

Financial inflows financial development digital financial transformation and export performance in upper middle income African economies

Soliu Bidemi ADEGBOYEGA

adegbsb@unisa.ac.za

University of South Africa

Kgaugelo Sammy BOYA

University of South Africa

Research Article

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Abstract

Purpose-

This study examines the link between financial inflows, financial development and exports in seven upper-middle-income African countries, with focuses on the moderating and non-linear impact of digital financial transformation on the finance-export relationship, thus filling a gap in the context-specific literature for African economies.

Design/Methodology/Approach-

A quantitative panel study design using data from seven countries ranging 2008 to 2023. Fixed effects estimation with Driscoll-Kraay robust standard errors that allow for cross-sectional dependence, heteroskedasticity and serial autocorrelation is used, as data come from the World Development Indicators.

Findings-

Results reveal a significant negative direct financial development impact on export performance, attributed to credit misallocation toward non-tradable sectors. However, digital financial transformation, measured by mobile subscriptions, internet usage, and broadband infrastructure significantly moderates and reverses this effect. Broadband infrastructure emerges as the most consistent driver of export performance. Also, a U-shaped non-linear relationship confirms that financial development becomes export-enhancing beyond a critical threshold, while FDI exhibits no direct effect but becomes significant when conditioned on digital connectivity.

Practical Implications:

Policymakers should prioritize targeted credit allocation to export-oriented sectors and invest in digital financial infrastructure, particularly broadband, to enhance trade competitiveness. Integrating FDI policies with digital development strategies is also essential.

Social Implications:

Enhanced digital financial systems can promote inclusive participation in international trade, particularly for SMEs, thereby supporting employment and economic diversification.

Limitation

- Inclusion of institutional quality indices as additional moderators would add to the conditionality framework, and machine learning methods for threshold detection could yield more accurate estimates of the FD-export threshold.

Originality/Value:

The study provides novel, integrative evidence on the finance–trade nexus by incorporating digital financial transformation as a structural moderator within the African context, offering new policy-relevant insights.

1. Introduction

The increasing interconnectedness of the global financial system has had a significant impact on the development pathways of emerging and developing countries, particularly in terms of financial inflows, financial development and international trade. In this respect, financial inflows, especially foreign direct investment (FDI) and other capital flows, have traditionally been recognised as the key determinants of economic transformation, which allows host economies to access capital, technology, management know-how and global value chains (Awad, 2021; Ofori-Sasu et al., 2024). Not only do they stimulate domestic investment but also allow them to be integrated into global value chains, thereby enhancing their export potential and competitiveness. However, the success of financial inflows in creating trade benefits depends on the absorptive capacity of domestic financial sector and institutional structure.

In theory, both the neoclassical and endogenous growth models imply that financial resources are important to economic growth and trade. Whereas the neoclassical perspective emphasises capital deepening and technological catch-up as growth drivers, endogenous growth theory highlights the importance of financial development, innovation and knowledge spillovers in driving long-term growth (Adegboyega et al., 2021). In this context, financial development is crucial in the nexus between financial inflows and economic growth. Financial development facilitates mobilisation of savings, efficient allocation of resources and reduces transaction and information costs, which are essential in facilitating export activities (Abor et al. 2024; Irandoust, 2021). It has been demonstrated that countries with better and more efficient financial systems are better positioned to mobilise foreign capital to productive investments, thereby facilitating the growth of exports and diversification (Riaz et al., 2024; Abor et al. 2024).

In addition, financial development helps firms, especially small and medium-sized enterprises (SMEs), access credit and alleviate their liquidity constraints to participate in trade. The interplay between finance and trade is however complex and contingent with mixed outcomes in varying geographical and development contexts. However, more recently, the introduction of digital financial transformation has introduced a new dimension to this relationship. The emergence of digital financial technologies, including mobile banking, fintech platforms, digital payment systems, and e-government services, have revolutionised financial intermediation by increasing accessibility, reducing transaction costs, and enhancing transparency (Li et al., 2025; Mai, 2025). Such technologies are particularly relevant in the emerging markets where the traditional financial sector is usually riddled with inefficiencies, low coverage and information asymmetries. Digital finance has the potential to increase the effect of financial inflows and financial development on the performance of the economy, due to improved financial inclusion and efficiency of financial services.

The new literature describes the multifaceted effect of digital financial transformation on the economic results. As an example, the digital transformation has been identified to have a significant effect on attracting foreign direct investment (FDI) through its positive impact on the business environment, institutional transparency and costs of investors (Li et al., 2025; Mai, 2025). Likewise, digital finance enhances the nexus between financial inclusion and sustainable economic growth by improving access to financial services and economic participation (Al-Smadi, 2025). On the micro level, digital financial systems have been demonstrated to alleviate finance constraints, trade risks and prolong export time, thereby improving export performance and resilience (Xu et al., 2026). These lessons indicate the role of digitalization as an enabler that does not only have a direct effect on economic performance but also influences the effects of traditional financial channels.

Nonetheless, there are still many obstacles to transferring financial and digital trends into export growth, particularly in Africa. Even the economies of the upper-middle-income group are not diversified in terms of exports, with the focus on commodity exports, which makes them vulnerable to external shocks and price changes (UNCTAD, 2022). According to the UNCTAD Economic Development in Africa Report, over 60 percent of African countries continue to rely on commodity exports, which is why structural change and diversification is necessary. Financial services and digital technologies are becoming more and more viewed as the drivers of export upgrading and competitiveness. They can facilitate the development of more value-added industries and open up to the global market through increased access to financial services and reduced trade costs. However, the existing literature on the relationship between finance and trade is fragmented and is not integrated. The current literature has been inclined to consider pairwise relationships, including the impacts of FDI on GDP growth or the impacts of financial development on FDI inflows, without fully taking into consideration the interdependencies among these factors. As an example, despite the positive impact of financial development on the FDI inflows, the literature has ignored the spillover effects on exports and trade (Irandoost, 2021).

Similarly, the research on digital finance has concentrated more on its direct impacts on economic growth or financial inclusion, rather than its moderating effects on the relationship between financial inflows, financial development and exports. Moreover, the interaction between financial inflows and digital finance is another complex factor. The capital base is provided by financial inflows, but digital financial systems affect the effectiveness of capital mobilisation and allocation in the economy. Studies have shown that financial technology is a key factor that influences capital inflows by promoting greater transparency, reducing risks, and enhancing investor confidence (Danladi et al., 2025). On the other hand, the volatility of the global financial markets integration can result in capital outflows which can destabilise the financial systems and exports (Blouin et al., 2025). This underscores the importance of robust financial institutions and regulatory frameworks to reduce risks posed by capital mobility. Furthermore, the literature has a geographical bias with a disproportionate representation of Asian and European countries. Most empirical research on the impact of digital finance and financial development on export performance is based on data from China, Vietnam and European transition economies (Li et al., 2025; Nam & Ryu, 2024).

While these studies offer important insights, the results may not be directly transferable to African economies, which have unique structural, institutional and development challenges. As such, there is a clear need for research that is relevant to the specific circumstances of upper-middle-income African economies. In view of these deficiencies, this study aims to offer an integrative nexus of financial inflows, financial development, and export performance, focusing on the moderating effect of digital financial transformation in upper-middle-income African countries between 2008 and 2023, and the nature of relationship between financial development and export performance on one hand, and digital financial transformation and export performance, on the other hand. The present study aims to advance understanding of the finance–trade nexus in the context of digitalisation and contribute to the development of a coherent research agenda. Finally, such an integrative strategy is needed to inform policy interventions that can leverage financial and digital innovations to facilitate sustainable export growth and economic transformation. The study presents strong evidence of the structural conditions in which financial digitalisation promotes sustainable export growth in the study area. The rest of this paper will be divided as follows: Section 2 will provide a review of the relevant literature, whereas Section 3 will outline the methodological framework. Section 4 reports and discusses empirical findings, and Section 5 concludes with policy recommendations and directions on future research.

2. Literature Review

2.1 Theoretical Review

The theories that support the relationship between financial inflows, financial development and export performance are complemented by a number of theories. According to neoclassical growth theory, financial inflows, particularly foreign direct investment (FDI) enhance capital formation and capacity, which in turn promote trade growth (Solow, 1956). However, this theory supposes diminishing returns, and it does not take into account structural and institutional obstacles. Endogenous growth theory is based on this, but it emphasizes the role of innovation, human capital and knowledge spillovers to drive long-term growth, implying that financial inflows and efficient financial systems enhance export performance by increasing productivity (Romer, 1990; Lucas, 1988). Financial intermediation theory also indicates that properly functioning financial systems reduce the cost of transactions and information asymmetries, enabling firms, especially small and medium enterprises, to access finance and engage in exports (Levine, 1997).

In the same vein, modern trade theories, including the firm heterogeneity theory, propose that only efficient firms export and financial access is a major factor in the export decision-making (Melitz, 2003). The institutional theory also implies that good governance is effective in allocating resources and creating confidence in investors (North, 1990). The latest theory of digital finance focuses on how technological changes can affect financial inclusion and efficiency. Digital finance lowers transaction costs, enhances access to finance, and enables global trade. The combination of these theories suggests that the inflows, efficiency of financial system, institutional quality, and digital finance are the factors that determine export performance.

2.2 Empirical review

2.2.1 Financial Inflows, Financial Development and Export Promotion

The body of empirical evidence on the relationship between financial inflows, financial development, and export performance is a rich yet complex set of evidence with a wide range of methodological approaches and a fragmented analysis. The empirical data indicate that there is a positive impact of financial development on export performance. Riaz et al. (2024) confirm the long-term association between financial development and export growth in South Asia through panel co-integration and FMOLS/DMOLS approaches. Their results indicate that financial systems facilitate export performance through enhancing access to credit and reducing trade costs. The good relationship between financial inflows and export promotion is explained by the spillovers of technology and the global value chain (GVC) integration. FDI enhances productivity, technological development and export competitiveness through integration of domestic firms into global value chains.

Ofori-Sasu et al. (2024) offer macro-level evidence that FDI contributes to economic performance through complementarity with financial systems, demonstrate that FDI and financial inclusion are complementary factors in enhancing economic performance in a digital financial system, and Mai (2025) using a modified gravity model, shows that digital transformation increases FDI inflows by enhancing transparency and reducing transaction costs factors that indirectly boost export potential. However, empirical data shows that the FDI-export nexus depends on the financial development, institutional quality and digital infrastructure. Without them, FDI might fail to result in diversification and upgrading of exports. Using dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS), Awad (2021) concludes that although trade and aid inflows have a positive effect on economic growth in SSA, other inflows, such as remittances and FDI, have insignificant or mixed effects. Likewise, Adegboyega et al. (2021), using the autoregressive distributed lag (ARDL) model, show that capital inflows can have a negative impact on growth in the absence of suitable trade liberalisation policies. These mixed results indicate that financial inflows are not enough to boost exports.

Capital inflows, particularly FDI, are commonly believed to be a source of export growth via capital deepening, technology spillovers and involvement in global value chains. Dynamic panel studies approaches such as system GMM provide good evidence of the positive effect of FDI on export performance. Indicatively, Gamariel and Hove (2019) demonstrates that the FDI is an important factor in improving the export sophistication in African countries through mechanisms such as human capital, technology spillovers and productivity. Irandoust (2021) who uses bootstrap panel Granger causality in post-communist countries demonstrates that financial development has a significant impact on attracting FDI, which supports the supply-leading hypothesis. Likewise, Islam et al. (2020) using generalized method of moments (GMM) estimation demonstrate that financial development attracts FDI, especially in the presence of high-quality institutions. This underscores the fact that institutional and financial development are mediators of the inflow-development relationship. To address the problems of endogeneity and dynamic, most empirical literature uses sophisticated econometric techniques such as System Generalized Method of Moments (GMM), Autoregressive Distributed Lag (ARDL) models, pooled mean group estimators, and other panel regression techniques. Within this body of research, three major strands emerge: the impact of financial inflows, financial development, and the significance of digital financial transformation. Yet, they are often studied separately with little attempt to bring them together in an integrated analysis, especially in Africa. Therefore, the research hypothesis is stated as:

H₁: Financial development and financial inflows positively influence export promotion in upper-middle-income African economies.

2.2.2. Moderating Role of Digital Financial Transformation

Digital financial transformation brings about a structural change in the finance-trade relationship, serving as a moderator and a multiplier of financial relations. Theoretical foundations are rooted in digital finance theory and innovation diffusion models, which highlight efficiency, cost and information benefits. There is strong empirical evidence for its moderating effect. For instance, Mai (2025), employing panel gravity models, shows that digital transformation has a positive effect on FDI inflows through improving the investment environment. Al-Smadi (2025), using system GMM, shows that digital finance enhances the link between financial inclusion and sustainable development. Danladi et al. (2025), using feasible generalized least squares (FGLS), demonstrate that financial technology has a positive impact on capital inflows in Africa. Xu et al. (2026), using firm-level survival models, show that digital finance prolongs export duration by relaxing liquidity constraints and mitigating export risks.

Li et al. (2025) also shows that digital finance improves export competitiveness via finance and innovation. Tidjani and Madouri (2024), employing dynamic and static panel models, demonstrate that fintech and financial inclusion have a positive effect on sustainable development in African countries, but their interaction has a slightly negative effect, implying coordination inefficiencies. Likewise, Al-Smadi (2025) using System GMM for the Middle East and North African (MENA) countries, shows that digital finance enhances the link between financial inclusion and sustainable development. These results verify the moderating role of digital finance in strengthening financial systems. Through lowering transaction costs, enhancing credit access, and overcoming information problems, digital financial technologies provide a platform for firms, especially small and medium-sized enterprises to engage in international

trade but the existing literature mainly considers digital finance as a standalone factor, with few studies on its moderating role in multiple relationships. Therefore, the hypothesis in the case of upper middle-income countries in Africa is stated as:

H₂: Digital financial transformation positively moderates the relationship between financial development and export performance on one hand as well as financial inflows and export performance on the other hand.

H₃: Digital financial transformation and financial development exhibit non-linear relationships between financial inflows-export performance

3. Methodology

3.1. Model Specification

This paper is based on endogenous growth theory that is rooted in Cobb-Douglas Production Function, which assumes that endogenous growth in the long run is driven by internal factors such as human capital, innovation, and knowledge spillovers as opposed to exogenous technological advancement. In this context, financial inflows, financial development, and digital financial transformation are essential factors contributing to productivity and structural change. To address the research objectives, three empirical models are specified.

The first model examines the direct effects of financial inflows and financial development on export performance. Thus, functionally written as

$$EP_{it} = f(FI, FD_{it}, X_{it})$$

1

Where: EP is the export performance; financial inflows (FI) is captured by Foreign Direct Investment (FDI); FD denotes financial development expressed as credit to private sector (% of GDP); and X is a vector of control variables including GDP per capita (GDPPC), inflation (INF), and Industrialisation (IND). Furthermore, by extension the variable of digital financial transformation is added to affirm the direct impact if included in equation. Therefore, Eq. 1 is extended and becomes:

$$EP_{it} = f(FI, FD_{it}, DFT_{it}, X_{it})$$

2

From Eq. 2, *DFT* is decomposed for this present study as MSB = Mobile Subscription (digital penetration, %); INUT = Internet Usage (% of population, proxy for digital financial transformation); FBS = Financial Broadband Subscription (Digital Infrastructure)

In econometric form, the baseline model is therefore specified as:

$$EP_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FD_{it} + \beta_3 DFT_{it} + \beta_4 IND_{it} + \beta_5 INF_{it} + \beta_6 GDPPC_{it} + X_{it} + \mu_i + \epsilon_{i,t}$$

3

where *i* represents country and *t* stands for time. μ_i captures country-specific effects, and $\epsilon_{i,t}$ is the error term. This specification allows for heterogeneous effects consistent with endogenous growth dynamics.

To evaluate the moderating role of digital financial transformation on FDI-export performance nexus, the interaction effects are incorporated as follows:

$$EP_{i,t} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FD_{it} + \beta_3 DFT_{it} + \beta_4 (FDI_{it} * DFT_{it}) + \beta_5 IND_{it} + \beta_6 INF_{it} + \beta_7 GDPPC_{it} + \mu_i + \epsilon_{i,t} \quad (4a)$$

Similarly, to evaluate the moderating role of digital financial transformation on FD-export performance nexus, the interaction effects are incorporated as follows:

$$EP_{i,t} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FD_{it} + \beta_3 DFT_{it} + \beta_4 (FD_{it} * DFT_{it}) + \beta_5 IND_{it} + \beta_6 INF_{it} + \beta_7 GDPPC_{it} + \mu_i + \epsilon_{i,t} \quad (4b)$$

The interaction terms allow the study to assess whether digital financial transformation amplifies or dampens the effects of financial inflows and financial development on export performance. However, to avert multicollinearity plight from estimating all interaction terms simultaneously, Eq. 4's is estimated as a series of embedded models, each introducing one set of interaction terms while holding all main effects constant. This process aligns with the study conducted by Brambor et al. (2006) and allows clear identification of each moderate impact.

Furthermore, to capture potential nonlinearities, the study specifies a quadratic functional form as follows:

$$EP_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FD_{it} + \beta_3 FD_{it}^2 + \beta_4 DFT_{it} + \beta_5 IND_{it} + \beta_6 INF_{it} + \beta_7 GDPPC_{it} + X_{it} + \mu_i + \epsilon_{i,t}$$

5a

$$EP_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FD_{it} + \beta_3 DFT_{it} + \beta_4 DFT_{it}^2 + \beta_5 IND_{it} + \beta_6 INF_{it} + \beta_7 GDPPC_{it} + X_{it} + \mu_i + \epsilon_{i,t}$$

5b

To establish the nature of the non- linearity from equations 5a and 5b, the turning point is computed as $-\beta_2/(2\beta_3)$ and $-\beta_3/(2\beta_4)$ respectively. However, all definitions of variables are shown in Table 1 and all variables are log-transformed which is supported by Azuh et al. (2020).

Table 1
Variable description, countries selected and data source

Variable	Proxy	Description	Measurement	Source	Countries
EP	Export Performance	Total exports of goods and services	% of GDP	WDI (2025)	Algeria, Botswana, Gabon, Mauritius, Namibia, South Africa, and Tunisia (World Bank Classification)
FBS	Fixed broadband subscriptions	Digital infrastructure	per 100 people		
INTU	Internet users	Digital usage	% population		
MSB	Mobile subscriptions	Digital penetration	per 100 people		
FD	Financial Development	Domestic credit to the private sector	% of GDP		
CI	Foreign Direct Investment	Net inflows of foreign direct investment	% of GDP		
IND	Industrialisation	Value-added	% of GDP		
GDPPC	GDP per capita (economic size and development)	GDP per capita (economic size and development)	US dollar		
INF	Inflation	Consumer price index	unit		
Note: This table provides details on all data used in this study.					
Source: Authors own work					

3.2. Estimation Strategy

Seeking to inform evidence-based and data-driven policymaking, this research adopts a quantitative panel research approach to investigate the dynamic relationship between financial inflows, financial development and export performance. It also incorporates the moderating and potentially non-linear effects of digital financial transformation and financial development in the upper-middle-income African economies from 2008–2023 (see Table 1). Panel data is well suited for this study as it allows for the control of unobserved country-specific effects while accounting for cross-country and time variations. To ensure the reliability and validity of the results, the study employs a combination of data-cleaning techniques and state-of-the-art econometric approaches, such as second-generation panel unit root tests, cointegration tests, and Fixed Effects with Driscoll-Kraay standard errors. These methods are selected for their capacity to deal with cross-sectional dependence, heteroskedasticity and serial correlation. A well-organised summary of each methodological step is presented to ensure transparency and to enhance the analytical framework. Prior to the main empirical analysis, it is crucial to investigate the stationarity of all variables to avoid spurious regression results (Tsay and Chung, 2000). In this context, second-generation panel unit root tests are more suitable than first-generation tests as they explicitly take into account cross-sectional dependence, which is a common characteristic of macro-panel data. Therefore, this research adopts Pesaran’s (2007) Cross-Sectionally Augmented IPS (CIPS) test. This approach builds on the traditional Augmented Dickey-Fuller (ADF) test by including the cross-sectional averages of lagged levels and first differences, thus accounting for unobserved common factors across countries.

Using this framework, the Cross-Sectionally Augmented Dickey–Fuller (CADF) statistics are calculated for each cross-sectional unit and then averaged to obtain the Cross-Sectionally Augmented IPS (CIPS) statistic, which offers a complete picture of the stationarity of the panel (Im et al., 2003). This approach explicitly accounts for cross-sectional dependence and slope heterogeneity, and provides more accurate stationarity tests, ensuring that the subsequent estimation is based on meaningful long-run relationships rather than spurious correlations. This is a major advancement over first-generation unit root tests, like Levin et al. (2002), which relies on the assumption of cross-sectional independence, which is often unrealistic. After stationarity diagnostics, the paper will look at the long-run cointegration relationship and then move on to the actual estimation method. The relatively small size of the cross-sectional units (N) and the longer time dimension (T) drive the application of second generation estimation techniques which are suitable in such data. The Driscoll-Kraay (DK) standard error estimator is used to complement Fixed Effects estimation, and is known to provide consistent and valid inferences in panels where $T > N$ (Driscoll and Kraay, 1998). The DK estimator yields a nonparametric covariance matrix that is robust to cross-sectional dependence, heteroskedasticity and serial autocorrelation, and the covariance matrix does not need to explicitly model these error structures. It performs better with longer time dimensions, which is the case in this study. In sum, this strategy increases the robustness, reliability and policy relevance of the estimated results (Hoechle, 2007).

4. Results and Discussion

Pretest

Table 2 reports pairwise correlations and VIF statistics for 112 observations across 7 panels. FDI exhibits the strongest positive association with EP ($r = 0.477$), followed by FD ($r = 0.310$), while INF is negatively correlated ($r = -0.202$). Although FD and IND show a notable negative correlation ($r = -0.737$), all VIF values remain below 10 (mean VIF = 1.85), confirming the absence of detrimental multicollinearity.

Table 2
Correlation Matrix and Variance Inflation Factors

Variable	EP	FD	FDI	GDPPC	INF	IND	MSB	INUT	FBS	VIF
EP	1.000									-
FD	0.310	1.000								2.65
FDI	0.477	-0.018	1.000							1.18
GDPPC	0.199	0.101	0.085	1.000						1.14
INF	-0.202	0.012	-0.023	0.169	1.000					1.13
IND	0.161	-0.737	0.184	-0.020	-0.155	1.000				3.05
MSB	-0.007	0.153	-0.182	0.094	-0.150	-0.150	1.000			1.71
INUT	-0.157	0.122	-0.037	-0.057	-0.043	-0.318	0.560	1.000		2.13
FBS	0.113	0.442	-0.134	0.134	0.014	-0.530	0.272	0.488	1.000	1.79
Notes: N = 112 observations (7 panels × 16 periods). EP = Export Performance is the dependent variable; FD = Financial Development (proxied by domestic credit to private sector); GDPPC = GDP per capita (constant); FDI = Foreign Direct Investment inflows; INF = Inflation; IND = Industrialisation; MSB = Mobile subscription i.e digital penetration; INUT = Internet Usage (digital financial transformation proxy); FBS = Financial Broadening Subscription (digital infrastructure). VIF = Variance Inflation Factor. A dash (–) denotes the dependent variable, excluded from VIF computation. Mean VIF = 1.85. All correlations based on 112 observations.										
Source: Authors own work										

Table 3 presents four CD tests applied to all nine variables. Results reveal pervasive cross-sectional dependence, with nearly all variables significant at the 1% level ($p < 0.01$) and FDI at the 5% level under the Pesaran CD test. INUT, FBS, and MSB record the highest LM statistics, reflecting strong interdependence among digital variables. These findings necessitate second-generation panel estimation techniques, such as the CIPS test, to avoid biased and inconsistent estimates.

Table 3
Panel cross-sectional dependence analysis

Test	EP	INUT	MSB	FBS	FD	FDI	GDPPC	IND	INF
Bias-corrected scaled LM	9.013 ^a	38.968 ^a	31.231 ^a	32.727 ^a	15.186 ^a	3.611 ^a	17.94 ^a	22.833 ^a	8.391 ^a
Breusch-Pagan LM	80.921 ^a	275.059 ^a	224.914 ^a	234.60 ^a	120.93 ^a	32.95 ^a	138.8 ^a	170.48 ^a	76.892 ^a
Pesaran CD	3.052 ^a	16.486 ^a	14.838 ^a	15.17 ^a	4.735 ^a	2.03 ^b	11.182 ^a	12.705 ^a	7.262 ^a
Pesaran scaled LM	9.246 ^a	39.202 ^a	31.465 ^a	32.961 ^a	15.42 ^a	4.84 ^a	18.18 ^a	23.065 ^a	8.624 ^a
Note: ^a $p < 0.01$, ^b $p < 0.05$									
Source: Authors own work									

Table 4 reports CIPS unit root test results for all variables at level and first difference. At level, EP, FBS, and IND are non-stationary, while INUT, FD, FDI, GDPPC, and INF are stationary $I(0)$. Upon first differencing, all variables attain stationarity, confirming integration of order $I(1)$ where applicable. The mixed integration orders validate the appropriateness of panel cointegration approaches, justifying the subsequent application of the Kao cointegration test.

Table 4
Panel Unit Root Tests (CIPS)

Test	EP	INUT	MSB	FBS	FD	FDI	GDPPC	IND	INF
Level	-1.165	-2.751 ^b	-2.086	-0.631	-2.797 ^b	-3.304 ^b	-3.658 ^b	-2.301	-2.555 ^b
First Diff.	-3.093 ^b	-2.939 ^b	-4.389 ^b	-2.642 ^b	-3.100 ^b	-5.278 ^b	-4.175 ^b	-3.310 ^b	-4.795 ^b
Note: ^a $p < 0.01$ (-2.22), ^b $p < 0.05$ (-2.37).									
Source: Authors own work									

Table 5 reports Kao residual cointegration test results across five statistical variants. All statistics are significant at the 5% level, unanimously rejecting the null hypothesis of no cointegration. This confirms a stable long-run equilibrium relationship among the panel variables, justifying subsequent long-run panel estimation.

Table 5
Panel Cointegration Tests (KAO)

Test	Modified DF t	Dickey-Fuller t	Augmented DF t	Unadjusted Modified DF t	Unadjusted DF t
Statistics	-2.327 ^b	-1.979 ^b	-1.808 ^b	-2.311 ^b	-1.972 ^b
Note: ^a p < 0.01, ^b p < 0.05					
Source: Authors own work					

Presentation of Main Results

Table 6 reports the baseline and progressively expanded Driscoll-Kraay (DK) fixed effects standard errors regression estimates of the determinants of export performance (EP) for five successively expanded model specifications, which are robust to cross-sectional dependence, heteroskedasticity and serial autocorrelation that make them credible for panel data with relatively large cross-sectional units and short time series. The progressive model design, from a baseline specification (Model 1) to a full specification (Model 5), allows testing for coefficient stability, the incremental value of each digital financial proxy, and the consistency of key findings across models. The coefficient on Financial Development (FD), measured by domestic credit to the private sector, is negative and significant at the 5 percent level across all five models, with t-statistics ranging from -3.78 (Model 1) to -5.07 (Model 5). The coefficient in the baseline model is -3.788, which is a remarkably large elasticity, implying a 1 percent rise in domestic credit to the private sector which is associated with a 3.79 percent fall in export performance, all else held constant. This effect is tempered as digital financial proxies are added, with the coefficient ranging from -0.351 to -0.468 in Models 2 to 4, and -0.427 in the full model, suggesting the extreme baseline coefficient partly reflects the omission of significant conditioning variables.

Table 6
Driscoll-Kraay Fixed Effects Regression Outcomes

Variable	DK ESTIMATE - EP				
	Coeff./t-stat. (1)	Coeff./t-stat. (2)	Coeff./t-stat. (3)	Coeff./t-stat. (4)	Coeff./t-stat. (5)
FD	-3.788**(-3.78)	-0.351**(-6.12)	-0.468**(-5.48)	-0.451**(-5.45)	-0.427**(-5.07)
MSB		0.360**(4.90)			0.146(1.56)
INUT			0.095**(2.67)		0.001(0.03)
FBS				0.102**(6.23)	0.083**(3.60)
FDI	0.016(0.37)	0.026(0.47)	0.009(0.20)	-0.000(-0.01)	0.004(0.10)
GDPPC	0.0342(1.82)	0.025(1.39)	0.034**(2.33)	0.032**(2.75)	0.029**(2.43)
INF	-0.047(-1.10)	-0.040(-1.50)	-0.055*(-1.85)	-0.057**(2.96)	-0.053**(-3.22)
IND	0.536**(2.01)	1.039**(3.82)	0.824**(3.25)	1.060**(4.54)	1.176**(4.62)
CONSTANT	3.275**(3.22)	-0.269(-0.21)	2.285**(2.40)	1.653(1.76)	0.083**(3.60)
Within R^2/f	0.380**	0.465**	0.456**	0.524**	0.534**
Fixed Effect/DK std. error	Yes				
Notes: t-statistics in parentheses. All variables are in natural logarithms.. Models 2–5 introduce digital financial proxies sequentially; Model 5 (Full Model) includes all regressors simultaneously. p = fraction of total variance due to individual fixed effects. F-test for all $u_i = 0$ is significant in all models (p < 0.05). Observation and group are 74(7)					

*** p < 0.01, ** p < 0.05, * p < 0.10.

Source: Authors own work

The inclusion of Mobile Subscriptions (MSB) in Model 2 gives a positive and significant coefficient of 0.360 (t = 4.90), suggesting that digital penetration through mobile subscriptions has a positive impact on export performance. A 1% increase in mobile subscriptions leads to a 0.36% increase in EP, implying that the increased access to the mobile network enables trade-related activities such as access to market information, online payments, and coordination of logistics. But when included in the full model (Model 5) with other digital proxies, MSB becomes insignificant (coeff. = 0.146, t = 1.56), suggesting that the impact of MSB may be captured by the more sophisticated digital financial infrastructure variables. Further, internet usage, as a proxy for digital financial transformation, has a positive coefficient of 0.095 (t = 2.67) in Model 3, implying that increased internet usage promotes export performance as the coefficient becomes statistically indistinguishable from zero in the full model (coeff. = 0.001, t = 0.03), suggesting that the direct effects of internet usage are largely captured by the more comprehensive financial broadband subscription variable when all digital proxies are included.

But financial broadband subscription (FBS) is the most stable and significant digital financial variable. In Model 4, its coefficient is 0.102 (t = 6.23), and it retains significance in the full model at 0.083 (t = 3.60). This cross-model stability indicates that FBS is a measure of an aspect of digital financial infrastructure that is not well captured by mobile network access or internet access. The largest positive and statistically significant coefficient of the

control variables is always the IND coefficient, which ranges between 0.536 in Model 1 and 1.176 in the full Model 5. All the coefficients are significant at the 5 percent level with t-statistics of 2.01 to 4.62. The coefficient on inflation is negative throughout all models, gradually increasing in magnitude from an insignificant – 0.047 ($t = -1.10$) in Model 1 to a significant – 0.053 ($t = -3.22$) in Model 5. The coefficient for GDP per capita growth is positive across all models, ranging from 0.025 to 0.034, and is significant at the 5 percent level in Models 3, 4 and 5. Against conventional theory, the coefficient on FDI inflows is consistently small and insignificant across all five models, ranging from – 0.000 to 0.026.

Table 7
Moderating Role of Digital Financial Transformation on Financial Development-
Export Performance Nexus.

Variable	MSB Moderator	INUT Moderator	FBS Moderator
	Model 1 (MSB*FD)	Model 2 (INUT*FD)	Model 3 (FBS*FD)
	Coeff./t-stat.	Coeff./t-stat.	Coeff./t-stat.
FD	-3.696**(-7.99)	-0.595**(-6.04)	-0.409**(-4.13)
MSB	-2.581**(-6.39)		
MSB*FD	0.805**(7.27)		
INUT		-0.164**(-1.95)	
INUT*FD		0.073**(2.53)	
FBS			-0.108(-1.13)
FBS*FD			0.061**(2.50)
FDI	0.009(0.33)	0.006(0.12)	0.005(0.12)
GDPPC	0.027(1.52)	0.035**(2.12)	0.027**(2.00)
INF	-0.013(-0.59)	-0.045(-1.35)	-0.037**(-2.07)
IND	1.481**(6.39)	0.889**(3.47)	1.187**(5.21)
CONSTANT	10.482**(6.37)	0.073**(2.96)	1.031(1.07)
With R ² /f	0.669**	0.472**	0.550**
Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.			
Source: Authors own work			

Table 7 builds on the baseline model in Table 6 by explicitly testing for moderation of the effect of financial development (FD) on export performance (EP) by digital financial transformation. Using three different interaction specifications, each with a different proxy for digital financial transformation (Mobile Subscriptions, Internet Usage, and Financial Broadband Subscription) in Models 1, 2 and 3, respectively. The moderation model is theoretically grounded in the idea that the negative impact of traditional financial development on export performance (as shown in Table 6) may be contingent on the level of digital financial transformation in an economy. The coefficient of FD in Table 7 is in line with the result from the baseline model in Table 6. But the coefficient of MSB is – 2.581 ($t = -6.39$), which is negative and statistically significant. However, the interaction coefficient (MSB*FD) of 0.805 ($t = 7.27$) is positive, large in magnitude, and statistically significant, which is the main finding of Model 1. In other words, the negative direct effect of FD on EP is gradually reduced and ultimately reversed with increasing mobile subscription penetration.

Also, the interaction coefficient (INUT*FD) of 0.073 ($t = 2.53$, $p < 0.05$) is positive and significant, suggesting that internet usage significantly moderates the impact of financial development on export performance. Although smaller than the MSB interaction in Model 1 of Table 7. The coefficient of the main effect of FBS is -0.108 ($t = -1.13$), which is not statistically significant. In the interaction model, this coefficient captures the effect of FBS at the zero level of FD, a limiting condition that is not of much independent interest. The insignificance of this main effect implies that FBS does not affect export performance at low levels of financial development; rather, its export-enhancing effect is conditional on the presence of financial sector depth whereas, the interaction coefficient (FBS*FD) of 0.061 ($t = 2.50$) is positive and statistically significant, confirming that broadening of financial services moderates the FD-EP relationship in a directionally consistent manner as in Models 1 and 2.

Importantly, coefficient of foreign direct investment, inflations, GDP per capital growth and industrialization still follows the outcomes from the baseline model presented in Table 6.

Table 8
Moderating Role of Digital Financial Transformation on FDI-Export Performance Nexus.

Variable	MSB Moderator	INUT Moderator	FBS Moderator
	Model 1 (MSB*FDI)	Model 2 (INUT*FDI)	Model 3 (FBS*FDI)
	Coeff./t-stat.	Coeff./t-stat.	Coeff./t-stat.
FD	-0.355**(-6.58)	-0.414**(-4.74)	-0.407**(-4.68)
MSB	0.484** (3.68)		
MSB*FDI	-0.086(-1.01)		
INUT		0.019(0.40)	
INUT*FDI		0.068** (2.57)	
FBS			0.066(1.69)
FBS*FDI			0.022(1.11)
FDI	-0.439(-1.09)	-0.262*(-1.67)	-0.024(-0.40)
GDPPC	0.027*(1.68)	0.036** (2.95)	0.033** (2.89)
INF	-0.039(-1.38)	-0.042(-1.28)	-0.048(-1.85)
IND	1.053** (3.65)	0.879** (3.37)	1.043** (4.22)
CONSTANT	-0.865(0.67)	2.188** (2.25)	1.591(1.62)
Within R ² /f	0.470**	0.496**	0.535**
Notes: *** p < 0.01, ** p < 0.05, * p < 0.10.			
Source: Authors own work			

Furthermore, from Table 8 it becomes clear that foreign direct investment (FDI) interacts negatively with export performance (EP) in Africa's upper middle income countries as FD is negatively and significantly related with EP at the 5% level of confidence in all three models (Model 1: $\beta = -0.355$, $t = -6.58$; Model 2: $\beta = -0.414$, $t = -4.74$; Model 3: $\beta = -0.407$, $t = -4.68$). This suggests that the conventional financial development indicator used here (domestic credit to the private sector) is insufficient to drive export performance in the sampled countries. While mobile subscription alone is positive and significantly impacts export performance, the interaction term MSB*FDI is negative and insignificant ($\beta = -0.086$, $t = -1.01$). It means that even though mobile subscription helps to promote exports, it does not enhance the export promoting capabilities of FDI inflows.

Internet Usage (INUT) coefficient stands positive but insignificant ($\beta = 0.019$, $t = 0.40$), meaning that there is no statistically significant effect of having access to the internet alone on export performance. At the same time, the interaction term INUT*FDI is positively and significantly associated with export performance at the 5% level ($\beta = 0.068$, $t = 2.57$). This is the most important result from the perspective of the model being discussed. Financial broadband subscription (FBS) coefficient stands positive and approaches conventional significance levels ($\beta = 0.066$, $t = 1.69$) suggesting that the broadband usage for financial purposes might be conducive for export performance of upper middle-income countries in Africa. However, the interaction term FBS*FDI stands positive but insignificant ($\beta = 0.022$, $t = 1.11$).

Table 9
Non-Linear Effects of Digital Financial Transformation and Financial Development on Export Performance.

Variable	DK ESTIMATE			
	FD Non-Linearity	MSB Non-Linearity	INUT Non-Linearity	FBS Non-Linearity
	Model 1	Model 2	Model 3	Model 4
	Coeff./t-stat.	Coeff./t-stat.	Coeff./t-stat.	Coeff./t-stat.
FD	-1.789**(-3.92)	-0.368**(-5.07)	-0.468**(-5.88)	-0.447**(-5.72)
FD ²	0.213** (2.67)			
MSB	0.177(1.73)	2.564(0.99)		
MSB ²		-0.235(-0.85)		
INUT	0.022(0.53)		0.101(0.42)	
INUT ²			-0.001(-0.02)	
FBS	0.069** (3.48)			0.110** (5.49)
FBS ²				0.007(1.04)
FDI	0.004(0.009)	0.024(0.59)	0.009(0.20)	0.001(0.02)
GDPPC	0.029** (2.49)	0.02(1.25)	0.034** (2.38)	0.032** (2.67)
INF	-0.029(-1.57)	-0.036(-1.15)	-0.055** (-2.02)	-0.065** (-3.30)
IND	1.054** (4.47)	1.046** (3.76)	0.823** (3.11)	1.161** (5.52)
CONSTANT	2.695** (1.96)	-5.391(0.84)	3.281** (2.31)	1.281(1.43)
With R ² /f	0.578**	0.474**	0.456**	0.533**
Notes: *** p < 0.01, ** p < 0.05, * p < 0.10.				
Source: Authors own work				

Table 9 shows whether the relationships between FD, digital financial transformation and export performance are non-linear, and whether these relationships are inverted U (concave) or U-shaped (convex). In model 1 of Table 9, the linear term for FD is negative and very significant ($\beta = -1.789$, $t = -3.92$), but the squared term FD^2 is positive and significant ($\beta = 0.213$, $t = 2.67$). The combination of a negative linear coefficient and a positive quadratic coefficient is the distinctive signature of a U-shaped non-linear relationship, suggesting that FD has a negative impact on export performance at low levels of financial deepening, but at a certain level of financial development, FD starts to have a positive and increase export performance impact. The point of inflection of the U-shaped curve can be calculated algebraically as $-\beta_1/(2\beta_2) = -(-1.789)/(2 \times 0.213) \approx 4.20$ in log units, and can be used as an empirical benchmark for the level of financial development at which the relationship between FD and export performance turns from negative to positive.

Further, Model 2 examines the non-linearity of the relationship between MSB and EP. The linear coefficient of MSB is positive but insignificant ($\beta = 2.564$, $t = 0.99$), while the coefficient of the quadratic term (MSB^2) is negative and insignificant ($\beta = -0.235$, $t = -0.85$). The signs of the linear coefficient and the square term are in line with an inverted U-shaped relationship. But the insignificance of both terms does not allow a clear inference about a non-linear mobile penetration-export relationship. Likewise, model 3 shows the linear coefficient of INUT to be positive but insignificant ($\beta = 0.101$, $t = 0.42$), while the quadratic coefficient of $INUT^2$ is close to zero and also insignificant ($\beta = -0.001$, $t = -0.02$). The very small magnitude of the quadratic coefficient, and its statistical insignificance does not offer any reliable evidence of a non-linear (concave or convex) relationship between internet usage and export performance.

Critically, model 4 offers the most informative results in relation to the digital financial transformation proxies. The linear FBS coefficient is positive and highly significant ($\beta = 0.110$, $t = 5.49$), suggesting a strong positive linear effect of digital financial services on export performance. However, the coefficient of the squared term FBS^2 is positive and insignificant ($\beta = 0.007$, $t = 1.04$), implying that there is no evidence of the relationship turning back on itself, suggesting no inverted-U. Thus, the strong positive and significant linear term implies that the relationship between FBS and export performance is monotonic positive, where increased access to digital financial services consistently improves export performance without showing signs of saturation within the sample range. In addition, the inflation coefficient in Model 3 and 4 are negative and highly significant, the strongest inflationary suppression effect observed across all models in Table 9, suggesting that macroeconomic price instability is particularly detrimental in economies where export performance is driven by FBS, perhaps due to the fact that inflation reduces the real value of digital financial transactions and the planning horizons of export-oriented firms that rely on digital payment systems.

Discussion of Findings

The empirical findings reported provide a consistent and insightful narrative that adds significantly to our knowledge of the finance–trade relationship in upper-middle-income African economies. The first and most robust finding across the various model specifications is the negative and statistically

significant impact of FD on EP. This result is not a theoretical quirk but is interpretable as a case of financial resource misallocation, as observed in emerging market economies (Levine, 1997). In upper-middle-income African economies, domestic credit to the private sector is skewed towards non-tradable sectors rather than export-oriented manufacturing and services. This sectoral distortion results in a paradox where financial deepening, without targeted sectoral allocation, displaces the productive financing demands of export-oriented firms, in line with Riaz et al. (2024) and Abor et al. (2024), who stress that the export-boosting effects of financial development depend on efficient credit allocation.

Crucially, the moderation results in Table 7 reveal that this negative effect is not fixed; it is gradually tempered and ultimately reversed as digital financial system deepens, creating a policy conditionality. Unlike the predictions of neoclassical growth theory and endogenous growth models, foreign direct investment (FDI) has consistently small and insignificant direct effects on export performance in all baselines and most interaction models. This finding, though unexpected, is consistent with the conditional FDI hypothesis advanced by Awad (2021) and Adegboyega et al. (2021), who show that FDI inflows do not spill over to exports in the absence of complementary absorptive capacity, specifically, financial system depth and institutional quality. In the selected economies, the lack of export diversification and enclave nature of resource-based FDI may also dampen technology and backward linkage spillovers.

Most importantly, the interaction model shows that internet usage significantly moderates the FDI-export performance nexus while mobile subscriptions and financial broadband subscriptions do not have significant moderation effects. This finding implies that it is the quality of digital connectivity rather than mobile subscriptions or the breadth of digital infrastructure that allows firms to benefit from FDI inflows for export performance, as found in Mai (2025) and Li et al. (2025). Table 6 shows a clear ranking of digital financial transformation effects on export performance as digital financial proxies are introduced in a stepwise fashion. Mobile subscription and internet usage have positive and significant coefficients in their respective models but become statistically insignificant in the fully augmented model, and partial mediation between digital proxies. By contrast, FBS remains significant in both individual and fully augmented models and is the most structurally stable digital financial proxy on export performance. This suggests that FBS represents a different facet of digital financial infrastructure, the institutional underpinning of digital financial intermediation that mobile and internet connectivity alone cannot substitute for. The results aligns with Danladi et al. (2025) and Ofori-Sasu et al. (2024) who highlight that infrastructure-grade digital systems, rather than peripheral connectivity measures, are more likely to condition the effectiveness of financial mechanisms in delivering economic outcomes. The moderation analysis offers the most theoretically significant finding of this research.

The interaction effects of all three digital proxies MSB, INUT and FBS with FD are all positive and significant and support Hypothesis 2 and the argument that digital financial transformation changes the export implications of traditional financial deepening. The magnitude of the $MSB*FD$ interaction coefficient is particularly remarkable, which means that in the countries where the mobile financial deepening is developed enough, the normally export-destroying effect of the deepening of domestic credit is not only moderated but ultimately inverted. This multiplier effect is in line with the theory of digital finance developed by Xu et al. (2026) and Al-Smadi (2025) where the digital financial systems reduce information asymmetries, transaction costs, and credit constraints of the export-oriented SMEs. In this regard, financial depth can only be productive in exports when mediated by a digital financial system.

Table 9, which tests the non-linearity, contributes to the policy debate. The U-shaped effect of financial development on export performance (linear $\beta = -1.789$, quadratic $\beta = 0.213$, turning point ≈ 4.20 in log-units) suggests the export-depressing effect of financial deepening is transitory. This implies that below the turning point, credit growth is mainly used to support non-tradable sectors, whereas above it, financial systems are mature enough to channel funds to export sectors, in line with the finance-led structural transformation theory (Levine, 1997; Romer, 1990). Remarkably, no notable non-linearities are found in relation to MSB or INUT, which further confirms the complementary roles of MSB and INUT as digital financial channels. Nevertheless, FBS demonstrates a significant and monotonically positive linear relationship with exports without any signs of saturation, which implies that in the range of data, no saturation effects have been observed on digital financial infrastructure. This observation has an obvious policy implication: additional investment in broadband financial infrastructure remains unambiguously productive to export performance in the upper-middle-income African countries.

The coefficient on industrialisation is consistently the largest positive coefficient, confirming the structural transformation theory that industrialisation is the main driver of export growth. Inflation has a growing negative impact as specifications are augmented, confirming that macroeconomic instability is detrimental to firm-level export planning and competitiveness. GDP per capita growth has a positive effect on exports in the more complete specifications, capturing the demand and productivity effects of income growth on export capacity. Taken together, these results offer robust empirical confirmation of Hypotheses H1 and H2, and the U-shaped non-linear relationship in H3. The findings highlight that in upper-middle-income African economies, the key to export growth is a policy framework that simultaneously deepens financial systems, broadens digital financial infrastructure, stabilises the macroeconomic environment and fosters structural industrialisation.

5. Conclusion, Implications, Limitations, and Future Research

This research investigated the nexus between financial inflows, financial development and export performance in seven upper-middle-income African countries between 2008 and 2023 (data from WDI) with explicit focus on the moderating and non-linear effects of digital financial transformation. Three key insights emerge. First, traditional financial development has a large negative direct impact on export performance, reflecting the misallocation of credit to non-tradable sectors. Second, digital financial transformation, especially financial broadband subscriptions, is the critical channel through which this adverse effect is mitigated; all three digital proxies significantly enhance the export-enhancing role of financial depth, while internet usage alone moderates the FDI-export relationship. Third, a non-linear U-shaped threshold exists in the FD-export nexus, above which financial deepening turns from export-suppressing to export-enhancing, while digital infrastructure has been found to have positive monotonic effects with no saturation. In aggregate, these findings elevate digital financial transformation from a marginal to a structural condition for realising the trade benefits of financial systems and capital inflows in Africa.

The results have policy-implications. Governments in upper-middle-income African economies should shift from aggregate financial deepening policies to credit allocation policies that specifically target private sector credit allocation to export sectors. Second, ongoing investment in broadband digital financial infrastructure is a must; given the stable and non-saturating export effect of FBS, policymakers and multilateral development banks should focus on universal digital financial connectivity as a trade competitiveness measure. For FDI promotion strategies, the evidence suggests complementing investment promotion strategies with digital infrastructure upgrading; internet penetration, not FDI, is a critical determinant of export performance. Businesses, especially SMEs, should take advantage of digital payment networks to lower trade costs and increase export market access, as suggested by the firm-level evidence of Xu et al. (2026).

The results are subject to some limitations. The sample is restricted to seven economies over 16 years, reflecting data availability for upper-middle-income African economies; the small cross-section restricts the diversity of inferences. Aggregated digital indicators (MSB, INUT, FBS) may mask firm- and sector-level digital adoption differences. Moreover, the Driscoll-Kraay fixed effects estimator, although robust to cross-sectional dependence, does not allow for dynamic panel inference over long time frames. Researchers should use firm-level panel data to unpack the micro-level channels of digital finance effects on export participation and duration. The analytical framework should be applied to lower-middle-income African countries to test the identified threshold conditions. Inclusion of institutional quality indices as additional moderators would add to the conditionality framework, and machine learning methods for threshold detection could yield more accurate estimates of the FD-export threshold.

Author Information

Authors and Affiliation

¹Soliu Bidemi ADEGBOYEGA (adegbsb@unisa.ac.za) and ²Sammy Kguagelo BOYA (bhoyask@unisa.ac.za)

^{1 & 2} University of South Africa, Business Management Department, Pretoria, South Africa.

Corresponding Author

All correspondence to SB ADEGBOYEGA (adegbsb@unisa.ac.za)

Declarations

Author Information

Authors and Affiliation

¹Soliu Bidemi ADEGBOYEGA (adegbsb@unisa.ac.za) and ²Sammy Kguagelo BOYA (bhoyask@unisa.ac.za)

^{1 & 2} University of South Africa, Business Management Department, Pretoria, South Africa.

Corresponding Author

All correspondence to SB ADEGBOYEGA (adegbsb@unisa.ac.za)

Authors Contributions: Soliu Bidemi Adegboyega- Conceptualization, methodology, data analysis, writing and original draft preparation.

Kgaugelo Sammy Boya - Introduction, methodology, supervision, writing, review, and editing.

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References

1. Al-Smadi MO. The impact of financial inclusion on sustainable development in the MENA region: The moderating effect of digital finance. *Cogent Econ Finance*. 2025;13(1):2563158. <https://doi.org/10.1080/23322039.2025.2563158>.

2. Abor JY, Ofori-Sasu D, El-Shal A. (2024). Firms' access to finance, export trade channels, and exports in Africa. Afreximbank Policy Research Working Paper Series.
3. Adegboyega S, Akinbobola T, Ajayi F. Capital flows and economic growth: What roles does trade liberalisation play? *Izv J Varna Univ Econ*. 2021;65(1):26–44. <https://doi.org/10.36997/IJUEV2021.65.1.26>.
4. Awad A. Foreign capital inflows and economic growth: The experience of low-income countries in Sub-Saharan Africa. *J Chin Economic Foreign Trade Stud*. 2021;14(3):225–39. <https://doi.org/10.1108/JCEFTS-07-2020-0028>.
5. Azuh DE, Ejemeyovwi JO, Adiat Q, Ayanda BA. Innovation and human development perspectives in West Africa. *SAGE Open*. 2020;10(4). <https://doi.org/10.1177/2158244020983277>.
6. Blouin A, Ghosal S, Mukand SW. Globalization of capital flows and the (in)disciplining of nations. *J Comp Econ*. 2025;53:209–26. <https://doi.org/10.1016/j.jce.2024.12.005>.
7. Brambor T, Clark WR, Golder M. Understanding Interaction Models. *Political Anal*. 2006;14(1):63–82. <https://doi.org/10.1093/pan/mpi014>.
8. Driscoll JC, Kraay AC. Consistent covariance matrix estimation with spatially dependent panel data. *Rev Econ Stat*. 1998;80(4):549–60. <https://doi.org/10.1162/003465398557825>.
9. Danladi JD, Adeleke I, Boluwaji OD, Oyewole KS, Debo-Ajagunna AA, Obamoyegun OJ, Lawal AM. The effect of financial technology on capital inflows in low- and middle-income countries. *Int J Econ Financial Issues*. 2025;15(4):416–26. <https://doi.org/10.32479/ijefi.19202>.
10. Gamariel G, Hove S. Foreign direct investment and export competitiveness in Africa: Investigating the channels. *J Afr Trade*. 2019;6(1–2):30–46. <https://doi.org/10.2991/jat.k.191115.001>.
11. Hoechle D. Robust standard errors for panel regressions with cross-sectional dependence'. *Stata J*. 2007;7(3):281–312.
12. Irandoust M. FDI and financial development: Evidence from eight post-communist countries. *Stud Econ Econometrics*. 2021;45(2):102–16. <https://doi.org/10.1080/03796205.2021.1978859>.
13. Islam MA, Khan MA, Popp J, Sroka W, Oláh J. Financial development and foreign direct investment—The moderating role of quality institutions. *Sustainability*. 2020;12(9):3556. <https://doi.org/10.3390/su12093556>.
14. Im KS, Pesaran MH, Shin Y. Testing for unit roots in heterogeneous panels. *J Econ*. 2003;115(1):53–74. [https://doi.org/10.1016/S0304-4076\(03\)00092-7](https://doi.org/10.1016/S0304-4076(03)00092-7).
15. Li W, Liu X, Zhou L. The role of digital finance in enhancing export competitiveness: Insights from China's listed companies. *Finance Res Lett*. 2025;71:106376. <https://doi.org/10.1016/j.frl.2024.106376>.
16. Levin A, Lin CF, Chu CSJ. Unit root tests in panel data. asymptotic and finite- sample properties. *J Econ*. 2002;108(1):1–24. [https://doi.org/10.1016/S0304-4076\(01\)00098-7](https://doi.org/10.1016/S0304-4076(01)00098-7).
17. Levine R. Financial development and economic growth: Views and Agenda. *J Econ Lit*. 1997;35(2):688–726. <https://www.jstor.org/stable/2729790>.
18. Lucas RE. On the mechanics of economic development. *J Monet Econ*. 1988;22(1):3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7).
19. Melitz MJ. The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*. 2003;71(6):1695–725. <https://doi.org/10.1111/1468-0262.00467>.
20. Mai HG. Digital transformation as a catalyst for foreign direct investment: Evidence from an emerging economy. *Cogent Econ Finance*. 2025;13(1):2586304. <https://doi.org/10.1080/23322039.2025.2586304>.
21. Nam H-J, Ryu D. (2024). Digital trade and financial development in European transition economies. (*Working paper / journal forthcoming*).
22. North DC. Institutions, institutional change and economic performance. Cambridge University Press; 1990.
23. Ofori-Sasu D, Boachie C, Tetteh JE, Kwablah A. Financial globalization, digital financial system and economic wealth in Africa. *Res Globalization*. 2024;9:100243. <https://doi.org/10.1016/j.resglo.2024.100243>.
24. Pesaran MH. A simple panel unit root test in the presence of cross-section dependence. *J Appl Econom*. 2007;22(2):265–312. <https://doi.org/10.1002/jae.951>.
25. Riaz K, Siddique HMA, Audi M, Sumaira. (2024). Impact of financial development on export performance: Evidence from South Asia. *Munich Personal RePEc Archive (MPRA Paper No. 122474)*. <https://mpa.ub.uni-muenchen.de/122474/>
26. Romer PM. Endogenous technological change. *J Polit Econ*. 1990;98(5):71–102. <https://doi.org/10.1086/261725>.
27. Solow RM. A contribution to the theory of economic growth. *Quart J Econ*. 1956;70(1):65–94. <https://doi.org/10.2307/1884513>.
28. Tidjani C, Madouri A. Fintech, financial inclusion, and sustainable development in the African region. *Front Appl Math Stat*. 2024;10:1276218. <https://doi.org/10.3389/fams.2024.1276218>.
29. Tsay W, Chung C. The spurious regression of fractionally integrated processes. *J Econ*. 2000;96(1):155–82. [https://doi.org/10.1016/S0304-4076\(99\)00056-1](https://doi.org/10.1016/S0304-4076(99)00056-1).
30. UNCTAD. (2022). *Economic development in Africa report 2022: Rethinking the foundations of export diversification in Africa*. United Nations Conference on Trade and Development. <https://unctad.org>
31. WDI. (2025). World Development Indicators data base.
32. Xu X, Xie M, Chen X, Yin X. Exploring the role of digital finance in extending export duration: Evidence from Chinese firms. *Asian Econ J*. 2026;40(1):71–104. <https://doi.org/10.1111/asej.70007>.