/jofi.13031

APPENDIX A

Table A1

Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) DI	1.000											
(2) FD	0.192*	1.000										
	(0.001)											
(3) TECH	-0.057	0.261*	1.000									
	(0.022)	(0.000)										
(4) HC	0.156*	0.366*	0.269*	1.000								
	(0.007)	(0.000)	(0.000)									
(5) URB	0.412*	0.061	-0.237*	0.518*	1.000							
	(0.000)	(0.291)	(0.000)	(0.000)								
(6) TAX	-0.400*	0.173*	-0.262*	0.185*	0.153*	1.000						
	(0.000)	(0.003)	(0.000)	(0.001)	(0.008)							
(7) TO	0.002	0.362*	0.450*	0.486*	-0.106	0.281*	1.000					
	(0.975)	(0.000)	(0.000)	(0.000)	(0.066)	(0.000)						
(8) FDI	0.123*	-0.240*	-0.074	0.089	0.126*	0.105	0.177*	1.000				
	(0.033)	(0.000)	(0.201)	(0.124)	(0.029)	(0.070)	(0.002)					
(9) REM	-0.132*	-0.387*	0.559*	-0.161*	-0.429*	-0.176*	-0.009	-0.061	1.000			
	(0.022)	(0.000)	(0.000)	(0.005)	(0.000)	(0.002)	(0.882)	(0.294)				
(10) GDPG	0.436*	-0.101	0.091	-0.271*	-0.291*	-0.177*	-0.075	0.171*	0.085	1.000		
	(0.000)	(0.080)	(0.114)	(0.000)	(0.000)	(0.002)	(0.193)	(0.003)	(0.144)			
(11) GFC	-0.002	-0.040	-0.003	-0.096	-0.065	-0.028	-0.024	-0.001	0.009	-0.155*	1.000	
	(0.974)	(0.488)	(0.960)	(0.098)	(0.260)	(0.635)	(0.676)	(0.983)	(0.871)	(0.007)		
(12) COVID	-0.051	0.052	0.010	0.112	0.063	-0.017	-0.013	-0.041	0.011	-0.260*	-0.111	1.000
	(0.383)	(0.372)	(0.859)	(0.052)	(0.279)	(0.772)	(0.822)	(0.484)	(0.844)	(0.000)	(0.055)	

*Note: * shows significance at p<.05*

Source: authors' computations using data from the International Monetary Fund Financial Development Database, Penn World Table version 11.0 and World Development Indicators (World Bank).

Table A2

The complementary role of human capital development and technology in the influence of financial development on domestic investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Human Capital Moderation			**Technology Moderation**			**Double Moderation**	
VARIABLES	System GMM	Full GMM	CSD-Robust GMM	System GMM	Full GMM	CSD-Robust GMM	System GMM	Full GMM	CSD-Robust GMM
DI = Lag1	0.718***	0.727***	0.545***	0.672***	0.683***	0.595***	0.713***	0.724***	0.683***
	(0.0668)	(0.0591)	(0.205)	(0.0597)	(0.0511)	(0.270)	(0.0582)	(0.0499)	(0.195)
DI= Lag2	-0.00836	-0.00897		-0.00620	-0.0240		0.0103	-0.00812	
	(0.0509)	(0.0524)		(0.0632)	(0.0643)		(0.0662)	(0.0650)	
FD	0.0300***	0.0197***	0.0717***	0.0294***	0.0371***	0.0169***	0.0851***	0.0921***	0.0741***
	(0.00857)	(0.00843)	(0.00503)	(0.00126)	(0.00124)	(0.00398)	(0.00996)	(0.00976)	(0.0334)
HC	2.814***	2.275***	3.183***				2.023***	2.075***	2.119***
	(1.175)	(1.424)	(3.121)				(0.843)	(0.901)	(0.213)
FD * HC	1.710***	2.086***	1.081***				2.523***	2.302***	5.368***
	(0.139)	(0.151)	(0.432)				(1.220)	(1.026)	(2.127)
TECH				5.0494***	5.0495***	9.0436**	3.0280***	3.283***	4.966***
				(0.0156)	(0.0154)	(0.0228)	(0.0125)	(0.0118)	(0.0384)
FD * TECH				0.617***	0.6984***	1.561**	0.318***	0.3889***	0.732***
				(0.0877)	(0.101)	(0.850)	(0.0996)	(0.106)	(0.242)
URB	0.155***	0.157***	0.410*	0.158***	0.158***	0.595***	0.129***	0.130***	0.338***
	(0.0306)	(0.0305)	(0.226)	(0.0329)	(0.0343)	(0.208)	(0.0313)	(0.0297)	(0.113)
TAX	-0.132	-0.135	-0.550	-0.211*	-0.212*	-2.110***	-0.138	-0.139	-1.318
	(0.0893)	(0.0960)	(0.953)	(0.124)	(0.128)	(0.979)	(0.103)	(0.105)	(1.947)
TO	0.0152	0.0165	0.0113	0.0195	0.0205	0.0218	0.0223	0.0235*	0.000875
	(0.0117)	(0.0117)	(0.0378)	(0.0138)	(0.0138)	(0.0322)	(0.0140)	(0.0137)	(0.0831)
FDI	0.281*	0.284*	0.492***	0.324**	0.322*	4.124***	0.226	0.227	0.0517
	(0.146)	(0.150)	(0.188)	(0.168)	(0.170)	(0.223)	(0.153)	(0.156)	(0.184)
REM	-0.277***	-0.272***	-2.263***	-0.242***	-0.237***	-1.838***	-0.244***	-0.238***	-3.189***
	(0.0959)	(0.0923)	(0.202)	(0.0756)	(0.0715)	(0.816)	(0.0894)	(0.0845)	(0.564)
GDPG	4.800***	4.818***	5.620***	6.140***	6.197***	5.164***	3.058*	3.031*	9.154***
	(1.420)	(1.468)	(1.389)	(1.391)	(1.342)	(1.962)	(1.571)	(1.595)	(3.375)
GFC	-0.6667***	-0.6764***	-	-0.5588***	-0.5786***	-	-0.2135***	-0.2528***	-
	(0.1214)	(0.1455)		(0.2129)	(0.1948)		(0.0128)	(0.0383)	
COVID	-0.4407**	-0.4832***	-	-0.2678***	-0.2585***	-	-0.3494***	-0.3387***	-
	(0.2189)	(0.2281)		(0.0507)	(0.0593)		(0.0510)	(0.0554)	
Hansen J *p-value*	0.741	0.755	0.833	0.789	0.822	0.8591	0.7088	0.6393	0.6884
AR (1) *p-value*	0.0020	0.007	0.015	0.0029	0.0026	0.0530	0.0020	0.0021	0.0371
AR (2) *p-value*	0.1296	0.3881	0.6442	0.2734	0.3884	0.4412	0.1853	0.1037	0.4682
VCE	robust	robust	WC - robust	robust	robust	WC - robust	robust	robust	WC - robust
Observations	300	300	300	300	300	300	300	300	300
Number of panel_id	15	15	15	15	15	15	15	15	15

*Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. WC- robust is Windmeijer bias-corrected robust (Windmeijer, 2005). The Global Financial Crisis (2008-2009) and COVID-19 (2020-2021) dummy variables are included in the Double-D GMM specifications to control for major global macroeconomic shocks. They are omitted from the CSD-Robust GMM estimations because the estimator explicitly accounts for common cross-sectional shocks through latent common factors, rendering these time-specific event dummies redundant.*

Source: authors' computations using data from the International Monetary Fund Financial Development Database, Penn World Table version 11.0 and World Development Indicators (World Bank).

APPENDIX B

Pre-diagnostic tests

Table B1

Pesaran (2007) CADF panel unit root test results

Variable	Level (CADF t-bar)	p-value	First Diff. (CADF t-bar)	p-value	Order
DI	-2.241**	0.031	-2.686***	0.000	I(0)
FD	-2.845***	0.000	-3.778***	0.000	I(0)
TECH	-1.759	0.486	-2.669***	0.000	I(1)
HC	-2.189**	0.048	-2.194**	0.046	I(0)
URB	-2.125*	0.077	-2.101*	0.091	I(0)
TAX	-1.336	0.942	-2.988***	0.000	I(1)
TO	-1.286	0.961	-2.276**	0.023	I(1)
FDI	-2.616***	0.001	-4.275***	0.000	I(0)
REM	-1.677	0.610	-2.842***	0.000	I(1)
GDPG	-2.296**	0.019	-3.857***	0.000	I(0)

*Notes: The null hypothesis is that all panels contain a unit root. Rejection of the null indicates stationarity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Source: authors' computations

Table B2

Cross-sectional dependence tests

Test	Statistic	p-value / Critical values
Pesaran CD	$z = 2.732$	0.0063
Frees Q	$Q = 0.816$	> 0.2468 (1% Critical value)
Friedman	$x^2 = 24.135$	0.0441**

Note: H_0: Cross-sectional independence

Source: authors' computations

Table B3

Slope heterogeneity tests (Pesaran&Yamagata, 2008)

	Delta	p-value
	4.724	0.000
adj.	7.096	0.000

Note: H_0: slope coefficients are homogeneous

Source: authors' computations

Table B4

Cointegration results

Test	Statistic	Value	p-value
Pedroni	Modified Phillips-Perron t	4.4119***	0.0000
	Phillips-Perron t	−4.1433***	0.0000
	Augmented Dickey-Fuller t	−4.5281***	0.0000
Kao	Modified Dickey-Fuller t	2.7145***	0.0033
	Dickey-Fuller t	−2.9867***	0.0014
	Augmented Dickey-Fuller t	−3.2841***	0.0005

*Notes: The null hypothesis (H_0) for both the Pedroni and Kao tests is no cointegration. Rejection of H_0 indicates the existence of a stable long-run equilibrium relationship among the variables. The Pedroni test allows for heterogeneous cointegrating vectors across cross-sectional units, whereas the Kao test assumes a common cointegrating vector. Statistical significance is denoted by *** $p < 0.01$.*

Source: authors' computations

Table B5

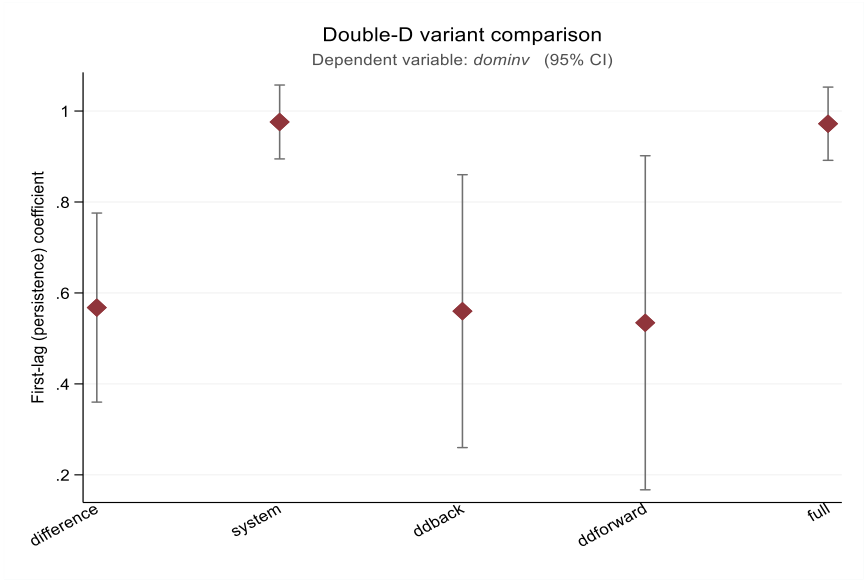
Double-D variant comparison: first-lag (persistence) coefficient

Variant	L1 coef	Std. Err.	z	p>z moments	
difference	0.5678	0.1060	5.35	0.0000***	171
system	0.9759	0.0414	23.55	0.0000***	189
ddback	0.5600	0.1531	3.66	0.0003***	153
ddforward	0.5344	0.1874	2.85	0.0043***	136
full	0.9722	0.0411	23.66	0.0000***	478

Source: authors' computations

Figure B1

Double-D variant comparison



Source: authors' computations

Table B6

Additional diagnostic tests

Category	Statistic	Value	p-value
Serial Correlation	F(1,14)	34.261	0.0000
Multicollinearity diagnostics	Mean VIF	3.086	

Note: H_0 of no first-order serial correlation in the idiosyncratic errors of the panel model. Rejection of the null indicates the presence of serial correlation, supporting the use of dynamic panel estimators that explicitly accommodate persistence. A mean VIF substantially below the conventional threshold of 10 indicates that multicollinearity is unlikely to bias the coefficient estimates.

Source: authors' computations

APPENDIX C

Conditional marginal test results and plots

Table C1

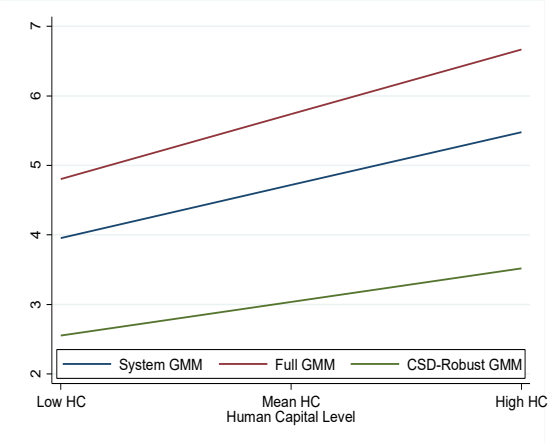
Conditional marginal effect of financial development on digital inclusion at representative levels of human capital

HC Level	HC Value	System GMM	Full GMM	CSD-Robust GMM
Low (Mean − 1 SD)	2.295	3.954	4.806	2.552
Mean	2.741	4.717	5.736	3.035
High (Mean + 1 SD)	3.187	5.479	6.666	3.517

Source: authors' computations

Figure C1

Conditional marginal effect of financial development on digital inclusion at representative levels of human capital



Source: authors' computations

Table C2

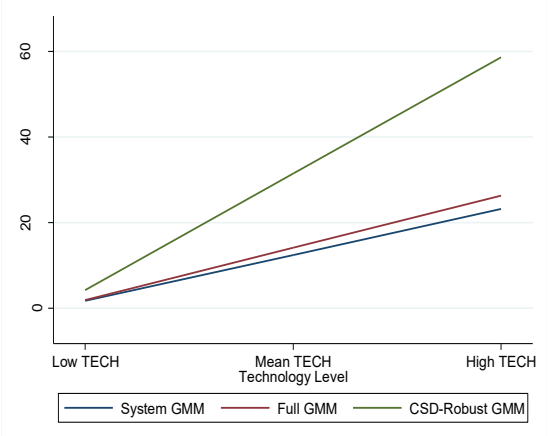
Conditional marginal effect of financial development on domestic investment at representative levels of technology

Tech Level	TECH Value	System GMM	Full GMM	CSD-Robust GMM
Low (Mean − 1 SD)	2.703	1.697	1.925	4.236
Mean	20.129	12.449	14.094	31.439
High (Mean + 1 SD)	37.555	23.197	26.262	58.633

Source: Authors' computations

Figure C2

Conditional marginal effect of financial development on domestic investment at representative levels of technology



Source: authors' computations

Table C3

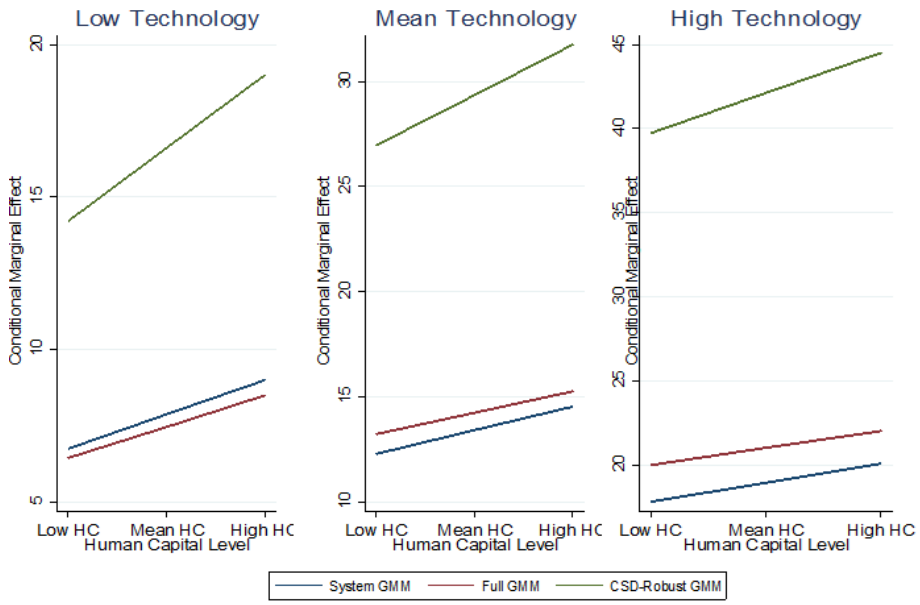
Conditional marginal effect of financial development on domestic investment under simultaneous human capital and technology moderation

Human Capital Level	Technology Value	System GMM	Full GMM	CSD-Robust GMM
Low HC	Low TECH	6.738	6.430	14.219
Low HC	Mean TECH	12.280	13.207	26.973
Low HC	High TECH	17.823	19.983	39.728
Mean HC	Low TECH	7.863	7.456	16.613
Mean HC	Mean TECH	13.405	14.233	29.367
Mean HC	High TECH	18.948	21.009	42.122
High HC	Low TECH	8.988	8.483	19.007
High HC	Mean TECH	14.530	15.260	31.761
High HC	High TECH	20.073	22.036	44.515

Source: authors' computations

Figure C3

Conditional marginal effect of financial development on domestic investment under simultaneous human capital and technology moderation



Source: authors' computations

SYSTEMIC FRAGILITY IN EUROPEAN CAPITAL MARKET INFRASTRUCTURES: A REVIEW OF FINANCIAL, OPERATIONAL, CYBER, AND GEOPOLITICAL RISKS

Amalia HOFFMANN, PhD Candidate*

Abstract

This paper reviews the academic and regulatory literature on systemic fragility in European capital market infrastructures (CMIs), focusing on the interaction between financial, operational, cyber, and geopolitical sources of risk. Existing reviews typically examine individual dimensions of systemic risk, such as financial contagion, cyber resilience, or operational risk, in isolation. In contrast, this review integrates these complementary strands of the literature into a unified perspective centred on European capital market infrastructures. The paper synthesises recent theoretical and empirical evidence on the mechanisms through which shocks propagate across European financial markets, highlighting the role of financial interconnectedness, operational dependencies, cyber vulnerabilities, and geopolitical uncertainty in amplifying systemic fragility. The review shows that systemic vulnerability is inherently multidimensional and cannot be adequately assessed through traditional market-based indicators alone. Instead, the resilience of European CMIs depends on the interaction between financial, operational, technological, and geopolitical factors. These findings underscore the need for integrated macroprudential and operational resilience frameworks capable of addressing the evolving sources of systemic vulnerability and strengthening the resilience of European capital market infrastructures.

Keywords: systemic risk, financial stability, operational vulnerabilities, geopolitical shocks

JEL Classification: G01, G10, G20

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1. Introduction

Financial stability and the resilience of European capital market infrastructures (CMIs) play a central role in ensuring the smooth functioning of the financial system and the efficient allocation of resources across the economy. Capital market infrastructures, including trading venues, central counterparties (CCPs), central securities depositories (CSDs), and payment and settlement systems, form the backbone of modern financial markets by facilitating liquidity provision, risk sharing, and price discovery. In addition to financial interconnections, CMIs exhibit operational interdependencies, including reliance on IT systems, third-party services, and cross-border settlement infrastructures, which can amplify vulnerabilities during crises (Holt & Lampke, 2010; Croicu & Călin, 2024).

However, rising financial integration, technological complexity, and heightened geopolitical uncertainty have significantly increased systemic fragility. The literature on financial fragility emphasises that deeply interconnected financial systems are inherently vulnerable to contagion and non-linear shock propagation. Early theoretical contributions highlight how interbank linkages and incomplete markets can amplify localised shocks into systemic crises (Allen & Gale, 2000). Subsequent studies demonstrate that diversification and interconnectedness, while beneficial in normal times, may exacerbate losses under extreme conditions, generating so-called “diversification disasters” (Ibragimov, Jaffee & Walden, 2010).

Early regulatory frameworks largely relied on microprudential approaches focused on the soundness of individual institutions. However, a growing body of literature highlights that such measures are insufficient to address system-wide vulnerabilities arising from interconnectedness and common exposures (Borio, 2003). The global financial crisis reinforced the need for macroprudential policies aimed at preserving financial stability from a systemic perspective (IMF, 2011, Croicu et al., 2023).

More recent network-based approaches show that the stability of financial systems depends critically on their structure. Highly interconnected networks may either absorb or amplify shocks depending on the distribution of exposures and the concentration of key nodes (Acemoglu, Ozdaglar & Tahbaz-Salehi, 2015). These insights are particularly relevant for European CMIs operating in an integrated yet heterogeneous regulatory and economic environment.

Financial stability remains a complex and evolving concept. Rather than representing the absence of crises, stability is increasingly defined as the capacity of the financial system to absorb shocks and continue performing its essential functions (Ballouk et al., 2024). Capital market infrastructures occupy a distinctive position within the financial system, as they combine financial intermediation functions with critical operational and technological processes. Unlike banks or asset managers, CMIs concentrate risk through clearing, settlement, and collateral management mechanisms, making them potential single points of failure in periods of stress (Gofman, 2017).

Systemic fragility in CMIs arises not only from financial exposures but also from operational, cyber, and liquidity shocks, which can amplify instability during crises (Kopp, Kaffenberger & Jenkinson, 2017). From this perspective, systemic fragility reflects latent vulnerabilities that can materialize under stress, driven by structural, operational, and exogenous factors. Empirical research highlights the importance of market infrastructures and sectoral interdependencies in shaping financial stability outcomes (Lupu et al., 2025).

In recent years, the literature has expanded beyond traditional macroeconomic and microprudential determinants of fragility to include cyber risks and geopolitical shocks. These include digital disruptions, energy market shocks, and pandemics, which propagate through financial and operational channels, affecting both infrastructure functionality and market stability. Cyber incidents and digital disruptions have emerged as potential sources of systemic risk, capable of undermining market confidence and operational continuity (Kopp, Kaffenberger & Jenkinson, 2017; Tosun, 2021). At the same time, geopolitical crises and energy-related shocks have demonstrated their capacity to transmit instability across financial markets and sectors (Konovalova & Abuzov, 2023; Lupu et al., 2021).

Despite these advances, several gaps remain in the existing literature. While a substantial body of research investigates systemic risk through market-based indicators, network structures, and entropy-based methodologies (Billio et al., 2016; Lupu et al., 2020), most studies focus either on financial institutions or on asset price dynamics, with limited attention to the operational and infrastructural dimension of systemic fragility. In particular, the role of capital market infrastructures as amplifiers of financial, cyber, and geopolitical shocks remains underexplored, and sectoral analyses of systemic risk transmission are rarely linked to the operational resilience and functioning of CMIs.

This paper addresses these gaps by integrating the existing literature on financial, operational, cyber, and geopolitical sources of systemic fragility into a unified perspective centered on European capital market infrastructures. By synthesizing recent theoretical and empirical evidence, the review highlights the key transmission channels of systemic risk and identifies the main factors shaping the resilience of European CMIs. In doing so, it provides a conceptual basis for future research and offers policy-relevant insights for strengthening macroprudential supervision and the operational resilience of European capital market infrastructures.

The remainder of the paper is organized as follows. Section 2 describes the data and methodology. Section 3 presents and discusses the empirical results. Section 4 concludes and outlines the main implications of the findings.

2. Data and methodology

This study adopts a narrative literature review approach to examine the main sources and transmission channels of systemic fragility in European capital market infrastructures (CMIs). The review draws on seminal contributions as well as recent academic and regulatory publications covering the period 2000–2025. Relevant studies were identified through searches of major academic databases, including JSTOR, ScienceDirect, Scopus, MDPI, and SpringerLink, complemented by reports published by international institutions such as the International Monetary Fund (IMF) and the Bank for International Settlements (BIS).

The literature search was conducted using combinations of keywords including systemic risk, financial fragility, capital market infrastructures, cyber risk, operational risk, geopolitical risk, and European capital markets. Priority was given to peer-reviewed journal articles, institutional reports, and empirical studies employing quantitative or network-based methodologies.

Rather than providing a statistical meta-analysis, the review synthesises the existing literature from a thematic perspective. The selected studies are organised into four complementary dimensions of systemic fragility—financial, operational, cyber, and geopolitical—to identify the principal transmission channels of systemic risk, the methodological approaches adopted in the literature, and the main research gaps relevant to the resilience of European capital market infrastructures.

3. Results

3.1 Financial fragility and systemic vulnerabilities

Financial fragility describes the susceptibility of financial systems to shocks that can propagate across institutions, markets, and sectors, potentially leading to systemic crises (Acemoglu, Ozdaglar & Tahbaz-Salehi, 2015; Ballouk et al., 2024). Interconnectedness, market concentration, and the complexity of financial instruments are widely recognised as key amplifiers of systemic risk (Ibragimov, Jaffee & Walden, 2010).

Existing research broadly emphasises that systemic risk is largely rooted in the dense network of interconnections among financial institutions. While these linkages facilitate liquidity provision and risk sharing under normal conditions, they also act as powerful transmission channels for shocks (Wang et al., 2018; Gofman, 2017), allowing localised disturbances to cascade rapidly across markets and institutions. Consequently, systemic fragility emerges not only from the weaknesses of individual institutions, but also from the structural characteristics of the financial network, including the distribution of exposures, concentration of critical nodes, and connectivity of systemically important infrastructures.

Empirical research has proposed a range of indicators to quantify systemic vulnerability, including measures derived from conditional tail risk and network spillovers. Applying CoVaR and MES to the Romanian equity market, Călin and Lupu (2026b) show that carbon-price innovations are associated with heterogeneous systemic-risk responses, with transition risk being concentrated in carbon-exposed non-financial firms rather than financial intermediaries. Similarly, Croicu (2026) combines BSADF-based bubble detection with market-based systemic risk measures to demonstrate that speculative bubbles are a recurrent feature of shadow banking institutions, highlighting the importance of continuous macroprudential monitoring. Extending this evidence, Călin et al. (2026) show that conventional systemic risk measures exhibit a pro-cyclical bias, tending to underestimate the buildup of vulnerabilities during speculative expansions while capturing systemic stress only after bubbles collapse, suggesting that bubble detection provides a valuable complement to traditional systemic risk indicators. Lupu et al. (2026) provide evidence that highly volatile bubble episodes are consistently associated with elevated systemic risk across multiple indicators, with

vulnerabilities remaining significant throughout all phases of the bubble lifecycle rather than being confined to the bursting stage.

Other recent contributions introduce composite fragility indices designed to capture the sensitivity of financial systems to asset price bubbles and speculative dynamics, showing that fragility intensifies during periods of excessive risk-taking (Lupu et al., 2025). Recent studies increasingly employ hybrid indicators combining fragility indices, network metrics, and entropy-based measures to account for financial, operational, and sectoral risks simultaneously.

Within the European context, cross-country empirical analyses provide valuable insights into how national market structures and policy frameworks shape systemic fragility. The literature consistently documents heterogeneous fragility patterns across European financial markets, with Eastern European countries exhibiting significant cross-country variation in systemic vulnerability. Empirical evidence based on dimension-reduction techniques, such as Principal Component Analysis and the Absorption Ratio, shows that individual markets contribute differently to overall systemic risk, with macroeconomic conditions and policy perceptions playing an important role in shaping these dynamics (Lupu et al., 2018). These findings support the case for differentiated and country-specific macroprudential strategies within the European financial system.

At the sectoral level, studies focusing on European stock markets demonstrate that certain industries act as persistent generators of systemic risk. Albu, Lupu and Călin (2017) highlight the role of sectoral interdependencies in amplifying market-wide instability, reinforcing the relevance of network-based monitoring frameworks for European capital market infrastructures. In Eastern European countries, stock market fragility has been closely linked to macroprudential policy effectiveness, market liquidity, and structural characteristics, underscoring the importance of tailored regulatory interventions (Albu et al., 2014; Albu et al., 2015; Lupu et al., 2018; Călin & Lupu, 2026a).

Network effects play a central role in shaping these dynamics. Dense interconnections within and across CMIs can facilitate rapid shock transmission, reinforcing the need for network-based monitoring frameworks that move beyond institution-level indicators (Acemoglu, Ozdaglar & Tahbaz-Salehi, 2015).

3.2 Cyber and operational vulnerabilities

The increasing digitalization of capital market infrastructures has introduced new forms of operational risk. Cyber incidents, including ransomware attacks, distributed denial-of-service (DDoS) events, and data breaches, can disrupt trading, settlement, and clearing processes, with potential systemic consequences (Kopp, Kaffenberger & Jenkinson, 2017; Corbet & Gurdgiev, 2019).

Empirical evidence suggests that cyber-attacks can affect market activity and volatility, particularly when incidents undermine investor confidence or impair critical infrastructure (Tosun, 2021).

From a systemic perspective, cyber risk differs from traditional operational risk due to its potential to simultaneously affect multiple institutions and infrastructures. Moreover, operational interdependencies, including IT service providers and clearing relationships, create channels through which cyber or technical failures can propagate systemically (Corbet & Gurdgiev, 2019).

Chida et al. (2026) provide evidence that cyber shocks affecting banks' intermediation capacity are associated with future systemic fragility, suggesting that incident-based cyber risk indicators can complement traditional tools used for financial stability monitoring. A substantial body of literature has examined systemic risk in the banking sector, focusing on a wide range of transmission channels, including market, credit, liquidity, operational, and more recently cyber-related risks (Aldasoro et al., 2020; Boungou, 2023; Kotidis & Schreft, 2025).

Using a connectedness framework, Gaies et al. (2026) demonstrate that cyber risk contributes to systemic financial instability through asymmetric spillover effects, with market fear amplifying contagion, particularly during bearish market conditions.

Entropy-based methodologies have been increasingly adopted in the literature as effective tools for capturing the non-linear and time-varying nature of systemic risk transmission across sectors, by quantifying uncertainty and information dispersion within interconnected financial and operational networks. Recent contributions using Bayesian entropy frameworks model information flows and uncertainty propagation within financial systems, enabling the identification of dominant risk-transmitting sectors over time (Lupu et al., 2020). Empirical evidence suggests that financial, industrial, and energy sectors frequently emerge as systemic risk hubs, particularly during periods of heightened stress, thereby highlighting the limitations of traditional linear correlation-based measures.

From the perspective of capital market infrastructures, entropy-based approaches are particularly relevant, as they capture abrupt regime shifts and amplification mechanisms that may arise from operational disruptions or cyber incidents. By focusing on uncertainty spillovers rather than price co-movements alone, such frameworks provide valuable insights into how operational shocks can evolve into system-wide fragility (Lupu et al., 2020), reinforcing the need for monitoring tools that integrate financial and operational dimensions of risk. Scenario-based stress tests complement these approaches by simulating compound shocks, including operational, cyber, and financial disturbances, to assess system-wide resilience.

3.3 Geopolitical risks

Geopolitical shocks have emerged as significant drivers of financial instability in Europe. Events such as the COVID-19 pandemic and the Russia–Ukraine conflict triggered sharp increases in volatility, disrupted energy markets, and altered cross-market correlations (Konovalova & Abuzov, 2023; Nimani & Spahija, 2023; Hu et al., 2025).

Growing evidence suggests that geopolitical risk represents an important driver of systemic risk across a wide range of financial markets and institutions. In cryptocurrency markets, Lau et al. (2026) demonstrate that US–China tensions exert a stronger influence on systemic interconnectedness than broader geopolitical risk measures. Similar evidence is reported for traditional financial markets, where Zhong et al. (2026) show that domestic geopolitical shocks amplify systemic tail risk spillovers across major Chinese financial sub-markets. The banking sector appears equally vulnerable. Gabbiadini et al. (2025) find that greater exposure to foreign geopolitical risk significantly increases European banks' systemic risk, while Wang et al. (2025) provide cross-country evidence that geopolitical uncertainty raises systemic risk through higher individual bank risk, deteriorating asset quality, and the bursting of asset price bubbles, although stronger regulatory frameworks mitigate these effects. Beyond financial institutions, geopolitical risk also intensifies systemic spillovers in the real economy. Liu et al. (2024) show that geopolitical shocks amplify systemic risk spillovers among global energy firms through both direct and indirect channels, with contagion propagating across countries via geographic proximity and energy trade linkages. Sectoral analyses highlight the strategic role of the energy sector in transmitting geopolitical risk to financial markets. Empirical studies

show that energy-related shocks generate systemic spillovers, affecting equity markets and broader financial stability in Europe (Lupu et al., 2021). These spillovers complicate traditional risk-monitoring frameworks, which often fail to account for non-linear and delayed transmission channels.

Existing literature has highlighted the energy sector as a key transmitter of systemic risk in European markets. Nevrla (2020) uses a dynamic factor copula approach to quantify the spillovers between European energy and financial sectors, highlighting the prominent role of energy companies during crisis periods. Tiwari et al. (2020) and Wu et al. (2021) provide empirical evidence that shocks in energy prices propagate to equity and derivative markets, affecting both sectoral and infrastructure stability. Entropy-based approaches, as discussed by Lupu et al. (2020) and Billio et al. (2016), further allow for modelling non-linear and time-varying spillovers, underscoring the importance of integrating energy sector dynamics in systemic risk assessments.

The literature also points to methodological challenges in measuring geopolitical risk, as standard financial indicators may not fully capture political uncertainty or its interaction with market expectations (Petrov, Hentov & Zumbo, 2018). Scenario-based approaches and stress-testing exercises are therefore increasingly advocated as tools for assessing resilience under geopolitical stress.

For European capital market infrastructures, such shocks imply heightened operational and liquidity risks, as energy-driven disturbances affect clearing margins, collateral values, and settlement processes, amplifying systemic fragility beyond asset price volatility. Operational dependencies related to collateral management, settlement cycles, and margining mechanisms are particularly sensitive to energy price volatility and geopolitical uncertainty. In this context, scenario-based stress testing and entropy-based models provide valuable tools for quantifying spillovers across sectors and infrastructures under extreme geopolitical conditions, reinforcing the systemic relevance of CMIs during periods of heightened geopolitical stress (Lupu et al., 2021; Nevrla, 2020).

3.4 Measurement frameworks and indices

Beyond identifying individual sources of fragility, current research has increasingly focused on developing integrated measurement frameworks capable of capturing the joint dynamics of financial, operational, and macroeconomic risks (Iancu, 2026).

The measurement of systemic fragility has increasingly relied on multivariate and dimension-reduction techniques designed to capture common risk factors. Indicators such as the Absorption Ratio, derived from principal component analysis, have been shown to provide valuable insights into the degree of systemic interconnectedness and vulnerability (Kritzman et al., 2011; Lupu et al., 2018).

Beyond cyber and geopolitical dimensions, macroeconomic fundamentals continue to influence systemic fragility. Volatility dynamics, market capitalization, and macroeconomic indicators such as GDP growth and inflation shape vulnerability patterns across European markets (Lupu et al., 2025).

Comparative studies reveal that Eastern European markets tend to exhibit higher sensitivity to global shocks and policy changes, reflecting differences in market depth, liquidity, and investor behavior (Albu, Lupu & Călin, 2017). These findings reinforce the need for differentiated macroprudential strategies within the European financial architecture.

Recent advances increasingly combine network metrics, entropy-based measures, Bayesian techniques, and scenario analysis to provide a comprehensive assessment of systemic fragility under compound financial, operational, and geopolitical shocks. Such integrated frameworks are particularly suited for evaluating the resilience of capital market infrastructures, where financial, operational, and geopolitical risks interact non-linearly (Lupu et al., 2021).

Despite these advances, the literature points to a persistent gap between market-based systemic risk indicators and the operational realities of CMIs. Traditional measures often focus on price-based co-movements and tail dependencies, while underestimating the role of operational disruptions, liquidity constraints, and institutional design. Composite frameworks integrating network analysis, entropy-based measures, and stress-testing exercises address these limitations, offering a holistic perspective on systemic fragility (Billio et al., 2016).

These limitations are particularly relevant for capital market infrastructures, where systemic fragility emerges not only from financial interconnectedness, but also from operational dependencies and external shocks, reinforcing the need for integrated analytical perspectives such as the one proposed in this review.

4. Conclusions

European capital market infrastructures are inherently exposed to multiple, interacting sources of systemic fragility. Financial interconnections, market concentration, and the complexity of instruments create vulnerabilities that can propagate quickly across institutions and borders. Cyber threats have emerged as a structural component of these vulnerabilities, capable of generating significant disruptions to liquidity, volatility, and investor confidence. Operational interdependencies and sectoral linkages further amplify the systemic impact of both cyber and geopolitical shocks. Geopolitical shocks, such as pandemics, armed conflicts, and energy market disturbances, further exacerbate fragility and underscore the limitations of conventional stress-testing and risk-monitoring frameworks.

From a policy perspective, these findings suggest that the resilience of European capital market infrastructures cannot be ensured through siloed risk assessments. Financial, operational, cyber, and geopolitical risks interact in a non-linear manner, calling for integrated supervisory frameworks that combine quantitative systemic risk indicators with operational resilience testing.

Empirical and theoretical studies indicate that fragility is multidimensional and context-dependent, requiring integrated approaches that combine financial, operational, cyber, and geopolitical risk assessments. The development of fragility indices, entropy-based models, and scenario analyses provides valuable tools for understanding systemic risk, while cross-country comparisons highlight the importance of tailored macroprudential measures. Policy interventions must prioritise cyber resilience, robust stress-testing, and adaptive regulation to enhance the stability and resilience of European capital market infrastructures. Incorporating scenario-based and entropy-based modelling into supervisory frameworks allows policymakers to anticipate compound shocks and design integrated risk mitigation strategies. Overall, safeguarding market stability in this complex environment requires an integrated, forward-looking perspective that accounts for the evolving nature of both traditional and emerging risks.

For managers and regulators of European CMIs, these findings highlight the importance of integrated risk management frameworks, proactive cyber resilience strategies, and scenario-based contingency planning to mitigate potential systemic disruptions.

References

1. Acemoglu, D., Ozdaglar, A., & Tahbaz-Salehi, A. (2015). Systemic risk and stability in financial networks. *American Economic Review, 105*(2), pp. 564-608. https://doi.org/10.1257/aer.20130456
2. Albu, L.L., Lupu, R., & Călin, A.C. (2014). A nonlinear model to estimate the long term correlation between market capitalization and GDP per capita in Eastern EU countries. *Economic Computation and Economic Cybernetics Studies and Research, 48*(3), pp. 5–22.
3. Albu, L.L., Lupu, R., & Călin, A.C. (2015). Stock market asymmetric volatility and macroeconomic dynamics in Central and Eastern Europe. *Procedia Economics and Finance, 22*, pp. 560–567. https://doi.org/10.1016/S2212-5671(15)00259-2
4. Albu, L.L., Lupu, R., & Călin, A.C. (2017). Risk generating industries for European stock markets. *Economic Computation and Economic Cybernetics Studies and Research*, *51*(4), pp. 5-17.
5. Aldasoro, I., Gambacorta, L., Giudici, P., & Leach, T. (2020). Operational and cyber risks in the financial sector. *BIS Working Paper*, 840.
6. Allen, F., & Gale, D. (2000). Financial contagion. *Journal of Political Economy*, *108*(1), pp. 1-33. https://doi.org/10.1086/262109
7. Ballouk, H., Jabeur, S.B., Challita, S., & Chen, C. (2024). Financial stability: A scientometric analysis and research agenda. *Research in International Business and Finance*, *70,* 102294. https://doi.org/10.1016/j.ribaf.2024.102294
8. Billio, M., Casarin, R., Costola, M. & Pasqualini, A. (2016). An entropy-based early warning indicator for systemic risk. *Journal of International Financial Markets, Institutions & Money*, *45,* pp. 42-59. https://doi.org/10.1016/j.intfin.2016.05.008
9. Borio, C. (2003). Towards a macroprudential framework for financial supervision and regulation?. *CESifo Economic Studies, 49,* pp. 181-216. https://doi.org/10.1093/cesifo/49.2.181
10. Boungou, W. (2023). Cyber-attacks and banking intermediation. *Economics Letters*, 233, 111354.
11. Călin, A.C., & Lupu, R. (2026a). Tracing exuberance: Multi-model evidence of bubble episodes in the Bucharest stock market. *International Journal of Emerging Markets*. Advance online publication. https://doi.org/10.1108/IJOEM-12-2025-2934
12. Călin, A.C., & Lupu, R. (2026b). Systemic risk and the green transition: Carbon-price transmission in a European emerging

economy. *Energy Sources, Part B: Economics, Planning, and Policy, 21*(1), 2700321. https://doi.org/10.1080/15567249.2026.2700321

13. Călin, A.C., Lupu, R., Croicu, A.E., & Topa, R.A. (2026). Bubbles and the pro-cyclicality of systemic risk measures in shadow banking. *Journal of Risk and Financial Management, 19*(4), 242. https://doi.org/10.3390/jrfm19040242
14. Chida, M., Kim, S., & Yoshino, N. (2026). Cyber risk under stress: Bank cyber shocks and systemic fragility. *Finance Research Letters,* 100, 109950. https://doi.org/10.1016/j.frl.2026.109950
15. Corbet, S., & Gurdgiev, C. (2019). What the hack: Systematic risk contagion from cyber events. *International Review of Financial Analysis,* 65*,* 101386. https://doi.org/10.1016/j.irfa.2019.101386
16. Croicu, A. E. (2026). Speculative bubble dynamics and systemic risk in shadow banking institutions: Evidence from the United States and Europe. *Financial Studies, 30*(2), pp. 146–165. https://doi.org/10.65672/fs.2026.2.7
17. Croicu, A.-E., & Călin, A.C. (2024). Reconceptualizing stability: Dynamics of shadow banking in financial markets. *Proceedings of the International Conference on Business Excellence, 18*(1), pp. 1385–1397.
18. Croicu, A.-E., Iancu, L.A., & Rogojan, L.C. (2023). A review on the impact of shadow banking on financial markets prudential regulation. *Proceedings of the International Conference on Business Excellence, 17*(1), pp. 1596–1602.
19. Gabbiadini, M., Meoli, M., & Vismara, S. (2025). Geopolitical risk and systemic risk in the European banking system. *Finance Research Letters, 86(Part F)*, 108796. https://doi.org/10.1016/j.frl.2025.108796
20. Gaies, B., Chaâbane, N., & Sahut, J.-M. (2026). Cyber risk, market fear and financial instability: Hunting down risk through contagion analysis. *Journal of Economic Studies, 53*(5), pp. 1012–1032. https://doi.org/10.1108/JES-02-2025-0131
21. Gofman, M. (2017). Efficiency and stability of a financial architecture with too-interconnected-to-fail institutions. *Journal of Financial Economics*, 124, pp. 113-146. https://doi.org/10.1016/j.jfineco.2016.12.009
22. Holt, T.J., & Lampke, E. (2010). Exploring stolen data markets online: products and market forces. *Criminal Justice Studies, 23(*1), pp. 33-50. https://doi.org/10.1080/14786011003634415
23. Hu, Y., Corbet, S., Hou, Y. (Greg), Lang, C., & Oxley, L. (2025). Tail risk connectedness during geopolitical shocks: assessing the impact of Russian-Ukraine conflict on G7 stock markets. *Applied Economics,*

57(47), pp. 7705–7733. https://doi.org/10.1080/00036846.2024.2393893

24. Iancu, L. A. (2026). Explosive price dynamics in global REIT markets: Evidence from developed regions. *Financial Studies, 30*(1), pp. 50–67. https://doi.org/10.65672/fs.2026.1.3
25. Ibragimov, R., Jaffee, D., & Walden, J. (2010). Diversification disasters. *Journal of Financial Economics*, *99*(2), pp. 333-348. https://doi.org/10.1016/j.jfineco.2010.08.015
26. International Monetary Fund. (2011). *Macroprudential policy: An organizing framework*. IMF.
27. Konovalova, M., & Abuzov, A. (2023). Geopolitical crises, the energy sector, and the financial capital market. *E3S Web of Conferences*, 381*,* 01042. https://doi.org/10.1051/e3sconf/202338101042
28. Kopp, E. A., Kaffenberger, L., & Wilson, C. (2017). Cyber risk, market failures, and financial stability. *IMF Working Paper 17/185*. https://doi.org/10.5089/9781484313787.001
29. Kotidis, A., & Schreft, S. L. (2025). The propagation of cyberattacks through the financial system: Evidence from an actual event. *Journal of Finance, 80*(6), pp. 3313–3358.
30. Kritzman, M., Li, Y., Page, S., & Rigobon, R. (2011). Principal components as a measure of systemic risk. *The Journal of Portfolio Management*, *37*(4), pp. 112-126. https://doi.org/10.3905/jpm.2011.37.4.112
31. Lau, C. K. M., Wojewodzki, M., Gozgor, G., & Cheng, W. W. A. (2026). Geopolitical risk, US–China tensions, and systemic risk in cryptocurrency markets: A regime-dependent analysis. *International Review of Economics & Finance,* 110, 105574. https://doi.org/10.1016/j.iref.2026.105574
32. Liu, J., Zhu, B., & Hu, X. (2024). Systemic risk spillovers among global energy firms: Does geopolitical risk matter? *Energy Economics,* 140, 108036. https://doi.org/10.1016/j.eneco.2024.108036
33. Lupu, R., Călin, A.C., Bobircă A.B., & Miclăuș P.G. (2018). Stock market fragility for macroprudential policies in Eastern European countries. *Economic Computation and Economic Cybernetics Studies and Research*, *52*(4), pp. 19-33. https://doi.org/10.24818/18423264/52.4.18.02
34. Lupu, R., Călin, A.C., Dumitrescu, D.G., & Lupu, I. (2025). Introducing a novel fragility index for assessing financial stability amid asset bubble episodes. *The North American Journal of Economics and Finance*, 75, 102291. https://doi.org/10.1016/j.najef.2024.102291

35. Lupu, R., Călin, A.C., Dumitrescu, D.G., Popovici, O.C., & Khurshid, A. (2026). Unravelling systemic risk dynamics amid financial asset bubbles in times of enhanced volatility. *Amfiteatru Economic, 28*(71), pp. 328–344. https://doi.org/10.24818/EA/2026/71/328
36. Lupu, R., Călin, A.C., Zeldea, C.G., & Lupu, I. (2020). A Bayesian Entropy Approach to Sectoral Systemic Risk Modeling. *Entropy*, 22, 1371. https://doi.org/10.3390/e22121371
37. Lupu, R., Călin, A.C., Zeldea, C.G., & Lupu, I. (2021). Systemic Risk Spillovers in the European Energy Sector. *Energies,* 14, 6410. https://doi.org/10.3390/en14196410
38. Nevrla, M. (2020). Systemic risk in European financial and energy sectors: Dynamic factor copula approach. *Economic Systems,* 44, 100820. https://doi.org/10.1016/j.ecosys.2020.100820
39. Nimani, A., & Spahija, D. (2023). Financial markets and price increases in Europe after the Russian-Ukrainian war. *Scientific Horizons*, *26*(3). https://doi.org/10.48077/scihor3.2023.135
40. Petrov, A., Hentov, E., & Zumbo, F. (2018). *How does geopolitics affect financial markets?.* State Street Global Advisors.
41. Tiwari, A.K., Trabelsi, N., Alqahtani, F. & Raheem, I.D. (2020). Systemic risk spillovers between crude oil and stock index returns of G7 economies: Conditional value-at-risk and marginal expected shortfall approaches. *Energy Economics*, 86, 104646. https://doi.org/10.1016/j.eneco.2019.104646
42. Tosun, O.K. (2021). Cyber-attacks and stock market activity. *International Review of Financial Analysis,* 76, 101795. https://doi.org/10.1016/j.irfa.2021.101795
43. Wang, G.J., Jiang, Z.Q., Lin, M., Xie, C. & Stanley, H.E. (2018). Interconnectedness and systemic risk of China's financial institutions. *Emerging Markets Review*, 35, pp. 1-18. https://doi.org/10.1016/j.ememar.2017.12.001
44. Wang, Y., Song, G., & Lu, Y. (2025). Geopolitical risk, bank regulation, and systemic risk: A cross-country analysis. *Finance Research Letters,* 76, 106893. https://doi.org/10.1016/j.frl.2025.106893
45. Wu, F., Zhang, D. & Ji, Q. (2021). Systemic risk and financial contagion across top global energy companies. *Energy Economics,* 97, 105221. https://doi.org/10.1016/j.eneco.2021.105221
46. Zhong, J., Li, H., & Wang, B. (2026). Geopolitical risk and systemic tail risk spillovers: Evidence from Chinese financial markets. *International Review of Financial Analysis,* 109, 104834. https://doi.org/10.1016/j.irfa.2025.104834

ESG REPORTING AND FIRM VALUE OF LISTED COMPANIES IN EAST AFRICAN COMMUNITY COUNTRIES

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Abstract

Environmental, Social and Governance (ESG) reporting has become an increasingly important consideration in investment decisions, and firms that overlook ESG issues may face operational, legal, and reputational costs that can erode firm value. This study assessed the relationship between ESG reporting and firm value among companies listed on East African Community (EAC) securities exchanges. Applying a positivist philosophy and a longitudinal design, the study drew a purposive sample of 15 out of 93 listed EAC firms that disclose ESG information, based on inclusion criteria. The study obtained secondary data on ESG reporting and firm value from 2018 to 2024 from annual reports, sustainability reports, and securities exchange records, treating firm value as the dependent variable. Descriptive statistics and multivariate regression showed that ESG reporting exerted a statistically significant, positive effect on firm value. The study concludes that ESG reporting materially strengthens firm value and recommends that regulators tighten mandatory ESG requirements, that companies build more robust ESG reporting systems, and that investors factor ESG reporting into their decision-making.

Keywords: sustainability disclosure, capital market, financial performance, Tobin's Q, stakeholder theory

JEL Classification: G32, M14, Q56, O16

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1. Introduction

ESG serves as a framework for assessing a firm's non-financial conduct and influence across three domains: environmental sustainability, social responsibility, and corporate governance (Friede et al., 2015), while ESG disclosure denotes the extent and quality with which firms report on their environmental, social, and governance practices (Kotsantonis et al., 2020). Governments worldwide have already put ESG-related regulations and disclosure mandates in place, meaning firms that ignore these expectations risk their standing in an international marketplace increasingly attentive to sustainability. Investors generally regard high-ESG firms as lower-risk and better positioned for sustained growth, and folding ESG considerations into investment decisions has emerged as one of the more notable shifts in financial markets in recent years. Present estimates suggest that sustainable investment approaches incorporating ESG criteria into research and portfolio construction now account for more than $30 trillion in assets under management (Christensen et al., 2021).

By improving transparency and accountability, ESG reporting helps firms earn stakeholder trust and attract sustainability-minded investors (Cheng et al., 2015). ESG data is typically drawn from company disclosures, media coverage, alternative datasets, and modeled estimates; company disclosures and media coverage were once the dominant sources, but alternative and modeled data have gained ground as the ESG data landscape has broadened. Each source offers a different lens on ESG performance, with its own strengths and weaknesses, company filings and media coverage tend to look backward, whereas alternative and modeled data are better suited to forecasting a firm's future direction (Lee, 2021).

ESG reporting has grown in prominence and standardization within investment decision-making as institutional investors increasingly weave sustainability criteria into their portfolio management. Firms adopting a consistent reporting framework, such as the Global Reporting Initiative (GRI) or the Task Force on Climate-related Financial Disclosures (TCFD), are better able to communicate their sustainability performance to capital markets (Afolabi et al., 2022). Within the EAC, where sustainability-reporting regulation is still taking shape, voluntary ESG reporting can function as a forward-looking governance signal that may provide firms with an advantage in an increasingly competitive capital market environment. Third-party

assurance further reinforces the credibility of these disclosures, boosting investor confidence in their reliability (Manita et al., 2021).

Beyond attracting investment, ESG reporting functions as a governance instrument that influences how a firm is perceived by suppliers, employees, regulators, local communities, and other stakeholders. Robust ESG disclosure narrows the information gap between firms and investors, which in turn can reduce the cost of capital (Ng & Rezaee, 2020), an effect that may be especially pronounced in emerging markets, where such gaps tend to be wider. Firms operating in the EAC face additional contextual pressures, among them regulatory uncertainty, infrastructure constraints, and heightened expectations around community development and environmental stewardship. Against this backdrop, ESG reporting fulfils both a compliance function and a communicative one, signalling to stakeholders a firm's resilience and its capacity to build value over the long run (Broadstock et al., 2021).

Firm value denotes the total economic worth investors and the market assign to a company (Brealey et al., 2020), reflecting the present value of the cash flows its assets and operations are expected to generate (Brealey et al., 2020). It captures more than physical assets, extending to intangibles such as intellectual capital, governance quality, and growth potential, all of which inform how the market views a firm and its long-term performance (Damodaran, 2023). Firms that sustain strong, stable value are generally better able to draw long-term investors and access capital more cheaply (Ahmed & Elmarzouky, 2024; Hamdah et al., 2025).

Market conditions make the ESG disclosure-firm value relationship especially consequential in East Africa. Securities markets in Kenya, Tanzania, Uganda, and Rwanda remain comparatively shallow and concentrated, with market capitalisation dominated by a handful of large firms while many other listed companies see valuations stagnate or decline. Weak, inconsistent, or absent ESG disclosure in the region has been linked directly to depressed firm value (Ngugi & Otieno, 2023). ESG reporting and integration in the region remain uneven and largely voluntary, reflecting an early stage of development; although the securities exchanges of Kenya, Tanzania, Uganda, and Rwanda have introduced sustainability-reporting guidelines, enforcement remains weak.

Investor confidence, and by extension economic growth across the EAC, hinges on the financial stability of listed firms. Yet companies

on EAC securities exchanges saw market valuations decline steadily between 2018 and 2024. The market valuations decline was driven by factors including the COVID-19 pandemic, elevated inflation, rising interest rates, currency volatility, and weakened investor confidence, a combination that dragged down market capitalisation, equity valuations, and trading volumes across regional capital markets (International Monetary Fund [IMF], 2025; World Bank, 2025; World Federation of Exchanges [WFE], 2024). How ESG reporting relates to firm value in this setting, however, remains largely unstudied empirically. Most existing research on the ESG reporting-firm value link is concentrated in developed markets such as the USA, Germany, and Norway (Giannopoulos et al., 2022; Velte, 2017; Ademi & Klungseth, 2022), leaving a contextual gap given how different the socio-economic, institutional, and regulatory environment of the EAC is. No empirical evidence yet establishes this connection for EAC nations, despite the recognised importance of ESG reporting to firm value, a gap this study set out to address.

This paper's specific objective was to establish how ESG reporting relates to the firm value of listed companies on EAC securities exchanges, guided by the following hypothesis: H_{01}: There is no significant relationship between ESG reporting and the firm value of listed companies at the securities exchanges of EAC countries.

2. Literature review

2.1 Theoretical review

Edward R. Freeman introduced Stakeholder Theory in 1984 through his book Strategic Management: A Stakeholder Approach (Kumar, 2023), marking a sharp break from the shareholder-primacy view under which a firm exists solely to maximise shareholder returns. Under Freeman's framework, a company is better understood as a web of relationships linking workers, clients, suppliers, communities, regulators, and financiers, parties who both shape and are shaped by the firm's objectives, rather than merely a vehicle for boosting shareholder wealth.

This theory has spawned a considerable body of empirical work. Kumar (2023) applied it to examine how firms manage relationships with institutional investors, employee unions, regulators, and civil society, concluding that firms with formalised stakeholder-engagement mechanisms tend to respond more coherently to

competing demands. Harrison et al., (2010) showed that actively managing stakeholder claims lowers transactional friction, uncertainty, and litigation exposure, while Boubaker et al., (2021) found that stakeholder-sensitive investors treat ESG disclosure as a credible signal of long-term orientation and price it accordingly into valuation multiples.

A persistent criticism of Freeman's (1984) stakeholder concept is its breadth, encompassing anyone who can affect or be affected by the firm, which leaves managers without a clear basis for ranking competing claims (Antonacopoulou & Méric, 2024). This ambiguity carries real governance risk: absent a hierarchy among stakeholder claims, decisions can become inconsistent or reactive, swayed by whichever voice is loudest rather than what is most material.

Stakeholder Theory fits this study because ESG reporting functions as a channel through which firms communicate with their stakeholders, and the theory's central claim- that transparency in stakeholder engagement builds trust, narrows information asymmetry, and lifts firm value- speaks directly to the relationship under investigation.

2.2 Empirical review

ESG reporting is the mechanism by which organisations convey their ESG disclosures and impact to stakeholders (Ahmad et al., 2021). Its relevance has grown markedly as investors, regulators, customers, and the wider public pay closer attention to the societal and environmental footprint of businesses and to their governance and ethical conduct. In response, many firms now issue standalone or web-based ESG reports built on established standards and methods. Blending non-financial ESG indicators with financial reporting can sharpen strategic decision-making and help firms build long-term value for all stakeholders (Cheng et al., 2015).

Corporate governance reform has increasingly pushed firms toward ESG disclosure, and sustainability reporting has expanded rapidly across Europe, Latin America, and Asia-Pacific. Africa has moved more slowly, with transparency and accountability in sustainability reporting largely confined to Nigeria and South Africa. Kenya represents a notable exception, as its Companies Act 2015 contains robust ESG reporting provisions (Songi & Dias, 2019) that align closely with international legislative standards.

Aby (2020) set out to establish how ESG disclosure relates to firm value among Fortune 500 companies, treating ESG disclosure as the independent variable and firm value as the dependent variable in a quantitative panel-regression design. The study found that ESG scores were weak predictors of valuation among highly valued firms, implying that investors in those firms weigh other criteria more heavily than ESG. Because the sample was drawn from Fortune 500 firms, however, its findings generalise poorly to less mature markets such as the EAC.

El-Deeb et al. (2023) explored the ESG disclosure-firm value (FV) relationship among firms listed on the Egyptian Stock Exchange, with ESG disclosure as the independent variable, firm value as the dependent variable, and audit quality as a moderator. Using panel regression on data spanning 2017-2021, they found that audit quality (AQ) dampened the positive effect of ESG disclosure on FV. While the study confirmed a positive ESG-FV association, its reliance on AQ as the sole moderator leaves other potential moderators and control variables unexamined.

Serem et al., (2024) examined how sustainability reporting affected firm value among 32 non-financial NSE-listed firms in Kenya over 2012-2022, reporting a positive effect for environmental reporting, a negative one for economic reporting, and no significant effect for social reporting, with sustainability reporting as the independent variable and firm value as the dependent variable. Because the study's conceptualization was confined to the environmental, economic, and social components of sustainability reporting, it did not capture the broader set of ESG indicators used in the present study.

Nguyen et al., (2022) studied the link between sustainability reporting (SR) and firm value (FV) among non-financial firms on the Vietnamese stock exchange between 2015 and 2019, applying GRI standards and structural equation modelling (SEM). They reported a significant positive relationship between SR and FV, with economic, social, and environmental indicators each contributing positively; SR was the independent variable, FV the dependent variable, and firm size, audit quality, and leverage served as controls. Financial leverage was negatively associated with both SR and FV, while firm size and audit quality had a favourable influence.

Giannopoulos et al. (2022) used panel data regression to study how ESG disclosure affected the financial performance of Norwegian listed firms between 2010 and 2019 and found a mixed picture: ESG

initiatives was associated with lower ROA but is positively associated with firm value or Tobin's Q, pointing to short-term costs alongside longer-term growth potential. Because the study was confined to Norway, a developed economy with a social and economic context quite different from Kenya's, its findings may have limited generalizability to a developing market.

3. Methodology and data

Given that ESG reporting and firm value are measurable, quantifiable phenomena, this study was grounded in the positivist research philosophy, which suits an aim centred on hypothesis testing through the neutral, scientific analysis of numerical data (Lincoln et al., 2018). A longitudinal design was employed, since this design tracks the same units of analysis over time to capture changes, trends, and dynamic relationships among variables (Menard, 2020; Creswell & Creswell, 2018). It is well suited here given that the study spans 2018-2024 and seeks to trace how shifts in ESG reporting practices relate to shifts in firm value over that period. A quantitative approach was likewise adopted for its emphasis on objective measurement, numerical data, and statistical analysis, consistent with the positivist tradition (Bryman, 2016), alongside a correlational strategy suited to gauging the strength and direction of the association between ESG reporting (independent variable) and firm value (dependent variable) (Creswell & Creswell, 2018).

The study population comprised all 93 companies listed on East African stock exchanges: 62 on the Nairobi Securities Exchange (NSE) in Kenya, 6 on the Rwanda Stock Exchange (RSE), 16 on the Dar es Salaam Stock Exchange (DSE) in Tanzania, and 9 on the Uganda Securities Exchange (USE). Eligible firms had to be listed on one of these four EAC exchanges, publish ESG, sustainability, or integrated reports consistently from 2018 to 2024, and have financial and stock-performance data available throughout the study period. The study period was chosen due to the fact that the listed companies on the EAC securities exchanges suffered from a prolonged drop in market valuation between 2018 and 2024. The study commenced before 2025, and the time required for data collection, analysis, and completion of the research therefore limited the study period to 2018–2024. Therefore, the years 2025 and 2026 were not included. Only 15 firms satisfied all these criteria, giving n = 15. Accordingly, the study employed a census of all eligible firms rather than drawing a sample, a

choice that minimized sampling error and strengthened the completeness and reliability of the findings.

The study relied on secondary data covering ESG reporting and firm value, drawn from firms' annual reports, ESG or sustainability reports, and performance records or databases maintained by the NSE, DSE, USE, and RSE. An ESG Reporting Index was constructed to capture the extent and clarity of firms' ESG reporting, built from 15 indicators spanning the three ESG dimensions and aligned with recognized reporting frameworks. Each indicator was scored on a binary basis, 1 if the firm met the reporting threshold and 0 otherwise, and each firm's final score was obtained by dividing its total points by the 15 indicators to allow comparability across firms.

Firm value was measured using Tobin's Q, a standardized indicator that captures investor expectations and growth prospects by comparing a firm's market value against its book value. It was computed as the Market Value of Equity divided by the Book Value of Assets, with Market Value of Equity obtained by multiplying the total number of outstanding shares by the closing share price. Firm size, expressed as the natural logarithm of total assets, served as the moderating variable.

The study also sought to establish the moderating effect of firm size on relationship between ESG reporting and firm value. The size of the firm was in the form of natural logarithm of total assets. The log transformation assists in alleviating the impact of large-sized disparities across firms. The information was obtained directly in publicly traded company balance sheets where total assets were reported. Larger firms are generally considered to have higher firm value because of the presence of more market power and resources (Hirdinis, 2019; Nzioka et al., 2015).

Data analysis was quantitative throughout, carried out in SPSS Version 25. Prior to inferential analysis, diagnostic checks were run for normality, linearity, homoscedasticity, multicollinearity, and autocorrelation. Descriptive statistics were computed first to summarise the data, followed by correlation analysis using Pearson's correlation coefficient (r), given its suitability for linear associations between continuous variables, as the initial step in examining the ESG reporting- firm value link. The dependent variable, firm value, was then regressed on ESG reporting without a moderator using Model 1:

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$, where Y denotes firm value, X_1 denotes ESG reporting, β_0 is the regression constant, β_1 is the coefficient on ESG reporting, and ε is the stochastic error term.

4. Results

The descriptive statistics (see Table 1) show that ESG reporting among EAC-listed firms averaged 0.6476 (64.76%), with a standard deviation of 0.10538 and scores ranging from 0.38 to 0.92. On average, then, firms disclosed roughly 65% of the expected ESG reporting indicators, a finding pointing to moderate ESG reporting adoption across the region.

Table 1

Descriptive statistics for ESG reporting

N	Minimum	Maximum	Mean	Std. deviation
104	.38	.92	.6476	.10538

Source: Gathaiya et al., 2026

A mean of 0.6476 signals that ESG reporting is gaining ground among EAC-listed firms even though considerable room for improvement remains. The 0.38-0.92 range points to marked variation in reporting practice, with some firms disclosing exemplary levels of ESG information and others lagging well behind, a gap that may stem from differences in firm resources, regulatory exposure, and stakeholder pressure across the four EAC countries.

A standard deviation of 0.10538 points to relatively modest dispersion, with most firms clustered near the average and few extreme outliers. This pattern aligns with Ngwakwe's (2022) observation that ESG reporting across Africa tends to be voluntary and applied inconsistently, and where it exists, is often more descriptive than decision-relevant.

Table 2

Correlation between ESG reporting and firm value

		ESG_Reporting	LogFirm_Value_TobinsQ
ESG_Reporting	Pearson Correlation	1	.638
	Sig. (2-tailed)		<.001
	N	104	104

Source: Gathaiya et al. (2026)

4.1 Correlation between ESG reporting and firm value

ESG reporting and firm value showed a strong, positive correlation ($r = 0.638$, $p < 0.001$), indicating that firms that disclose more extensively on ESG tend to command higher firm value.

This strong positive correlation ($r = 0.638$) means ESG reporting accounts for roughly 40.7% ($r^2 = 0.407$) of the variation in firm value, a substantial share that bears out the theoretical expectation that transparent ESG reporting builds stakeholder trust, narrows information asymmetry, and signals long-term orientation, all of which capital markets tend to price favourably (Boubaker et al., 2021; Christensen et al., 2021).

This finding echoes results from other markets: El-Deeb et al., (2023) found ESG disclosure positively affected firm value in Egypt, while Nguyen et al. (2022) reported a significant positive sustainability reporting-firm value relationship in Vietnam, and Giannopoulos et al. (2022) found ESG initiatives lifted Tobin's Q among Norwegian firms. That said, the correlation observed here ($r = 0.638$) is noticeably stronger than in several of these studies, possibly because ESG disclosure carries greater signalling value in the still-emerging EAC markets, where information asymmetry runs higher (Bekaert et al., 2020).

4.2 Regression: ESG reporting and firm value

The regression analysis of Model 1 examined how ESG reporting relates to firm value.

Model 1: $$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Table 3

Model Summary of ESG Reporting and Firm Value

Model	R	R Square	Adjusted R Square	Std. error of estimate
1	.638	.407	.401	.48615

Source: Gathaiya et al. (2026)

A correlation coefficient of $R = 0.638$ points to a strong, positive linear relationship between ESG reporting and firm value (measured as log Tobin's Q), suggesting that firms scoring higher on ESG reporting also tend to have substantially higher firm values. With an R Square of 0.407, the model explains 40.7% of the variation in firm value among the sampled EAC firms, a sizeable share that indicates that ESG reporting is an important predictor of firm value.

Table 4

ANOVA of ESG reporting and firm value

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	16.535	1	16.535	69.962	<.001
	Residual	24.107	102	.236		
	Total	40.641	103			

Source: Gathaiya et al. (2026)

An F-value of 69.962 indicates that the model explains a statistically significant proportion of the variation, and a p-value below 0.001, well below the conventional 0.05 threshold, leads to rejection of the null hypothesis. The regression model is therefore statistically significant, confirming ESG reporting as a meaningful predictor of firm value.

Table 5

Coefficients of ESG reporting and firm value

Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-2.734	.298		-9.169	<.001
	ESG_Reporting	3.802	.455	.638	8.364	<.001

Source: Gathaiya et al. (2026)

The coefficients in Table 5 indicate that ESG reporting had a statistically significant, positive effect on firm value ($\beta = 3.802$, $t = 8.364$, $p < 0.001$). A one-unit change in the ESG reporting index (on a 0–1 scale) corresponds to a 3.802-unit change in log Tobin's Q. In practical terms, better-quality ESG reporting is associated with a meaningful rise in firm value, a result consistent with the theoretical expectation that ESG reporting lifts firm value by building transparency, stakeholder trust, and reducing information asymmetry.

Viewed through Stakeholder Theory, this sizeable positive effect confirms that ESG reporting functions as a tool for addressing stakeholder interests, easing conflict and uncertainty, and signalling long-term orientation (Harrison et al., 2010); Boubaker et al., 2021). The large effect size suggests that in the EAC, where information asymmetry runs higher and regulation is comparatively light, ESG reporting may have greater informational value for investors and other stakeholders.

This strong, positive ESG reporting-firm value relationship in the EAC is consistent with evidence from other emerging markets: El-Deeb et al., (2023) found a positive ESG disclosure effect on firm value in Egypt, and Nguyen et al., (2022) found a similar positive link in Vietnam. Even so, the effect size observed here (β = 3.802) markedly exceeds that of comparable studies, possibly because ESG reporting carries greater signalling value in developing markets where alternative information sources are scarcer. The study results further concur with other recent studies such as Holly et al., (2026); Chen et al. (2026); and Li et al. (2025), which have also established that ESG reporting has a positive and significant effect on firm value.

These results also concur with recent studies such as Holly et al., (2026). Using 61 IDX-listed oil, gas, and coal firms (2021–2023), Holly et al. (2026) establish that ESG disclosure has a positive and significant effect on firm value. This finding contrasts with Aby (2020), who found ESG scores to be poor predictors of valuation among Fortune 500 firms, suggesting that investors in highly valued firms weigh other factors more heavily and from Serem et al. (2024), who found that environmental reporting positively influenced, economic reporting negatively influenced, and social reporting did not significantly influence firm value among Kenyan firms. The overall positive effect of ESG reporting in the present study suggests that treating ESG as an integrated construct, rather than examining its components separately, reveals a stronger positive relationship.

4.3 Moderating effect of firm size on ESG reporting and firm value

This study investigates the moderating effect of firm size on ESG reporting and firm value. To examine whether firm size moderates the ESG reporting–firm value relationship, firm size was measured as the natural log of total assets. Firm size values ranged from approximately 17.3454 to 23.4443, reflecting substantial differences in asset bases across the sampled companies. To test moderation, we conducted a hierarchical multiple regression analysis.

Step 1 - included ESG reporting as the sole predictor (replicating Model 1):

Model 1: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Step 2 - included firm size as a second predictor:

Model 2: $Y = \beta_0 + \beta_1 X_1 + \beta_2 Z + \varepsilon$

Step 3 - included the interaction between ESG reporting and firm size:

Model 3 (final): $Y = \beta_0 + \beta_1 X_1 + \beta_2 Z + \beta_3 (X_1 \times Z) + \varepsilon$

where X_1 is ESG reporting, Z is firm size, and $X_1 \times Z$ - the interaction term.

The inclusion of firm size in Step 2 increased the explained variance in firm value from 40.7% to 59.1% (ΔF = 45.44, p < .001), which demonstrates that firm size has a significant independent contribution to firm value beyond the contribution of ESG reporting. The interaction term in Step 3 contributed an additional 1.9 percentage points (ΔF = 4.87, p = .029) that was statistically significant, but small enough to meet the standard test for moderation. The ESG value relationship is not uniform across firms of different sizes.

Table 6

Model summary of the moderating effect of firm size on ESG reporting and firm value

Step	Predictors entered	R	R^2	Adj. R^2	SE	ΔR^2	ΔF	Sig.
1	ESG reporting	.638	.407	.401	.486	-	-	--
2	Firm size	.769	.591	.583	.409	.184	45.44	<.001
3	ESG reporting firm size	.781	.610	.598	.401	.019	4.87	.029

Source: Gathaiya et al. (2026)

The ANOVA results, as shown in Table 7, indicate that the overall moderation model is statistically significant (F(3,100)=52.14, p< .001). This shows that the combined effects of ESG reporting, firm size, and their interaction significantly explain variations in firm value.

Table 7

ANOVA of the moderating effect of firm size on ESG reporting and firm value

Model	Sum of squares	df	Mean square	F	Sig.
Regression	24.791	3	8.264	52.14	<.001
Residual	15.850	100	.159		
Total	40.641	103			

Source: Gathaiya et al. (2026)

The interaction coefficient (β = −.152, t = −2.174, p = .032) is negative and significant, suggesting that the positive effect of ESG reporting on firm value is reduced with larger firm size. The negative interaction coefficient indicates that the positive association between ESG reporting and firm value weakens as firm size increases. This shows a negative firm-size effect, which contradicts the Resource-Based View interpretation, where larger firms are expected to have better ESG reporting, leading to higher firm value. However, the study found that smaller firms may implement and communicate ESG practices more efficiently.

Table 8

Coefficients of the moderating effect of firm size on ESG reporting and firm value (Step 3)

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	−.271	.048		−5.646	<.001
ESG reporting	2.312	.410	.388	5.639	<.001
Firm size	−.151	.020	−.554	−7.550	<.001
ESG reporting_firm size	−.087	.040	−.152	−2.174	.032

Source: Gathaiya et al. (2026)

The negative relationship between firm size and firm value contradicts the notion that larger firms are more valuable because they have economies of scale, market power and resource benefits (Hirdinis, 2019; Nzioka et al., 2015). Several possible explanations may account for this seemingly counterintuitive result. In the EAC context, the larger firms could experience the problem of bureaucratic inertia, organisational complexity, and slower decision-making, which affect the effectiveness of ESG implementation (Wibawa & Khomsiyah, 2022). Larger companies have more absolute ESG resources, but may have more difficult coordination costs and more complex stakeholder dynamics that make it more difficult to implement ESG integration. Smaller companies, on the other hand, may be more flexible, less expensive to coordinate and more efficient at the size level in terms of the implementation of ESG practices.

The finding is consistent with the negative moderating effect reported by Chong and Loh (2023) and Dihardjo and Hersugondo

(2023) but is contrary to the positive moderating effect found by Abdi et al., (2022) and Endri (2025). The EAC outcome is consistent with Endri (2025), as the market is still developing ESG regulatory frameworks and enforcement, and scale does not necessarily equal more credible and better rewarded ESG signals, and may, in some cases, be associated with the opposite effect.

4.4 Hypothesis Testing

The hypothesis proposed no significant relationship between ESG reporting and the firm value of listed EAC companies. Given the Model 1 regression results ($\beta = 3.802$, $p < 0.001$), this null hypothesis is rejected, providing sufficient evidence that ESG reporting bears a significant, positive relationship to firm value.

Rejecting H_0 confirms that ESG reporting is more than a compliance exercise for EAC-listed companies; it carries real value implications. The strong positive correlation bears out Stakeholder Theory's prediction that ESG reporting meets stakeholders' information needs, and it substantiates the study's underlying premise that weak ESG reporting contributes to depressed firm value in the EAC.

5. Conclusions and recommendations

The study's first conclusion is that ESG reporting bears a significant, positive relationship with firm value across the EAC. ESG reporting is not merely a compliance exercise but carries significant implications for firm value for listed companies, with firms offering fuller, clearer ESG reporting commanding better market values. This finding strengthens the case for regulators and stock exchanges in the region to implement and reinforce ESG reporting requirements, and it suggests that the sustained erosion of value among EAC-listed firms may be partly attributable to weak ESG reporting practices, a trend that improved ESG reporting could help reverse.

The study also concludes that firm size significantly moderates the ESG reporting-firm value relationship, with larger firms experiencing valuation discounts. The study concludes that market valuations of larger firms in the EAC context are lower than their asset bases, other things being equal, than those of smaller firms.

The study recommends strengthening mandatory ESG reporting requirements. Given the positive correlation identified between ESG reporting and firm value, Capital Markets Authorities and the exchanges in EAC countries (NSE, DSE, USE, RSE) should move

to expand mandatory ESG reporting, replacing the current voluntary approach with mandatory ESG reporting by all listed companies under clear standards aligned with international frameworks (GRI, SASB, TCFD, IFRS). Revising the existing NSE ESG Guidance Manual (2021) to add enforcement provisions and sanctions for non-compliance is a particularly urgent step, given how unevenly ESG reporting is currently applied across the region.

The study further recommends that EAC-listed companies invest in comprehensive ESG reporting mechanisms that go beyond mere compliance, adopting internationally recognised standards (GRI, SASB, IFRS), producing both quantitative and qualitative reporting, and subjecting ESG reports to external audit. Given that ESG reporting alone accounts for 41% of the variance in firm value, the findings suggest that investment in ESG reporting infrastructure may have potential benefits for firms.

The findings also suggest that EAC investors should weigh ESG reporting when evaluating and making investment decisions, since the strong positive correlation between ESG indicators and firm value points to ESG information as a useful predictor of future performance. Investors are encouraged to request ESG information from companies, apply ESG ratings where available, and engage portfolio companies on improving their ESG practices.

References

1. Abdi, Y., Li, X., & Câmara-Turull, X. (2022). Exploring the impact of sustainability (ESG) disclosure on firm value and financial performance (FP) in the airline industry: The moderating role of size and age. *Environment, Development and Sustainability, 24*(4), pp. 5052–5079. https://doi.org/10.1007/s10668-021-01649-w
2. Aby, A. (2020). ESG disclosure on firm value. *Journal of Critical Review, 7*, pp. 1–12.
3. Ademi, B., & Klungseth, N. J. (2022). Does it pay to deliver superior ESG performance? Evidence from US S&P 500 companies. *Journal of Global Responsibility, 13*(4), pp. 421–449. https://doi.org/10.1108/JGR-01-2022-0006
4. Afolabi, H., Olabisi, J., Kajola, S. O., & Adeyemi, S. B. (2022). ESG disclosure and financial performance: Evidence from listed firms in Nigeria. *International Journal of Financial Studies, 10*(3), pp. 54–71. https://doi.org/10.3390/ijfs10030054

5. Ahmad, R., Ayob, A., Zainon, S., & Probohudono, N. (2021). The influence of environmental, social, governance reporting on firm value: Malaysian evidence. *International Journal of Academic Research in Business and Social Sciences, 11*, pp. 1058–1080.
6. Ahmed, M., & Elmarzouky, M. (2024). Beyond compliance: How ESG reporting influences the cost of capital in UK firms. *Journal of Risk and Financial Management, 17*(8), 326. https://doi.org/10.3390/jrfm17080326
7. Antonacopoulou, P., & Méric, J. (2024). A critique of stakeholder theory: Management science or a sophisticated ideology of control? *Corporate Governance, 5*(2), pp. 22–33. https://doi.org/10.1108/14720700510562631
8. Bekaert, G., Engstrom, E., & Xu, N. (2020). The time variation in risk appetite and uncertainty. *Journal of Finance, 75*(3), pp. 1521–1572. https://doi.org/10.1111/jofi.12895
9. Boubaker, S., Cellier, A., Manita, R., & Saeed, A. (2021). Does corporate social responsibility reduce financial distress risk? *Economic Modelling, 91*, pp. 835–851. https://doi.org/10.1016/j.econmod.2020.02.008
10. Brealey, R. A., Myers, S. C., Allen, F., & Edmans, A. (2020). *Principles of corporate finance* (13th ed.). McGraw-Hill Education.
11. Broadstock, D. C., Chan, K., Cheng, L. T. W., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters, 38*, 101716. https://doi.org/10.1016/j.frl.2020.101716
12. Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.
13. Cheng, M., Green, J., & Ko, J. (2015). The impact of strategic relevance and assurance of sustainability indicators on investors' decisions. *Auditing: A Journal of Practice & Theory, 34*(1), pp. 131–162. https://doi.org/10.2308/ajpt-50885
14. Chen, K.-H., Zhang, Y., Elston, J. A., Chen, P.-H., & Hsu, K.-H. (2026). Environmental, social, and governance (ESG) initiative scores and firm performance: The importance and role of firm size. *Small Business Economics, 66*(1), pp. 71–95. https://doi.org/10.1007/s11187-025-01096-1
15. Chong, T., & Loh, L. (2023). Innovating ESG integration as sustainable strategy: ESG transparency and firm valuation in the palm oil sector. *Sustainability, 15*(22), 15943. https://doi.org/10.3390/su152215943

16. Christensen, D., Serafeim, G., & Sikochi, A. (2021). Why is corporate virtue in the eye of the beholder? The case of ESG ratings. *The Accounting Review, 97*, pp. 1–60.
17. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
18. Damodaran, A. (2023). *Narrative and numbers: The value of stories in business* (2nd ed.). Columbia University Press.
19. Dihardjo, J.F., & Hersugondo, H. (2023). Exploring the impact of ESG disclosure, dividend payout ratio, and institutional ownership on firm value: A moderated analysis of firm size. *Jurnal Ekonomi Bisnis dan Kewirausahaan, 12*(3), pp. 256–271. https://doi.org/10.26418/jebik.v12i3.67890
20. El-Deeb, S., Ismail, H., & El Banna, A. (2023). Does audit quality moderate the impact of environmental, social and governance disclosure on firm value? Further evidence from Egypt. *Journal of Humanities and Applied Social Sciences, 5*(4), pp. 293–322. https://doi.org/10.1108/JHASS-11-2022-0155
21. Endri, E. (2025). ESG disclosure, intellectual capital, and firm value in the energy sector in Indonesia: The moderating role of firm size. *International Journal of Energy Economics and Policy, 15*(6), pp. 1–10.
22. Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.
23. Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment, 5*(4), pp. 210–233. https://doi.org/10.1080/20430795.2015.1118917
24. Gathaiya, R. N., Macheru, J., & Osoro, C. (2026). *Environmental, social and governance disclosure and firm value of companies listed at the securities exchanges of East African Community countries* [Unpublished doctoral dissertation]. The Catholic University of Eastern Africa.
25. Giannopoulos, G., Fagernes, K., Elmarzouky, M., & Hossain, A. (2022). The ESG disclosure and the financial performance of Norwegian listed firms. *Journal of Risk and Financial Management, 15*(6), 237. https://doi.org/10.3390/jrfm15060237
26. Hamdah, L., Setiawan, A., Kartiko, E., Zakaria, B., & Fauzi, H. (2025). The effect of sustainability report disclosure on firm value with growth and leverage as control variables. *International Journal of Research*

and Innovation in Social Science. https://dx.doi.org/10.47772/IJRISS.2025.908000452

27. Harrison, J.S., Bosse, D.A., & Phillips, R.A. (2010). Managing for stakeholders, stakeholder utility functions, and competitive advantage. *Strategic Management Journal, 31*(1), pp. 58–74. https://doi.org/10.1002/smj.801
28. Hirdinis, M. (2019). Capital structure and firm size on firm value moderated by profitability. *International Journal of Economics and Business Administration, 8*, pp. 174–191.
29. Holly, A., Tangke, P., Kampo, K., & Wijaya, R.A. (2026). Environmental, Social, Governance (ESG) disclosure and firm value: Role of firm size. *AJAR, 9*(1), pp. 103–123. https://doi.org/10.35129/s8bfrc02
30. International Monetary Fund. (2025). *Regional Economic Outlook: Sub-Saharan Africa*. IMF.
31. Kotsantonis, S., Pinney, C., & Serafeim, G. (2020). ESG integration in investment management. *Journal of Applied Corporate Finance, 32*(2), pp. 10–16. https://doi.org/10.1111/jacf.12395
32. Kumar, S. (2023). A review of ESG performance as a measure of stakeholder theory. *Academy of Marketing Studies Journal, 27*(S3), pp. 1–18.
33. Lee, E. (2021). *What does ESG investing really mean? Implications for investors of separating financial materiality and social objectives*. Pension Research Council.
34. Li, Q., Liu, C., & Lin, Y.-E. (2026). ESG and firm value: The moderating effects of corporate transparency and institutional environment. *International Journal of Finance & Economics*. https://doi.org/10.1002/jfe.70005
35. Lincoln, Y.S., Lynham, S.A., & Guba, E.G. (2018). Paradigmatic controversies, contradictions, and emerging confluences, revisited. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE handbook of qualitative research* (5th ed.). SAGE Publications.
36. Manita, R., Bruna, M.G., Dang, R., & Houanti, L. (2021). Board gender diversity and ESG disclosure: Evidence from the USA. *Journal of Applied Accounting Research, 22*(2), pp. 330–346. https://doi.org/10.1108/JAAR-01-2020-0006
37. Menard, S. (2020). *Longitudinal research* (2nd ed.). SAGE Publications.
38. Ng, A.C., & Rezaee, Z. (2020). Business sustainability performance and cost of equity capital. *Journal of Corporate Finance, 34*, pp. 128–149. https://doi.org/10.1016/j.jcorpfin.2015.08.003

39. Ngugi, B., & Otieno, D. (2023). Sustainability reporting and firm performance in East African capital markets. *African Journal of Economic and Management Studies, 14*(3), pp. 1–19. https://doi.org/10.1108/AJEMS-10-2022-0475
40. Nguyen, L., Dang, H., & Ta, B. (2022). Relationship between sustainability reporting and firm's value: Evidence from Vietnam. *Cogent Business & Management, 9*(1), 2082014. https://doi.org/10.1080/23311975.2022.2082014
41. Ngwakwe, C.C. (2022). Environmental, social and governance disclosure in African capital markets. *Sustainability Accounting, Management and Policy Journal, 13*(4), pp. 1–21. https://doi.org/10.1108/SAMPJ-09-2021-0364
42. Nzioka, O., Mukras, M., & Mule, R. (2015). Corporate size, profitability and market value: An econometric panel analysis of listed firms in Kenya. *European Scientific Journal, 11*, pp. 1–21.
43. Serem, K., Gudda, P., Ombok, M., & Manyaga, B. (2024). Effect of sustainability reporting on firm value: Evidence from the Nairobi Securities Exchange, Kenya. *Journal of Finance and Accounting, 8*(1), pp. 29–49. https://doi.org/10.53819/8101810122302
44. Songi, O., & Dias, K. (2019). Sustainability reporting in Africa: A comparative study of Egypt, Equatorial Guinea, Kenya, Nigeria, Botswana and South Africa. *SSRN,* 42, pp. 536–552.
45. Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility, 8*(2), pp. 169–178. https://doi.org/10.1108/JGR-11-2016-0029
46. Wibawa, D.S., & Khomsiyah, K. (2022). The effect of the environment moderated by firm size on firm value during the COVID-19 pandemic. *Owner, 6*(4), pp. 3501–3509. https://doi.org/10.33395/owner.v6i4.1189
47. World Bank. (2025). *Africa's Pulse* (Vol. 31). World Bank.
48. World Federation of Exchanges. (2024). *Annual Statistics Guide 2024*. World Federation of Exchanges

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