FINANCIAL DEVELOPMENT AND DOMESTIC INVESTMENT DYNAMICS IN EMERGING MARKETS

David Aboagye DANQUAH, PhD*
Kunofiwa TSAURAI, PhD**

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

DOI: https://doi.org/10.65672/fs.2026.3.3

* *Postdoctoral Fellow, Department of Finance, Risk Management and Banking, University of South Africa, South Africa. ORCID: https://orcid.org/0000-0003-0725-505X. Corresponding author, e-mail: daviddanquah316@gmail.com*

** *Full Professor, Department of Finance, Risk Management and Banking, University of South Africa, South Africa. ORCID: https://orcid.org/0000-0001-8041-1181*

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

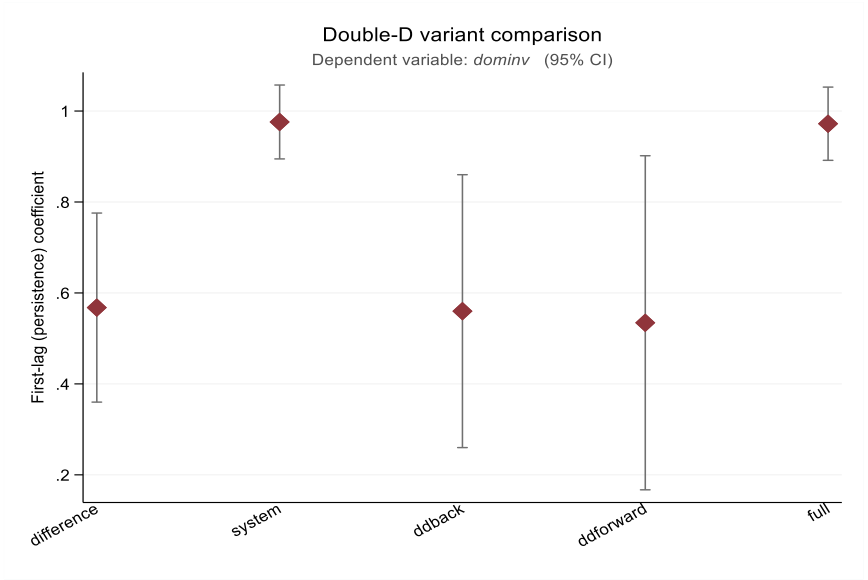
Double-D variant comparison: first-lag (persistence) coefficient

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

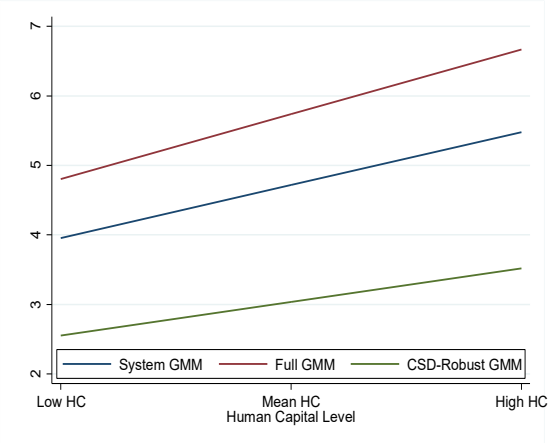
Conditional marginal effect of financial development on digital inclusion at representative levels of human capital

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

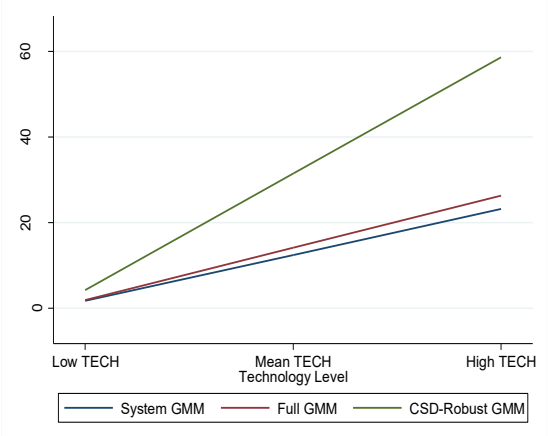
Conditional marginal effect of financial development on domestic investment at representative levels of technology

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

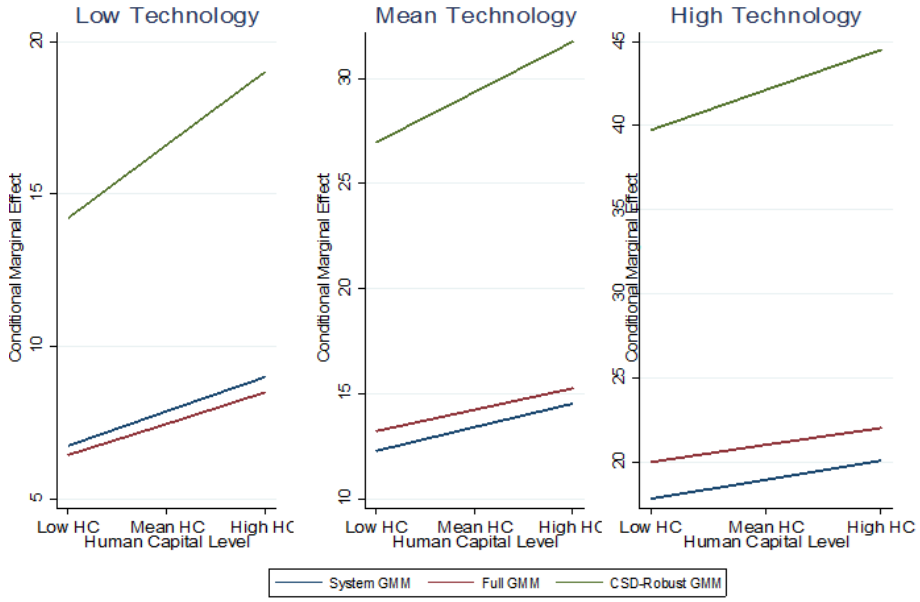
Conditional marginal effect of financial development on domestic investment under simultaneous human capital and technology moderation

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