Research Article

Title: Chinese Investment and Africa's Digital Leap: A New Era of Economic Growth

Author:

Houlda FAMBO [1]

[1]School of Economics, Nankai University, Tianjin, China

Corresponding author:

Houlda FAMBO;

Email:houlix2020@gmail.com

Original article

Topic: Chinese Investment and Africa's Digital Leap: A New Era of Economic Growth

Abstract

In the context of China's position as a leading investor in Africa, a continent currently trailing behind global standards in digital transformation, this research explores the interplay between Chinese Outward Foreign Direct Investment (OFDI), digital transformation, and economic growth across Africa. Using data from 41 African countries from 2005 to 2020 and applying Panel-Corrected Standard Errors (PCSE), System Generalized Method of Moments (System GMM), fixed effect, and Quantile regression methodologies, this study aims to assess the individual and synergistic effects of Chinese OFDI and digital transformation on the continent's economic growth. The findings of the analysis reveal crucial insights. First, the result reveals a positive and significant impact of Chinese OFDI on digital transformation in Africa. Second, the findings indicate that while the individual impacts of Chinese OFDI and digital transformation on economic growth are negligible, their combined influence significantly enhances economic growth. This reveals a complementary relationship between Chinese OFDI and digital transformation in Africa, suggesting that improving local digital transformation could enhance Chinese OFDI productivity, subsequently fostering economic growth. Conversely, Chinese investments accelerate digital transformation through infrastructure and skill transfer, which is crucial for economic growth. Accordingly, the study advocates for targeted Chinese investments and African policy reforms in sectors that catalyze digital transformation and economic growth, paving the way for sustainable development in a digitally evolving world.

Keywords: Digital transformation, Chinese OFDI, Economic growth, Africa, technology upgrade, ICT

Introduction

In the evolving global digital landscape, the African continent emerges as a contrast, marked by its rich cultural heritage and burgeoning youth demographic yet significantly lagging in the digitalization that propels economies into the new economy and sustainable growth. According to the World Bank, in 2020, while globally, urban households with internet access stand at an impressive 72%, Africa's urban areas present a far more modest figure, with only 28% of households enjoying this essential utility. This disparity is even more pronounced when comparing Africa's urban internet access to its rural counterpart, where a mere 6.3% of households are connected, highlighting a critical divide in digital inclusion within the continent. Moreover, data provided by the International Telecommunication Union (ITU) reported in Figure 1 indicates that Africa substantially lags behind the global average in digital connectivity, with only 33 active mobile broadband subscriptions, a meager 1 fixed-broadband subscriptions, and 82 mobile-cellular telephone subscriptions, compared to worldwide averages of 75, 15, and 105 respectively per 100 inhabitants. This digital divide, manifesting in limited Information and Communications Technology (ICT) infrastructure, internet accessibility, and digital literacy, not only hampers economic development but also sidelines Africa in the global digital economy. The roots of this divide are complex, embedded in infrastructural, educational, and policy-related challenges that have historically impeded widespread digital adoption (African Union Commission, 2019; Aker & Mbiti, 2010; The World Bank, 2021).

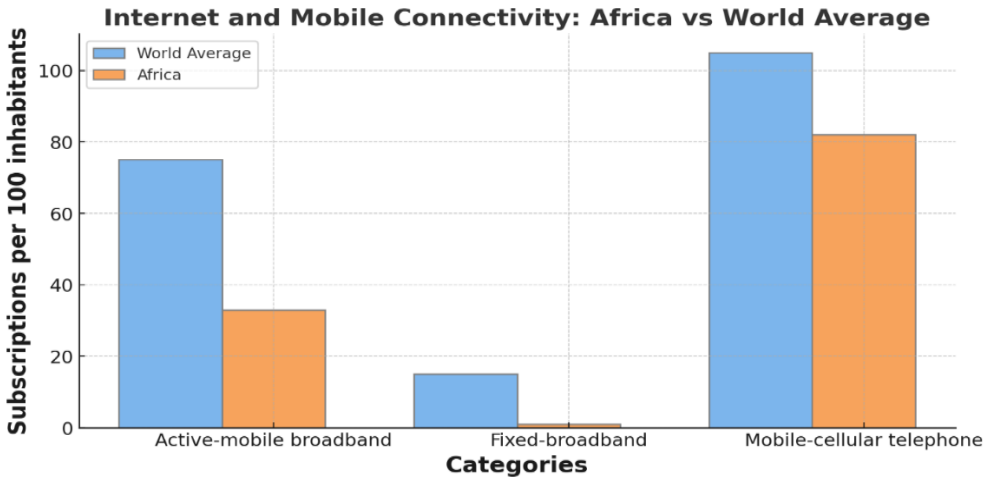


Figure 5.1 Mobile-cellular, fixed-broadband, and active-mobile broadband telephone subscriptions per 100 inhabitants, 2020

Source: Authors computations based on ITU data

Against this backdrop, China's ascendance as a digital superpower presents a compelling narrative of technological transformation and economic dynamism. As the world's largest e-commerce market, with groundbreaking advancements in 5G, AI, and digital finance, China embodies the potential of digitalization to reshape economies. More so, China's proactive export of its digital prowess, particularly under the Belt and Road Initiative's Digital Silk Road (DSR), positions it as a pivotal player in addressing the digital gap in Africa. Chinese OFDI in

Africa's ICT sector is not just an investment in technology but a bridge to economic revitalization, offering a pathway to leapfrog developmental constraints and integrate African economies into the digital global economy (Guo et al., 2019; The International Monetary Fund, 2023).

Research consistently underscores the pivotal role of ICT in fostering economic development, with studies such as Deco (2019), Myovella et al. (2020), Awad (2024), and Phuc & Doytch（2022) highlighting the critical contribution of ICT to economic growth. Adeleye et al.（2020） and Adeleye & Eboagu (2019a) also point out a synergistic relationship between ICT adoption, trade, and growth in African countries. Moreover, Asongu & Odhiambo (2019) found that ICT enhances the positive effect of FDI on economic growth in African countries. Despite these insights, the existing literature presents notable gaps, particularly in the exploration of the impact of Chinese OFDI on the ICT sector in Africa and its subsequent effect on economic growth. While the role of ICT in economic growth is well-documented, the specific contributions of Chinese investments, which have grown to make China the largest investor and trade partner in African countries over recent years, remain underexplored. This oversight is significant given the transformative potential of such investments in enhancing ICT infrastructure, technological transfer, and ultimately economic growth in Africa. Furthermore, the specific influence of Chinese contributions to Africa's digital transformation—especially given the presence of tech giants like Huawei, Tencent, and ZTE—for the continent have yet to be thoroughly examined. Moreover, the existing scholarship has not yet to fully delineate the indirect effects of Chinese OFDI through digital transformation on economic growth across different regions and different development levels within African economies. Hence,this research endeavors to empirically assess the impact of Chinese OFDI on digital transformation in Africa. Moreover, this study seeks to explore the effects of Chinese OFDI on economic growth via digital transformation, employing a dataset from 41 African countries spanning the years 2005 to 2020, analyzed through Panel-Corrected Standard Errors (PCSE), System GMM,fixed effect and quantile regression techniques.

At the heart of our study lies the hypothesis that Chinese OFDI in digital transformation not only acts as a catalyst for direct economic stimuli, such as infrastructure development but also fosters broader socio-economic dividends, including enhanced connectivity, digital literacy, and innovation ecosystems. These elements are indispensable for Africa's leap into a digitally empowered future, aligning with the Sustainable Development Goals (SDGs) and Africa's Agenda 2063. Moreover, the relevance of this empirical study, set against the backdrop of the post-COVID-19 era, becomes even more pronounced. The pandemic has not only underscored the indispensability of digital infrastructure for resilience and sustainability but has also accelerated the global transition to a digital-first economy. Hence, addressing these gaps is crucial for several reasons. First, exploring the impact of Chinese OFDI on Africa's digitalization and consequent economic growth is critical. The results will shed light on how strategic international investments can catalyze the continent's digital transformation, enabling Africa to harness digital technologies for recovery, innovation, and economic growth (African Union, 2020; The World Bank, 2021). Second, this research can contribute to policy discussions on how African countries can optimize benefits from Chinese OFDI investments in ICT, ensuring these contributions align with broader economic development goals. Finally, by examining the nuanced impacts of Chinese OFDI and ICT on economic growth across different African contexts, this study can offer targeted recommendations for enhancing the efficacy of ICT as a tool for sustainable development, considering the unique

challenges and opportunities presented by Chinese investments. Such insights are invaluable for policymakers, investors, and scholars interested in leveraging ICT for economic development in Africa, highlighting the study's relevance and potential to contribute to economic policy and strategy formulation.

The subsequent structure of this study is organized as follows: Chapter 2 introduces the literature review, Chapter 3 elaborates on the methodology, Chapter 4 discusses the results and findings, and the final chapter offers the conclusion.

2. Literature review

2.1 Theoretical Background (Endogenous Growth Theories)

The endogenous growth theory was developed in response to the limitations and shortcomings of neoclassical exogenous growth models, which did not consider technological change in their predictions of long-term economic growth. The most popular works on Endogenous growth theory are those of Solow (1956), Romer (1990), Mankiw Gregory et al. (1992), and Romer (1986) which suggest that productivity growth is contingent on technological progress in the productivity growth process. The endogenous growth theory argues that technological advancements and human capital are internal factors that drive productivity, which in turn determine the growth rate of economic output per person and long-term economic growth. The neo-classical approach argues that the scarcity and relatively high cost of labor in developed countries, compel firms in developed countries to transfer production facilities to developing and labor-intensive countries through horizontal or vertical FDI. Moreover, the model argues that foreign firms do not come to developing host countries with only investment but they also come with technology and innovation. Besides, the theory of multinational enterprises underscores the fact that foreign multinational companies have knowledge capital that can be transferred to the affiliates and subsidiaries in developing host countries which in return will benefit the host countries in terms of technology development and improvement of the human capital through training and the know-how. This is made possible because most key innovations come from the most developed or industrialized countries therefore in industrial countries, technology transfers from advanced to developing economies will boost host countries' productivity and improve the living standards of the local communities. This view is also supported by Yao & Wei (2007) who posited that developing nations have an advantage over developed nations because they have the possibility to get the same technologies and innovations more rapidly and mainly through imitation. However, the host country’s capability to produce and adopt technology will determine its rate of growth and catch up with the developed nations. Besides, developing countries can also benefit from developed countries and increase their productivity and sustain their economy through the import of intermediate goods which will be used as input to produce finished goods and services as this is the case in many African and Asian countries (Coe et al., 2007).

The new growth models expanded the theories by assuming that constant returns to scale to inputs, and the level of technology hypothetically depend on a set of inputs such as human capital accumulation Lucas (1988), investment in capital goods (Findlay (1978), and stock of research and development(R&D) Romer (1986). Moreover, the new growth models suggest that economic growth can continue over time, as the returns on investments in both physical and human capital do not necessarily decrease as the economy expands. This differs from traditional neoclassical models that assume diminishing returns as the economy grows (Lucas,1988). This indicates that there is potential for sustained economic growth, even as an economy becomes larger and more complex. The new growth models also

suggest that FDI affects long-term growth as long as it increases returns in production through externalities and productivity spillovers. Moreover, Findlay (1978) identified Foreign direct investment as a supporter of technological progress. According to his argument, the speed at which technology progresses depends on the difference in development between the country where it originates and the country that receives it, as well as how open the recipient country is to foreign direct investment, which is measured by the proportion of FDI compared to domestic investment. He also notes that transferring technology requires showing its effectiveness in the local environment before it can be adopted by domestic businesses. Multinational companies play an important role in demonstrating this effect, as the more visible it is, the faster the technology can be transferred to domestic firms. Moreover, the contribution of FDI to economic growth is emphasized in the new growth theory because, unlike the Solow model, the new growth theory treats technological progress, which is at the core of economic growth, as at least partially endogenous. In the new growth theory, capital formation is defined as investment in human capital and skill, R&D expenditures, and tangible capital. According to the standard propositions of those models, FDI is expected to encourage growth because (1) FDI increases capital accumulation through increased investment; and (2) FDI increases total factor productivity (TFP) of host countries directly and/or indirectly through:

$Y = F(K, L)$ (1)

With constant returns to scale

$Y/L = F(K/L, L/L)$ (2)

$Y = F(k) where\ y = Y/L$ (3)

where Y is the output, K is capital and L is labor, Y/K, K/L, and k/ are output per worker, capital per worker, and change in capital per worker respectively

Arrow model $Y = T(K)F(K, L)$ (4)

Lucas model $Y = T(K)(H).H\varepsilon$ (5)

Romer's model of technological change $\emptyset T = F(KT, HT, T)$ (6)

where Y is the individual firm's output, K is the capital of the individual firm and L denotes the labor of the individual firm. K denotes the aggregated stock of capital, T is the technological factor and φ T represents increasing technology, H denotes individual firm human capital, HT denotes the amount of human capital employed in a new design Hεeconomy's average level of human capital, the (ε) denotes the strength of the external effects from human capital to each firm's productivity.

On the other hand, MNCs support local companies to reduce the cost of imitation where Foreign Direct Investment and imitation both serve as channels of international technology transfer from developed countries to less developing countries (Glass & Saggi,1998, 2002). Dunning (1993) suggests that the effects of FDI depend on various factors, including the type of investment, the time frame considered, and the perspective from which it is assessed. The impact of FDI on economic growth depends on the characteristics of the multinational firm's ownership, the location of the host country, and how the multinational company organizes and uses its assets. The effects of FDI are more noticeable if the multinational firm operates across various countries and possesses distinct assets compared to local firms in the host country. Location-specific factors, such as government policies, cultural factors, and economic development stages, vary from one country to another and affect the impact of FDI on economic growth.

2.2 Empirical Literature Review

This literature review delves into the intricate relationship between ICT, FDI, and economic growth, particularly in the context of emerging and developing economies. The findings from diverse studies underscores the pivotal role of ICT infrastructure in attracting FDI and driving economic growth. A study by Sinha & Sengupta (2022) extends this discussion by examining the dynamic relationships among FDI inflows, ICT expansion, and economic growth in Asia-Pacific developing countries, revealing that both FDI and ICT significantly promote economic growth and suggesting the need for further improvement in ICT infrastructure to attract more FDI. Moreover, Ademosu (2023) offers a nuanced analysis within the BRICS nations, illustrating how ICT innovation synergizes with FDI to mitigate its negative impacts on economic growth, thereby emphasizing the strategic role of ICT infrastructure in fostering economic development. Studies by Campisi et al.(2013) and Arbia et al.(2023) further highlight the importance of ICT access quality and human capital in improving a country's technical efficiency and its capacity for technological catch-up, underscoring the complex relationship between FDI, ICT, and economic growth that can be influenced by various factors including education and government spending. Moreover, Belloumi & Touati (2022) elucidate the dynamic interplay between FDI inflows, ICT expansion, and economic growth across 15 Arab nations, discovering that both ICT and FDI significantly foster long-term economic growth.

On the other hand, recent scholarship has increasingly focused on the synergies between Information and Communication Technology, FDI, and economic growth, particularly within the African context. Research by Fakher (2016) examines the influence of ICT investments on FDI in Egypt, noting a positive albeit insignificant relationship attributed to the nascent stage of ICT infrastructure, which highlights the broader need for enhanced ICT investment and governance reforms to bolster FDI and economic growth. Odhiambo (2019) expands the discussion to Sub-Saharan Africa, demonstrating how mobile and internet penetration significantly modulates FDI to positively impact economic growth dynamics, suggesting the need for integrated ICT policies to maximize these benefits. Complementing this, Marasco et al.(2024) delve into the technology-specific aspects of FDI, uncovering a U-shaped relationship between FDI technological content and economic growth, indicating that both high-tech and low-tech FDI contribute positively to growth in the manufacturing sector of host countries. Owolabi et al.(2023)delve into the effects of various ICT variables on economic diversification across 37 Sub-Saharan countries, finding that while certain ICT investments like fixed-line telephones and imports might constrain diversification, the overarching impact of ICT on economic growth remains significant, albeit with nuances in its effect on diversification. Roger et al.(2022) further explore the impacts of ICT and innovation on sustainable economic growth in Sub-Saharan Africa, revealing that both ICT development and innovation substantially contribute to growth, albeit with innovation having a smaller effect compared to ICT. Moreover, Wang et al.(2023) delve into the significance of ICT for inclusive growth, particularly in African nations, advocating for policy measures that advance ICT development, promote trade openness, and enhance financial inclusion to support broad-based economic growth.

In sum, the existing literature on the relationship between ICT, FDI, and economic growth extensively covers various global contexts but exhibits a notable gap in specifically analyzing the impact of Chinese OFDI on Africa's economic development, particularly through the lens of digital transformation. This research is significant as it targets the

nuanced effects of Chinese OFDI in Africa, explores the mediating role of ICT in maximizing these effects, and aims to provide actionable insights for policymakers on leveraging ICT for greater economic benefits from Chinese investments. The study hypothesizes that Chinese OFDI significantly boosts African economies, especially when complemented by robust ICT infrastructure, suggesting a synergistic relationship where the combined effect of Chinese OFDI and ICT on economic growth surpasses their individual impacts.

Hypothesis 1: Chinese OFDI boosts (hinders) digital transformation in Africa

Hypothesis 2: ICT (Digital transformation) strength (weaken) the impact of Chinese OFDI Economic growth In Africa

3. Methodology

3.1. Data

This study used the dataset of 41 African countries between 2005 and 2020 (Algeria, Angola, Benin, Botswana, Burundi, Cabo Verde, Cameroon, Chad, Comoros, Congo Dem. Rep., Congo, Cote d'Ivoire, Djibouti, Egypt, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Libya, Madagascar, Mali, Mauritania, Mauritius, Morocco, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe). The choice of countries and periodicity were based on data availability Data for the analysis were retrieved from five official databases, namely The World Bank's World Development Indicators for GDP per Capita and Trade, the IMF's Financial Access Survey for Financial Development Index, the World Bank's World Governance Indicators (World Bank) for political stability, Chinese OFDI Stock from the China Africa Research Initiative (CARI) at Johns Hopkins University and African development bank's database and ICT development index from the African Development Bank database. Specifically, we use GDP per capita as the dependent variable and Chinese OFDI stock and ICT index as key variables of interest. Moreover, the financial development index, trade, and political stability are also included as control variables.

3.2Variable specification

This section presents the description of the variables used in this study.

Dependent variable:

GDP per Capita: Following recent studies by Obobisa et al.(2021), Abendin & Duan (2021), Mwananziche et al., (2023), and Awad & Albaity (2022), Real GDP per capita (constant 2015 US$) is used as the dependent variable. GDP per capita represents the total gross domestic product (GDP)—the aggregate gross value added by all resident producers in the economy, adjusted for product taxes and subsidies, excluding depreciation of assets and natural resource depletion—divided by the population at midyear.

Variable of interest:

Chinese OFDI stock: We use Chinese OFDI Stock instead of Chinese OFDI flow for the regression. For several reasons, Chinese OFDI stock is preferred over Chinese OFDI flow as the explanatory variable. First, Chinese OFDI stock is less volatile compared to Chinese OFDI flows, which is a feature that is especially significant in smaller countries (Bénassy-Quéré et al., 2007). FDI flows can fluctuate significantly year-to-year due to economic cycles, policy changes, or large one-time investments, whereas OFDI is more stable. The stability of FDI stock makes it more

reliable for analyzing the long-term impact of foreign investment on economic growth (Camarero et al., 2020; Atitianti & Dai, 2022)

Information and Communication Technology (ICT): We use ICT to capture digital transformation. In Africa, where traditional infrastructural and institutional barriers often impede economic activities, digital transformation emerges as a critical lever for economic growth, offering scalable solutions to overcome such challenges and propel the continent toward sustainable development. This perspective is supported by several recent empirical studies, including Adeleye & Eboagu (2019), Awad & Albaity (2022); David & Grobler(2020), Tchamyou et al.(2019); Owolabi et al.(2023); Roger et al.(2022) who demonstrated that investments in ICT infrastructure and the adoption of ICT services positively correlate with economic growth by enhancing productivity, fostering innovation, and providing new market opportunities.

Control variables:

Trade Openness: This chapter used the total merchandise trade as a share of GDP as a proxy for trade openness. Trade openness significantly influences economic growth in Africa by enabling access to global markets, attracting foreign investment, and promoting technological transfer. Besides, recent Studies by Abendin & Duan (2021), Kinfack & Bonga-Bonga (2022), and Oloyede et al.(2021) also used the same variable for their study about the impact of trade openness on economic growth in Africa.

Financial Development Index: The Financial Development Index captures the financial sector. Financial development streamlines capital allocation by offering essential insights for lucrative investments, thus lowering information costs. It ensures efficient contract execution within a sophisticated financial infrastructure(Bayraktar et al., 2023; Mohieldin & Hussein, 2019). Moreover, recent studies, including Haini et al.(2023) used the financial development index as a control variable while investigating the link between diversification, FDI, and economic growth.

Political stability: We use the Political stability indicator to capture Governance quality. Political instability and violence negatively affect countries' productivity and transactional capacities, dampening the country's economic growth (Miao et al.2021). Empirical studies by Aisen & Veiga (2013) and Ekpo et al.(2014) provide empirical evidence that political stability and the absence of violence positively impact countries' economic performance.

3.3 Estimation methods

3.1 The panel-corrected standard error (PCSE) econometric method

Building on the methodology of Zakari & Khan(2022); Dossou et al. (2024), and Ikpesu et al.(2019), our study utilizes the panel-corrected standard error (PCSE) approach to analyze the impact of Chinese OFDI stock and digital transformation on economic growth across 41 African countries. Several factors influence this choice: firstly, the selection of PCSE is grounded in its ability to account for the economic interconnectedness and globalization effects among African nations, particularly within frameworks like the African Continental Free Trade Area (AfCFTA) and the Belt and Road Initiative, where economic impacts can ripple across different member states. Secondly, the use of this method stems from its ability to produce estimates devoid of autocorrelation, offer precise standard error estimates, and exhibit reduced susceptibility to outlier effects. It is also particularly suitable for analyzing dynamic heterogeneous panel data, as highlighted by studies conducted by (Bailey & Katz (2011), Reed and Webb (2010), and Beck Katz

(1995). Thirdly, the model's relevance is reinforced by the presence of cross-sectional dependency in our data, as indicated by Pesaran's (2004) Cross-sectional dependence test, making it a suitable choice for examining the interconnected African economies. Finally, the PCSE method's relevance is reinforced by its application in similar recent studies (Ikpesu et al. 2019; Hossain 2016; Xu et al. 2022; Mamba et al. 2020).
Equation (7) displays the estimation function.

$$lngdp_{it} = \beta_0 + \beta_1 lnCfdi_{it} + \beta_2 lnfin_{it} + \beta_3 lnTrade_{it} + \beta_4 lnICT_{it} + \beta_5 PS_{it} + \mu_i + \varepsilon_{it} + \varphi_t \qquad (7)$$

where: ln*gdp* denotes economic growth, *lnCfdi* denotes the Chinese OFDI Stock, *PS* denotes political stability, *lnfin* denotes financial development index, *lnICT* denotes digital transformation*, lntrade* denotes the trade openness with other countries, and μ_i Represents individual country fixed effects. φ_t represents year, ε_{it} denotes general error term. Lastly, *i* and *t,* respectively, denote country and time indices.
The joint effect is calculated by inserting the interaction term into equation (7)

$$\mathrm{lngdp_{it}} = \beta_0 + \beta_1 \mathrm{lnCfdi_{it}} + \beta_2 \mathrm{lnfin_{it}} + \beta_3 \mathrm{PSit} + \beta_5 lnTrade_{it} + \beta_6 InICT_{it} + \beta_7 lnICTfdi_{it} + +\mu_i + \varepsilon_{it} + \varphi_t \quad (8)$$

where $lnICTfdi$ denotes the interaction term of Chinese OFDI and ICT.
For the initial robustness check, we reran the regression using the System Generalized Method of Moments (System GMM) to specifically address endogeneity issues. For the second robustness check, a subregional analysis was conducted using a Fixed Effect estimator to explore variations within specific geographic areas. Lastly, quantile regression was employed to examine the relationship across different developmental stages, providing a nuanced understanding of how impacts vary at various quantiles of the dependent variable. These robustness checks ensure a comprehensive evaluation of the effects of Chinese OFDI digital transformation on economic growth in Africa across different contexts and conditions.

3.2 Quantile regression

For robustness check, we use the quantile regression developed by Koenker & Bassett(1978) and Koenker & Hallock (2001) to examine the impact of Chinese OFDI and digitalization on economic growth in Africa across different quantiles using quantile regression across lower (Q25), middle (Q50), and upper (Q75) economic performance quantiles. Distinct from traditional regression methods that focus on mean effects, quantile regression provides a richer analysis by estimating the effects of independent variables across different quantiles of the dependent variable's distribution. This approach is preferred over traditional linear regression methods like OLS, FGLS, and PSCE due to its comprehensive analytic capabilities and its effectiveness in overcoming their limitations. This approach is particularly pertinent to our analysis, as it allows for a detailed examination of how Chinese OFDI influences economic growth through digitalization at various economic states, such as lower, median, and upper levels of growth distribution. The capability of quantile regression to capture the heterogeneity of FDI effects across the distribution spectrum is invaluable, especially in revealing potential asymmetries and nonlinear relationships. By deploying quantile regression, we aim to deliver a more granular and insightful understanding of the role of FDI and

digitalization in economic growth. This depth of analysis is crucial for crafting nuanced economic policies and tailoring investment strategies to specific economic contexts(Bassett & Koenker, 1982; Koenker & Bassett, 1978; Koenker & Xiao, 2006).

Given x_i the conditional quantile of y_i is expressed as:

$$\emptyset y_{it}(\delta/x_{it}) = x_{it}^{\delta}\beta_{\delta} \quad (9)$$

where δ denotes the quantile (*for* $0 < \delta < 1$) of the conditional distribution, $\emptyset y_{it}(\delta/x_{it})$ designates the δ *th* quantile of the dependent variable (economic growth), x_{it}^{δ} denotes the vector of the independent variables for each country i at the time t for quantile δ , and β_{δ} denotes the coefficients of the independent variables for quantile δ.

4. Results and Discussion

4.1 Descriptive statistics and correlation analysis

Table 1 provides a descriptive statistical analysis of the variables under study, illustrating the economic growth metrics, proxied by GDP per capita, across Africa with a mean value of approximately $2,373. A disaggregated view reveals considerable regional disparities: Central Africa reports the lowest GDP per capita at $1,070, followed by Western Africa at $1,759, East Africa at $2,320, Northern Africa at $2,873, and Southern Africa leading with $4,090. The peak economic growth values recorded during the study period in each region are Central Africa ($2,602.5), Eastern Africa ($16,990), Northern Africa ($4,224), Southern Africa ($14,010), and Western Africa ($7,504), respectively.

The study also examines the average stock of Chinese OFDI, which stands at 552 across the dataset. Sub-regionally, the averages are 578 in Central Africa, 349 in Eastern Africa, 665 in Northern Africa, 1270 in Southern Africa, and 324 in Western Africa, indicating the largest Chinese OFDI stock average in Southern Africa and the lowest in Western Africa. It is important to note that Chinese OFDI stock is expressed in Chinese yi(亿美元), which equals 100millions $.

Regarding digital transformation captured by ICT, the average index value across Africa is 7.9. However, there are significant variations across regions, with Central Africa recording an average of 4.1, Eastern Africa at 6.6, Northern Africa at 12.8, Southern Africa at 10.7, and Western Africa at 6.5.

The financial development index in Africa have an average value of 0.148, with a notable discrepancy across regions. Specifically, Central Africa, Eastern Africa, Northern Africa, Southern Africa, and Western Africa have indices of 0.07, 0.12, 0.20, 0.24, and 0.12, respectively.

Regarding trade openness, as captured by trade as a percentage of GDP, the average value for the entire sample is 72.7. Central Africa reports an average of 71.8 at the sub-regional level, Eastern Africa at 75.3, Northern Africa at 75, Southern Africa at 78.6, and Western Africa at 67.5.

Political stability predominantly displays negative values across the regions, suggesting areas of concern. The mean value of political stability for the entire sample is -0.5, indicating overall instability. Regionally, Central Africa records the lowest mean at -0.9, followed by Northern Africa at -0.8, Western Africa at -0.5, Eastern Africa at 0.5, and Southern Africa with the highest mean at -0.2, indicating relatively better political stability in this region.

Figure 2 displays the mean value of ICT, Chinese OFDI stock, and Economic growth across the countries under study.

In sum, the comprehensive findings indicate that Africa's development and digitalization levels are substantially lower than those of the rest of the world, with pronounced disparities between the continent's extremities and across its various regions.

The Correlation matrix reported in Table 2 indicates the absence of collinearity among the variables under consideration.

Table 1. Summary statistics

Region		GDP	Trade	FDIndex	ICT	PS	Stock
Full	Mean	2373.87	72.744	0.148	7.938	-.583	552.337
Sample	Std. dev.	2855.258	41.678	0.104	11.130	0.830	990.203
	Min	310.483	0.784	0.027	0.0002	-2.665	0
	Max	16990	347.997	0.642	71.813	1.111	7472.77
Central	Mean	1069.916	71.860	0.073	4.170	-.986	578.457
Africa	Std. dev.	653.818	28.686	0.024	4.744	0.779	-292.64
	Min	363.668	33.261	0.027	0.0002	-2.302	1.19
	Max	2602.5	148.587	0.121	17.060	0.245	5596.6
Eastern	Mean	2320.164	75.390	0.127	6.695	-.507	349.678
Africa	Std. dev.	4104.405	71.387	0.076	10.881	0.671	562.256
	Min	310.483	24.006	0.036	0.0003	-1.803	0
	Max	16990	347.997	0.358	60.602	0.937	2992.8
	Mean	2873.32	73.947	0.201	12.892	-.901	521.678
Northern	Std. dev	1077.566	39.955	0.096	13.279	0.767	665.970
Africa	Min	835.61	0.784	0.063	0.001	-2.665	0.6
	Max	4224.04	165.059	0.430	44.286	0.456	2552.48
Southern	Mean	4090.606	78.607	0.248	10.736	-.204	1270.573
Africa	Std. dev.	3551.329	21.300	0.169	15.255	0.894	1686.576
	Min	383.711	41.110	0.087	0.0005	-2.568	8.79
	Max	14010.5	127.204	0.642	71.813	1.111	7472.77
Western	Mean	1759.749	67.537	0.123	6.551	-.542	324.618
Africa	Std. dev.	1727.795	21.586	0.052	7.904	0.843	557.261
	Min	411.128	20.722	0.033	0.0002	-2.400	0.6
	Max	7504.26	117.817	0.270	34.248	0.963	2861.53
	Max	7504.26	148.587	0.196	31.103	0.660	3523.02
	Min	653.733	39.089	0.069	0.001	-.434	.6
	Max	7051.35	165.059	0.642	71.813	1.111	7472.77

Table 2. Correlation analysis

Variable	(1)	(2)	(2)	(3)	(4)	(5)
GDP, log	1					
Chinese OFDI Stock	0.104*	1				
Financial development index, log	0.636***	0.197***	1			
Trade, log	0.243***	-0.217***	0.202***	1		
ICT, log	0.264***	0.437***	0.310***	0.000706	1	
PS Political Stability	0.255***	-0.319***	0.327***	0.405***	-0.0223	1
N	611					

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

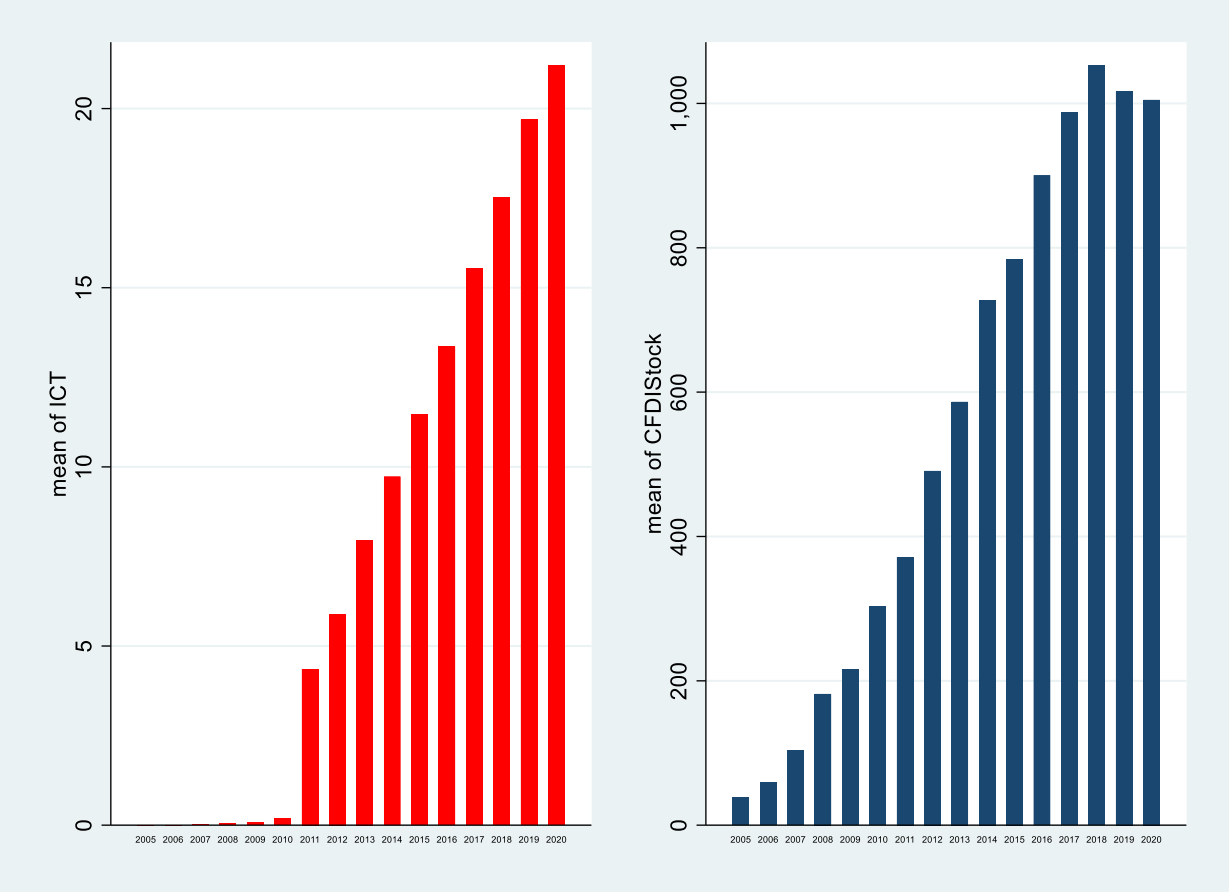


Figure 2 Mean of ICT and Chinese OFDI Stock in African Countries (2005-2020)

4.3 Preliminary tests.

Prior to conducting econometric analyses, it is crucial to subject the data to pre-estimation checks, namely cross-sectional dependence, and stationarity tests. The cross-sectional dependence test is applied to assess cross-sectional

dependence among the African countries under investigation, given the high risk of cross-sectionally dependent panels due to close proximities and shared common features. In addition, it is used to identify the suitability of econometrics methods to apply for the study. The Cross-Sectional Dependence (CSD) test applies to both balanced and unbalanced panel data, encompassing small and large datasets. Failure to account for cross-sectional dependence may lead to biased estimates (Pesaran, 2007, 2015). The study employs the Pesaran(2004)test for cross-sectional dependency, with results in Table 3 rejecting the null hypothesis of no cross-sectional dependence at various significance levels, implying that shocks in one country may transmit to others in Africa.

Consequently, second-generation unit root tests, such as Harris & Tzavalis's (1999) Harris-Tzavalis unit root and augmented Dickey-Fuller approaches, are employed to ensure the data's stationarity. The results are displayed in Table 3. The augmented Dickey-Fuller results suggest that all variables are stationary at the level, indicating integration of order zero. The Harris-Tzavalis test reveals variable stationarity at the first difference, except for Chinese Chinese OFDI , which remains stationary at the level for Africa. Variable stationarity also varies across African subregions.

Table 3. Pre-estimation tests (Cross-sectional dependence, augmented Dickey-Fuller approach (CADF), Harris-Tzavalis unit-root)

	CD	ADF		H-Tunit-root		CD	ADF		H-T unit-root		CD	ADF		H-T unit-root	
		Central Africa					East Africa					North Africa			
variable		Level	Dif	Level	Dif		Level	Dif	Level	Dif		Level	Dif	Level	Dif
GDP, log	-0.39	-1.935***		3.760	-0.983**	16.09***	-6.228***		0.524	-3.352***	6.56***	-5.280***		4.110	-1.351**
Stock, log	5.90***	-3.089***		-5.125***		8.24 ***	-7.139***		-2.750***		0.13	-4.217***		-6.524***	
FDIndex, log	2.13*	-5.197***		-2.180	-9.586***	5.82***	-3.951***		-3.551		3.33 ***	-7.026***		-5.613***	
ICT, log	12.63***	-4.296***		4.905	-5.254***	23.89***	-5.301***		6.244	-6.342***	18.25***	-4.978***		5.484	-5.738***
Trade, log	-0.08	-4.240***		-1.365	-8.161***	1.90*	-3.628***		0.092	-3.743***	7.20***	-3.686***		-0.248	-2.817***
PS	-1.36	-3.783***		-0.350	-11.522***	-0.91	-6.133***		-2.806***		-0.49	-3.607***		0.821	-4.796***
		South Africa					West Africa								
GDP, log	5.55***	-6.147***		1.734	-2.309**	22.47***	-3.310***		0.778	-7.863***					
Stock, log	6.80***	-7.304***		-3.681***		9.37***	-8.360***		-4.241***						
FDIndex, log	7.39***	-6.745***		-2.713***		17.25***	-6.769***		-2.474***						
ICT, log	18.22***	-4.521***		5.377***		35.20***	-6.088***		7.162	-7.016***					
Trade, log	0.83	-4.156***		-0.270	-7.256***	3.05 ***	-6.014***		-0.215	-8.591***					
PS	1.57	-4.320***		-1.754***		-1.44	-7.299***		-3.541***						

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Dif denotes difference; ADF: Augmented Dickey-Fuller approach; H-T unit-root: Harris-Tzavalis unit-root

Source: Author’s computation

Table 4 highlights the pivotal role of Chinese OFDI and digitalization in promoting economic growth, as evidenced by their positive and statistically significant impacts. The findings suggest that Chinese OFDI infuses vital capital into economies and potentially brings technological advancements and market expansion opportunities, which are instrumental in boosting economic performance. Simultaneously, digitalization emerged as a crucial driver of economic growth, indicating that adopting digital technologies across various sectors significantly enhances productivity, innovation, and competitiveness. These insights underscore the importance of creating conducive environments for foreign investment and digital innovation as key strategies for sustainable economic development. Furthermore, Figure 3 displays the relationship between the variables of interest, namely ICT and Chinese OFDI, and Economic growth across the countries under study. The outcomes reveal that most African nations have not effectively utilized ICT to foster economic growth. Notably, countries including South Africa, Seychelles, Botswana, and Gambia have managed to leverage ICT to promote growth to a certain degree. Furthermore, figure 3 reveals that only South Africa exhibits a significant correlation between Chinese OFDI stock and ICT development.

Table 4 Bivariate relationships between Economic growth and the variables of interest – digital transformation and Chinese OFDI stock

Variable	(1)	(2)
Chinese OFDI Stock, log	0.0467**	
	(0.0171)	
ICT, log		0.0762***
		(0.00973)
_cons	7.094***	7.331***
	(0.0900)	(0.0342)
N	639	648
R^2	0.012	0.087

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

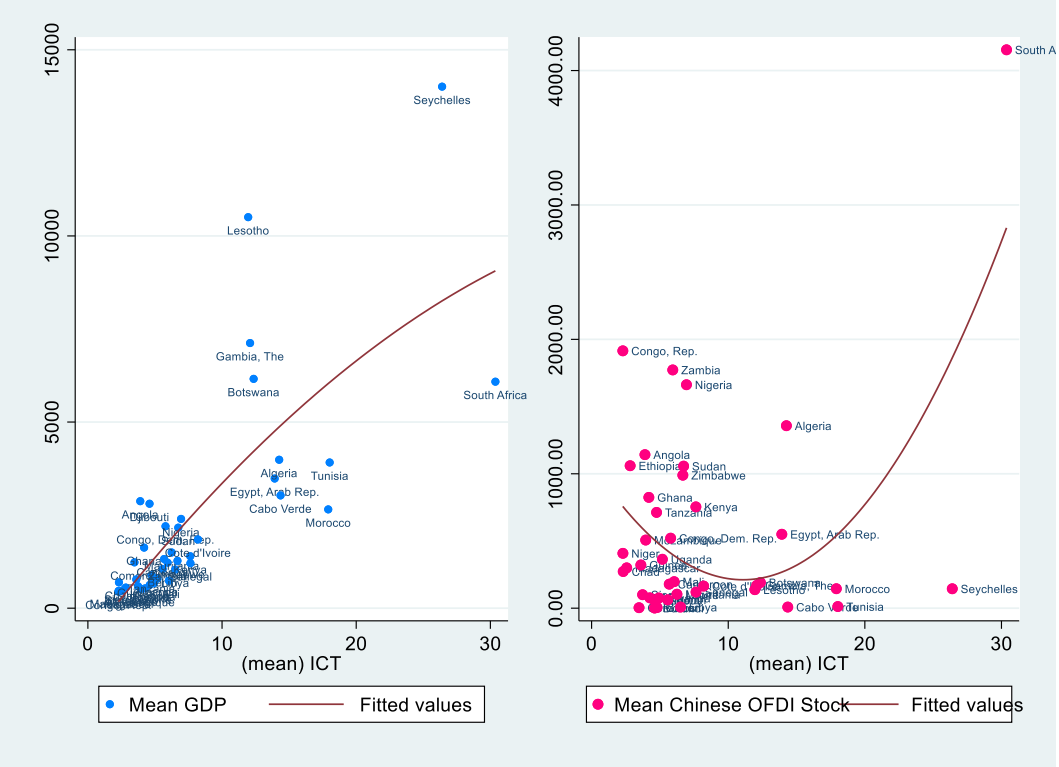


Figure 3: Relationship between ICT, GDP, and Chinese OFDI Stock in African Countries (2005-2020)

4.3 Effect of Chinese OFDI on digital transformation in Africa

We start this section with an analysis of the impact of Chinese OFDI stock on digital transformation in African countries. To address the endogeneity issue we adopt the system GMM model. The result reported in Table 5 shows that the first lagged value of digital transformation has a highly significant and positive correlation with the dependent variable. This suggests a strong positive autocorrelation in digital transformation rates, indicating that prior levels of digital transformation significantly influence future levels.

Chinese OFDI stock has a positive and significant impact on digital transformation in Africa indicating that Chinese investments, particularly in telecommunications infrastructure and technology transfer, play a crucial role in enhancing digital connectivity and accessibility across the continent, although the impact is relatively modest. Moreover, this implies that increases in Chinese OFDI are associated with enhancements in the digital transformation, consistent with spillover theory which posits that foreign investment introduces advanced technologies and practices that are absorbed by the local economy(Blomstrom & Kokko, 1998). Moreover, the results align with Romer's (1989) Endogenous Growth Theory, which underscores the importance of knowledge spillovers and innovation driven by investments, including FDI, in promoting sustainable economic growth and technological advancement. On the other hand, the findings support the Flying Geese Paradigm, as African countries appear to be following the technological advancement paths previously undertaken by Asian economies (Akamatsu Kaname, 1962). Besides, our findings are consistent with recent empirical studies including those of Chen (2021); Tang (2021); and Park & Tang, (2021) who

highlighted the crucial role of Chinese investment in technology and skills transfer into different sectors in African countries.

Financial Development Index shows a robust positive relationship with digital transformation, supporting the notion that greater financial inclusivity is crucial for leveraging digital technologies (King & Levine, 1993). This indicates that better financial access substantially facilitates ICT adoption. Moreover, this result can be linked to the Institutional Theory developed by North(1990), which postulates that the quality of financial institutions is crucial for economic development and technological adoption.

Trade Openness exhibits a positive but statistically insignificant correlation with digital transformation. This lack of significance indicates that, despite the potential of Trade Openness to drive digital transformation, it does not have a strong direct impact on digital transformation within the context of this analysis. Besides, Political stability has a negative and insignificant effect on digital transformation while economic growth captured by GDP has a positive but insignificant impact on digital transformation in Africa.

Lastly, the inclusion of fixed effects for country and year ensures that the results account for unobserved heterogeneity, enhancing the reliability of the findings as reflected in the substantial F-statistics and corresponding p-values near zero.

Table 5: Impact of Chinese OFDI on digital transformation in Africa

Variable	(1)	(2)	(3)
L.ICT	1.039***	1.038***	1.038***
	(0.0140)	(0.0142)	(0.0139)
Chinese FDI Stock	0.134*	0.116	0.131*
	(0.0742)	(0.0743)	(0.071)
Trade openness	0.0057	0.0201	-0.0119
	(0.124)	(0.113)	(0.139)
Financial Development Index, log	0.573***	0.618***	0.515***
	(0.157)	(0.163)	(0.141)
Political Stability		-0.134	
		(0.128)	
GDP			0.0950
			(0.125)
_cons	1.924*	2.013*	1.169
	(0.785)	(0.783)	(1.038)
	573	573	573

Number of Instruments	20	21	21
Number of groups	40	40	40
F-Statistics	8945.57	6672.44	7324.86
P-value	0.000	0.000	0.000
AR(2)	0.112	0.109	0.112
Hansen	0.189	0.189	0.208
Year fixed effects	yes	yes	yes
Country fixed effect	yes	yes	yes

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

4.4 Effect of Chinese OFDI stock and digital transformation on economic growth in Africa

Our analysis revealed a multifaceted impact of Chinese OFDI and digital transformation on the economic growth in African nations. Specifically, the findings of the PCSE results in the first column of Table 6 suggest that the direct impact of individual Chinese OFDI and digital transformation, on economic growth in the context of Africa, is statistically insignificant. This implies that Chinese OFDI and digitalization initiatives in the region are not currently translating into measurable improvements in overall economic growth. This could point to various factors such as insufficient infrastructure, regulatory challenges, or ineffective utilization of digital technologies hindering their potential positive effects on economic development. This result contradicts existing literature such as Yanne Sylvaire et al.(2022) and Doku et al.(2017) who found a positive and significant effect of Chinese OFDI on economic growth in Africa. The result also contradicts Deco(2019), Myovella et al.(2020); Awad (2024); Awad & Albaity (2022), and Dossou et al.(2024) who found a positive correlation between ICT and economic growth.

Moreover, the positive and significant influence of the financial development index on economic growth aligns with the findings of Abbas et al.(2022); Asante et al.(2023); Ibrahim & Acquah (2021), and Fambo & Ge (2024), emphasizing the crucial function of financial markets in facilitating economic growth in African countries. This association underscores the importance of robust financial systems in maximizing the growth benefits derived from foreign direct investments and digital infrastructure development.

The significance of trade in fostering economic growth, as observed in our study, is supported by Yameogo and Omojolaibi's (2021) analysis of trade openness and economic growth. Their empirical work highlights how trade liberalization and openness contribute to enhanced economic performance. Furthermore, the positive effects of political stability on economic outcomes find theoretical backing in the work of Alesina et al. (1996), who explores the intricate relationship between political instability and economic performance. This finding highlights the importance of political stability in promoting economic activities, especially in the context of African countries.

The combined effect of Chinese OFDI and digital transformation on economic growth is found to be positive and significant, a result that resonates with Romer's (1989, 1990) Endogenous Growth Theory, which underscores the pivotal role of technological advancement and human capital investment in spurring economic growth. Our results also find support in the Eclectic Paradigm (Dunning, 1998, 2000; Dunning et al., 1993), which supports that FDI can enhance host country productivity through technology transfer, managerial expertise, and capital inflows, which can directly impact digital transformation. This theoretical framework aptly encapsulates the transformative potential of digitalization, bolstered by foreign direct investment, in catalyzing sustainable economic development. Chinese OFDI often targets infrastructure projects, including digital infrastructure like telecommunications networks and internet access. This foundational digital infrastructure is critical for the modern digital economy, facilitating e-commerce, digital services, and the Internet of Things (IoT), which can significantly boost productivity and growth (Salim, et al. 2024; Shahiduzzaman & Alam, 2014). Moreover, digital transformation in Africa will increase the outcome of Chinese Companies and local companies(Wamboye et al., 2015). Digital technologies are fundamentally reshaping economies by boosting firm productivity through various means(Findlay, 1978). For instance, the automation of their routine tasks will free up resources for more value-added activities. Digital transformation will also enhance firms' decision-making through data analytics; improve communication and collaboration across borders; optimize supply chains; and provide access to global markets, especially for SMEs. Besides, this will promote innovation and new business models; elevate customer experiences through personalization; and contribute to environmental sustainability by optimizing resource use(Osei, 2024). Besides, The digital transformation will spur high-quality Chinese foreign investment by increasing productivity, attracting skilled talent, and enhancing investment returns(Cheng et al., 2023). Our findings align with Asongu & Odhiambo (2019); and Fatai et al.(2020) who highlight the role of ICTs in moderating the impact of FDI on economic growth.

Table 6. Chinese OFDI stock and Digital transformation on economic growth in Africa

Variable	PCSE results	System GMM
L.lnGDP		0.923***
		(0.038)
Chinese OFDI Stock, log	-0.012	0.00546
	(0.007)	(0.00361)
Financial Development Index, log	0.905***	0.0577*
	(0.022)	(0.0237)
Trade, log	0.185***	0.00946
	(0.051)	(0.0206)
ICT, log	-0.009	-0.00658*

	(0.013)	(0.00309)
Political Stability	0.006	-0.00887
	(0.026)	(0.00825)
ICT*Chinese OFDI stock, log	0.008***	0.0000391
	(0.003)	(0.000102)
_cons	8.497***	0.655*
	(0.240)	(0.269)
Number of observations	611	465
R^2	0.429	
Number of groups		38
Number of Instruments		23
F-Statistics		152189.83
P-value		0.000
AR(2)		0.480
Hansen		0.445
Year fixed effects	yes	yes
Country fixed effect	yes	yes

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

4.5 Robustness check

For the first robustness check in this study, the System Generalized Method of Moments (System GMM) was chosen, following the methodology of Fagbemi et al. (2022), who incorporated both Panel Corrected Standard Errors (PCSE) and System GMM in their analysis. The selection of System GMM is justified by its enhanced ability to tackle critical econometric issues such as endogeneity, omitted variable bias, and measurement errors, which are prevalent in dynamic system modeling. Additionally, System GMM utilizes internal instruments generated from lagged values of the variables, providing a robust framework for estimation that effectively mitigates endogeneity concerns and ensures consistent and efficient parameter estimates in dynamic panel data settings. This methodological approach

substantially strengthens the credibility of the empirical findings and firmly substantiates the relationship between Chinese OFDI, digital transformation, and economic growth in Africa.

The results reported in Table 6, Column 2, generally support the earlier findings, albeit with some differences in significance levels. Specifically, Chinese OFDI and trade openness exhibit a positive and insignificant impact on economic growth. Financial development demonstrates a positive and significant effect on economic growth. Moreover, digital transformation has a negative and significant impact on economic growth, while political stability has a negative and insignificant effect. Lastly, the combined effect of Chinese OFDI stock and digital transformation has a positive but weak impact on economic growth.

4.6 Subregional analysis

For the second robustness check, this section examines the nuanced impact of Chinese OFDI stock on economic growth in African subregions through digital transformation, revealing that it generally stimulates growth, albeit with varied impacts and mechanisms across regions, as evidenced by fixed effects analysis.

The results reported in Table 7 reveal that in East Africa (EA), North Africa (NA), Southern Africa (SA), and West Africa (WA), Chinese OFDI stock significantly enhances economic growth, highlighting its crucial influence in these regions; however, in Central Africa(CA), although the effect is positive, it lacks statistical significance, suggesting variations in the deployment or assimilation of Chinese OFDI across regions.

Surprisingly, the financial index predominantly negatively affects growth across most regions, except WA, where it significantly enhances economic growth. This suggests that the relationship between financial development and economic growth may be contingent on regional factors, including the state of financial markets and their alignment with real sector needs.

The influence of trade on economic growth presents a mixed picture. In CA and EA, the effect is negative and insignificant, suggesting that trade dynamics in these regions may not optimally contribute to growth. Conversely, trade significantly fosters economic growth in NA and SA, highlighting the beneficial impact of well-structured trade engagements and policies.

The effect of digital transformation on economic growth varies, being significantly positive in NA and indicating the transformative potential of digital technologies in this region. In EA and SA, while positive, the effect lacks statistical significance, and in CA and WA, it is negatively insignificant, reflecting disparities in digital infrastructure, policies, and capabilities.

Political stability uniformly supports economic growth in EA, NA, SA, and WA, affirming its foundational importance in creating a conducive environment for investment and economic activities. In CA, the positive effect does not reach significance, reinforcing the crucial role of stable governance for economic development.

The combined influence of Chinese OFDI stock and digital transformation exhibits a positive and significant effect in CA, EA, and WA, suggesting that the integration of Chinese investment with digital development strategies

can unlock growth opportunities. However, in SA, this effect is positive but not significant, and in NA, it turns negative and insignificant, indicating that the benefits of this synergy are not uniformly realized across regions.

Overall, the findings signal that Chinese OFDI, particularly when aligned with digital transformation, holds considerable promise for fostering economic growth in Africa. Nevertheless, the subregional variations underscore the need for tailored approaches that consider specific regional dynamics, infrastructure capabilities, and policy environments to fully leverage the potential of Chinese OFDI in conjunction with digital advancements for sustainable economic development.

Table 7: Chinese OFDI stock and Digital transformation on economic growth in African subregions

Variable	Regional estimations (Fixed effect results)				
	CA	EA	NA	SA	WA
Chinese OFDI Stock, log	0.022	0.036***	0.049***	0.048**	0.043***
	(0.014)	(0.008)	(0.011)	(0.016)	(0.007)
Financial Development Index, log	-0.088**	0.107	-0.146**	-0.034	0.116**
	(0.043)	(0.102)	(0.051)	(0.156)	(0.038)
Trade, log	-0.096	-0.003	0.036***	0.360***	-0.016
	(0.066)	(0.049)	(0.008)	(0.042)	(0.026)
ICT, log	-0.007	0.001	0.032***	0.004	-0.004
	(0.006)	(0.005)	(0.005)	(0.011)	(0.004)
Political Stability	0.032	0.061*	0.046**	0.112***	0.046***
	(0.031)	(0.035)	(0.019)	(0.017)	(0.010)
ICT*Chinese OFDI stock, log	0.003**	0.003***	-0.004***	0.0003	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.0009)
_cons	6.890***	7.220***	7.295***	6.078***	7.282***
	(0.292)	(0.328)	(0.097)	(0.373)	(0.139)
N	79	136	94	95	207
R^2	0.365	0.651	0.715	0.689	0.701

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

4.7. Developmental Level Examination

In this section, the analysis via quantile regression sheds light on the multifaceted impact of Chinese OFDI stock, financial development, trade, Digital transformation, and political stability on economic growth across different stages of an economy.

The findings in Table 8 reveal that Chinese OFDI stock does not significantly influence economic growth across various quantiles. Conversely, the financial development index consistently fosters economic growth across all quantiles, highlighting the universal importance of financial sector development for economic advancement.

Trade openness is intriguing, presenting a positive yet insignificant impact at the extremities of the growth distribution but turning positively significant in the middle quantile. This pattern may indicate that the economic benefits of trade are more tangible for countries at intermediate levels of economic development.

Digital transformation's relationship with economic growth varies across quantiles. Digital transformation correlates negatively and significantly with economic growth at the lower quantile, perhaps pointing to challenges in efficiently leveraging technology investments at early development stages. This negative association becomes insignificant in the middle quantile and shifts to a positive but still insignificant effect at the upper quantile, suggesting potential long-term benefits of Digital transformation that materialize as economies mature.

Political stability exhibits a primarily negative and insignificant effect on economic growth in the lower and middle quantiles but shifts to a positive, albeit insignificant, stance at the upper quantile. This change might reflect the complex role of governance and political conditions in facilitating economic growth, which could become more pronounced in more developed economies.

Interestingly, when examining the combined effect of Chinese OFDI and digital transformation on economic growth, a positive and significant impact is observed at the lower quantile. This suggests that, particularly for economies at the initial stages of development, the synergy between foreign direct investment and digital infrastructure can kickstart economic growth. However, this significant positive effect dissipates and turns insignificant at higher quantiles, indicating that the drivers of economic growth evolve as countries progress economically.

These results underscore the complexity of economic development factors and their varied impacts across different stages of growth. They highlight the need for nuanced, stage-appropriate economic policies that harness the benefits of financial development, trade, digital transformation, and stable governance to foster sustainable economic growth.

Table 8: Quantile regression results

Variable	q25	q50	q75
Chinese OFDI Stock	-0.007	-0.011	-0.032
	(0.014)	(0.023)	(0.028)
Financial development index, log	0.990***	1.031***	0.849***
	(0.036)	(0.044)	(0.068)
Trade, log	0.088	0.367***	0.153

	(0.065)	(0.097)	(0.162)
ICT, log	-0.038***	-0.025	0.010
	(0.009)	(0.020)	(0.030)
Political Stability	-0.0286	-0.054	0.092
	(0.067)	(0.036)	(0.062)
Chinese OFDI stock*ICT, log	0.0129***	0.012**	0.007
	(0.002)	(0.004)	(0.007)
_cons	8.565***	7.857***	8.965***
	(0.310)	(0.439)	(0.792)
N	611		

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations

5. Conclusion

In an era where digital transformation is reshaping economies, this study delves into the pivotal role of Chinese Outward Foreign Direct Investment in driving economic growth across Africa, uncovering the intricate dynamics and impacts of technological advancements facilitated by foreign investment. Using a dataset of 41 African countries from 2005 to 2020 alongside several econometrics methodologies, the findings reveal a complex picture of Chinese OFDI's impact on Africa's economic growth via digital transformation, highlighting a landscape filled with opportunities and challenges. First, the results reveal that Chinese OFDI boosts digital transformation in African countries. Secondly, the findings suggest that while OFDI and digital transformation hold tremendous potential to spur economic development, their effects are deeply influenced by regional characteristics, development level, financial development, trade openness, and political stability.

This study emphasizes the critical need for a detailed strategy in maximizing the growth potential of Chinese OFDI and digital evolution within Africa. It calls upon policymakers and other key players to create conducive environments that enhance the advantages of such investments and technological advances. This involves significant digital and physical infrastructure investments, strengthening financial systems, encouraging trade openness, and ensuring political stability. Given the diverse impacts observed across different regions and countries, it's clear that tailored, context-sensitive approaches are essential to fully leverage Chinese OFDI's benefits. This transformation, while promising, requires strategic investments in technology and skill development, alongside addressing challenges related to data privacy, security, and the potential for increased inequality between digitally advanced and lagging firms and regions.

To leverage the insights from this study, we recommend that African nations boost investment in telecommunications infrastructure at national and regional levels to foster continent-wide connectivity and collaborate with investors, governments, financial institutions, and international partners to develop financial instruments. These actions will help bridge the digital divide, attract more foreign investment, and enable African populations to explore new business opportunities, leading to economic diversification and inclusive growth. Furthermore, enhancing digital

literacy in Africa and encouraging Chinese investment in the continent's ICT infrastructure and digital skills are pivotal steps toward these goals.

This study primarily examines the synergistic impact of Chinese OFDI and digital transformation on economic growth, without delving into how Chinese OFDI through digital transformation affects local businesses and populations in Africa. Future research should explore these dynamics to provide a deeper understanding of how Chinese OFDI affects inclusive growth across the continent through digital transformation.

Disclosure statement

The authors declare no conflict of interest or funding regarding the publication of this paper.

Reference

Abbas, Z., Afshan, G., & Mustifa, G. (2022). *The effect of financial development on economic growth and income distribution : an empirical evidence from lower-middle and upper-middle- income countries*. https://doi.org/10.1080/21665095.2022.2065325

Abendin, S., & Duan, P. (2021). International trade and economic growth in Africa : The role of the digital economy International trade and economic growth in Africa : The role of the digital economy. *Cogent Economics & Finance*, *9*(1). https://doi.org/10.1080/23322039.2021.1911767

Adeleye, B. N., Adedoyin, F., Nathaniel, S., & Nathaniel, S. (2020). Information Technology for Development The criticality of ICT-trade nexus on economic and inclusive growth. *Information Technology for Development*, *0*(0), 1–21. https://doi.org/10.1080/02681102.2020.1840323

Adeleye, N., & Eboagu, C. (2019a). Evaluation of ICT development and economic growth in Africa. *Netnomics*. https://doi.org/10.1007/s11066-019-09131-6

Adeleye, N., & Eboagu, C. (2019b). *Evaluation of ICT development and economic growth in Africa*.

Ademosu, Y. S. H. 2Solomon T. (2023). ICT Innovation, FDI and Economic Growth: Evidence from BRICS. *Journal of Economics and Behavioral Studies*, *15*(2), 20–32.

African Union. (2020). The Digital Transformation Strategy for Africa (2020-2030). *Science and Technology Progress and Countermeasures (Chinese)*, 66. https://au.int/sites/default/files/documents/38507-doc-DTS_for_Africa_2020-2030_English.pdf

African Union Commission. (2019). The Digital Transformation Strategy for Africa (2020-2030). *Science and Technology Progress and Countermeasures (Chinese)*, *36*(16), 100–107.

Aisen, A., & Veiga, F. J. (2013). How does political instability affect economic growth? *European Journal of Political Economy*, *29*, 151–167. https://doi.org/10.1016/j.ejpoleco.2012.11.001

Akamatsu Kaname. (1962). A Historical Pattern of Economic Growth in Developing Countries. *Developing Economies*. https://doi.org/10.1111/j.1746-1049.1962.tb01020.x

Aker, J. C., & Mbiti, I. M. (2010). Mobile Phones and Economic Development in Africa. *Journal of Economic Perspectives*, *24*(3), 207–232.

Alesina, A., Özler, S., Roubini, N., & Swagel, P. (1996). Political Instability and Economic Growth. *Journal of Economic Growth*, *1*(2), 189–211. https://doi.org/10.1007/BF00138862

Arbia, A., Sobhi, K., Karim, M., & Eddaou, M. (2023). International Limited FDI, Information and Communication Technology, and Economic Growth : Empirical Evidence from Morocco. *Advances in Management & Applied Economics*, *13*(6), 189–214.

Asante, G. N., Takyi, P. O., Mensah, G., & Asante, G. N. (2023). *The impact of financial development on economic growth in sub-Saharan Africa. Does institutional quality matter ?* https://doi.org/10.1080/21665095.2022.2156904

Asongu, S. A., & Odhiambo, N. M. (2019). Foreign direct investment, information technology and economic growth dynamics in Sub-Saharan Africa. *Telecommunications Policy*, *March*, 101838. https://doi.org/10.1016/j.telpol.2019.101838

Atitianti, P. A., & Dai, Q. (2022). Does Chinese Foreign Direct Investment Improve the Welfare of Africans? *Journal of African Business*, *23*(4), 964–983. https://doi.org/10.1080/15228916.2021.1969192

Awad, A. (2024). Do ICT and economic globalization offer benefits to all nations ? Findings from a moment's quantile regression. *Environment, Development and Sustainability*, *26*(3), 5817–5841. https://doi.org/10.1007/s10668-023-02938-2

Awad, A., & Albaity, M. (2022). ICT and economic growth in Sub-Saharan Africa : Transmission channels and effects. *Telecommunications Policy*, *46*(8), 102381. https://doi.org/10.1016/j.telpol.2022.102381

Bailey, D., & Katz, J. N. (2011). *Implementing Panel-Corrected Standard Errors in R : The pcse Package*. *42*(June).

Bassett, G., & Koenker, R. (1982). An empirical quantile function for linear models with iid errors. *Journal of the American Statistical Association*, *77*(378), 407–415. https://doi.org/10.1080/01621459.1982.10477826

Bayraktar, Y., Ozyilmaz, A., Toprak, M., Firat, M., & Isik, E. (2023). Borsa _ Istanbul Review The role of institutional quality in the relationship between fi nancial development and economic growth : Emerging markets and middle-income economies. *Borsa Istanbul Review*, *23*(6), 1303–1321. https://doi.org/10.1016/j.bir.2023.10.002

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with Time-Series Cross-Section Data. In *Source: The American Political Science Review* (Vol. 89, Issue 3).

Belloumi, M., & Touati, K. (2022). *Do FDI Inflows and ICT Affect Economic Growth ? An Evidence from Arab Countries*.

Bénassy-Quéré, A., Coupet, M., & Mayer, T. (2007). Institutional determinants of foreign direct investment. *World Economy*, *30*(5), 764–782. https://doi.org/10.1111/j.1467-9701.2007.01022.x

Blomstrom, M., & Kokko, A. (1998). *MULTINATIONAL CORPORATIONS AND SPILLOVERS*. *12*(2), 1–31.

C.North, D. (1990). Institutions, Institutional Change and Economic Performance. *Cambridge: Cambridge University Press*, 1–23.

Camarero, M., Montolio, L., & Tamarit, C. (2020). Determinants of FDI for Spanish regions: evidence using stock data. *Empirical Economics*, *59*(6), 2779–2820. https://doi.org/10.1007/s00181-019-01748-8

Campisi, D., Nicola, A. De, Farhadi, M., & Mancuso, P. (2013). Discovering the Impact of ICT, FDI and Human Capital on GDP : a Cross-sectional Analysis. *International Journal of Engineering Business Management*, *5*, 1–10. https://doi.org/10.5772/56922

Chen, Y. (2021). 'Africa's China': Chinese manufacturing investment in Nigeria and channels for technology transfer. *Journal of Chinese Economic and Business Studies*, *19*(4), 335–358. https://doi.org/10.1080/14765284.2021.1943184

Cheng, S., Ma, W., Luo, L., & Li, Y. (2023). Can the development of a digital economy improve the quality of regional investment ? — Empirical evidence from Chinese cities. *Economic Analysis and Policy*, *80*, 214–221. https://doi.org/10.1016/j.eap.2023.08.006

Coe, D. T., Helpman, E., Hoffmaister, A. W., Journal, T. E., & Jan, N. (2007). *North-South R & D Spillovers*. *107*(440), 134–149.

David, O. O., & Grobler, W. (2020). Information and communication technology penetration level as an impetus for economic growth and development in Africa. *Economic Research-Ekonomska Istraživanja*, *33*(1), 1394–1418. https://doi.org/10.1080/1331677X.2020.1745661

Deco, K. A. (2019). ICT and Economic Growth in East African Countries : A Panel Data Approach. *Journal of Information Engineering and Applications*, *9*(7), 1–16.

Devincy, D., Sylvaire, Y., Hua Qing, W., Ran, C. H., Kassai, D. L., Vincent, N., Adjoa, D., Douce, C., Frank, O.-K., Nicaise, N. P., Traore, F., Boris, A. F., & Author, C. (n.d.). *Haikou Dolphin Oral Clinic, China 4. Guglielmo Saliceto Hospital Neurology Department, Italy 5. Administration School*. *3*(9), 10. https://ssrn.com/abstract=4056070

Doku, I., Akuma, J., & Owusu-Afriyie, J. (2017). Effect of Chinese foreign direct investment on economic growth in Africa. *Journal of Chinese Economic and Foreign Trade Studies*, *10*(2), 162–171. https://doi.org/10.1108/JCEFTS-06-2017-0014

Dossou, T. A. M., & Pascal, D. K. (2024). Do internet and mobile usage affect the democracy-economic growth nexus in Africa ? *Information Development*. https://doi.org/10.1177/02666669231223136

Ekpo, A. H., Afangideh, U. J., & Udoh, E. A. (2014). Private Sector Development and Economic Diversification: Evidence from West African States. *Advances in African Economic, Social and Political Development*, 97–110. https://doi.org/10.1007/978-3-319-05188-8_4

Fagbemi, F., Ejiaka, G., & Temilola, T. (2022). Regional Sustainability Interconnections between governance and socioeconomic conditions : Understanding the challenges in sub-Saharan Africa. *Regional Sustainability*, *2*(4), 337–348. https://doi.org/10.1016/j.regsus.2022.01.004

Fakher, A. (2016). The Impact of Investment in ICT Sector on Foreign Direct Investment : Applied Study on.

Review of Integrative Business and Economics Research, *5*(2), 151–166.

Fambo, H., & Shunqi, G. (2024). Driving economic growth in African countries : Do Chinese OFDI sectors matter ? *Social Science Quarterly*, *August 2023*, 1–18. https://doi.org/10.1111/ssqu.13376

Festus Fatai Adedoyina, Festus Victor Bekunb, c, Oana M. Drihad, D. B.-L. (2020). The effects of air transportation, energy, ICT and FDI on economic growth in the industry 4.0 era: Evidence from the United States. *Technological Forecasting & Social Change*, *January*.

Findlay, R. (1978). RELATIVE BACKWARDNESS, DIRECT FOREIGN INVESTMENT, AND THE TRANSFER OF TECHNOLOGY: A SIMPLE DYNAMIC MODEL. In *THE QUARTERLY JOURNAL OF ECONOMICS* (Issue 1).

Glass, A. J., & Saggi, K. (2002). Multinational Firms and Technology Transfer Ã. *Scand. J. of Economics*, *104*(4), 495–513.

Guo, L., Zhang, M. Y., & Dodgson, M. (2019). *Seizing windows of opportunity by using technology-building and market-seeking strategies in tandem : Huawei's sustained catch-up in the global market*. Asia Pacific Journal of Management.

Haini, H., Wei Loon, P., & Raimi, L. (2023). Does export structure enhance the growth gains from foreign investment? Evidence from the ECOWAS region. *International Journal of Development Issues*. https://doi.org/10.1108/IJDI-12-2022-0282

Harris, R. D. F., & Tzavalis, E. (1999). Inference for unit roots in dynamic panels where the time dimension is "xed. In *Journal of Econometrics* (Vol. 91).

Hossain, S. (2016). *Foreign direct investment (FDI) and corruption : Is it a major hindrance to encouraging inward FDI ? 10*(10), 256–269. https://doi.org/10.5897/AJBM2016.8032

Ibrahim, M., & Acquah, A. M. (2021). Re-examining the causal relationships among FDI, economic growth, and financial sector development in Africa. *International Review of Applied Economics*, *35*(1), 45–63. https://doi.org/10.1080/02692171.2020.1822299

Ikpesu, F., Vincent, O., & Dakare, O. (2019b). Growth effect of trade and investment in Sub-Saharan Africa countries : Empirical insight from panel corrected standard error (PCSE) technique. *Cogent Economics & Finance*, *7*(1), 1–13. https://doi.org/10.1080/23322039.2019.1607127

Kinfack, E., & Bonga-bonga, L. (2022). *The growth effect of trade openness on African countries : Evidence from using an instrumental variable panel smooth transition model*. *April*, 366–379. https://doi.org/10.1111/boer.12360

King, R. G., & Levine, R. (1993). Finance and growth: schumpeter might be right*. *The Quarterly Journal of Economics*, *August*.

Koenker, R., & Bassett, G. (1978). Regression Quantiles. In *Econometrica* (Vol. 46, Issue 1).

Koenker, R., & Hallock, K. F. (2001). Quantile Regression. In *Journal of Economic Perspectives* (Vol. 15, Issue 4).

Koenker, R., & Xiao, Z. (2006). Quantile autoregression. *Journal of the American Statistical Association*, *101*(475), 980–990. https://doi.org/10.1198/016214506000000672

Mamba, E., Gniniguè, M., & Ali, E. (2020). Cogent Economics & Finance Effect of foreign direct investment on structural transformation in West African Economic and Monetary Union (WAEMU) countries Effect of foreign direct investment on structural transformation in West African Economic and Monet. *Cogent Economics & Finance*, *8*(1). https://doi.org/10.1080/23322039.2020.1783910

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A CONTRIBUTION TO THE EMPIRICS OF ECONOMIC GROWTH. *The Quarterly Journal of Economics*.

Marasco, A., Khalid, A. M., & Tariq, F. (2024). Does technology shape the relationship between FDI and growth ? A panel data analysis analysis. *Applied Economics*, *56*(21), 2544–2567. https://doi.org/10.1080/00036846.2023.2192033

Miao, M., Borojo, D. G., Yushi, J., & Desalegn, T. A. (2021). The impacts of Chinese FDI on domestic investment and economic growth for Africa. *Cogent Business and Management*, *8*(1). https://doi.org/10.1080/23311975.2021.1886472

Mohieldin, M., & Hussein, K. (2019). On financial development and economic growth in Egypt. *Journal of Humanities and Applied Social Sciences*, *1*(2), 70–86. https://doi.org/10.1108/JHASS-08-2019-0027

Myovella, G., Karacuka, M., & Haucap, J. (2020). Digitalization and economic growth : A comparative analysis of Sub-Saharan Africa and OECD economies. *Telecommunications Policy*, *44*(2), 101856. https://doi.org/10.1016/j.telpol.2019.101856

Narula, R. (1994). Transpacific foreign direct investment and the investment development path: The record assessed. *South Carolina Essays in International Business*, *10*(September).

Niebel, T. (2018). ICT and Economic Growth – Comparing Developing, Emerging and Developed Countries ICT and Economic Growth – Comparing Developing, Emerging and Developed Countries. *World Development, Elsevier*, *14*.

Obobisa, E. S., Chen, H., Ayamba, E. C., & Nyarko Mensah, C. (2021). The Causal Relationship Between China-Africa Trade, China OFDI, and Economic Growth of African Countries. *SAGE Open*, *11*(4). https://doi.org/10.1177/21582440211064899

Odhiambo, S. A. & N. M. (2019). A G D I Working Paper. *African Governance and Development Institute Research*, 1–31.

Oloyede, B. M., Osabuohien, E. S., & Ejemeyovwi, J. O. (2021). Heliyon Trade openness and economic growth in Africa's regional economic communities : empirical evidence from ECOWAS and SADC. *Heliyon*, *7*(5), e06996. https://doi.org/10.1016/j.heliyon.2021.e06996

Osei, D. B. (2024). Telematics and Informatics Digital infrastructure and Innovation in Africa : Does human capital mediate the effect ? *Telematics and Informatics*, *89*(January), 102111. https://doi.org/10.1016/j.tele.2024.102111

Owolabi, O. A., Adedeji, A. O., & Aderounmu, B. (2023). Do Information and Communications Technology (ICT) and financial development contribute to economic diversification ? Evidence from sub-Saharan Africa. *Journal of Economic Structures*, *7*. https://doi.org/10.1186/s40008-023-00299-7

Pesaran, M. H. (2004). *General Diagnostic Tests for Cross Section Dependence in Panels*.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, *22*(2), 265–312. https://doi.org/10.1002/jae.951

Pesaran, M. H. (2015). Testing Weak Cross-Sectional Dependence in Large Panels. *Econometric Reviews*, *34*(6–10), 1089–1117. https://doi.org/10.1080/07474938.2014.956623

Phuc, C., & Doytch, N. (2022). The impact of ICT patents on economic growth : An international evidence. *Telecommunications Policy*, *46*(5), 102291. https://doi.org/10.1016/j.telpol.2021.102291

Reed, W. R., & Webb, R. (2010). The PCSE estimator is good--just not as good as you think. *Journal of Time Series Econometrics*, *2*(1).

Robert E. Lucas, J. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3–42.

Roger, M., Shulin, L., & Sesay, B. (2022). ICT Development, Innovation Diffusion and Sustainable Growth in Sub-Saharan Africa. *SAGE Open*, *1*(17). https://doi.org/10.1177/21582440221123894

Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy*, *94*(5). http://www.journals.uchicago.edu/t-and-c

Romer, P. M. (1989). ENDOGENOUS TECHNOLOGICAL CHANGE. In *ENDOCENOUS TECHNOLOGICAL CHANGE*.

Romer, P. M. (1990a). Endogenous Technological Change. *Journal of Political Economy*, *98*(5).

Romer, P. M. (1990b). Endogenous technological growth. *Nber Working Paper Series*, *3210*, Working Paper No. 3210.

Salim, A., Wen, J., Bello, A.U., Lubis, F.R.A., Khoirudin, R., Khasanah, U., Sukarniati, L., Nasir, M. S. (2024). Does information and communication technology improve labor productivity? Recent evidence from the

Southeast Asian emerging economies (2024). *Growth and Change*, *55*(1), 2024. https://doi.org/10.1111/grow.12708

Shahiduzzaman, M., & Alam, K. (2014). The long-run impact of Information and Communication Technology on economic output: The case of Australia. *Telecommunications Policy*, *38*(7), 623–633. https://doi.org/10.1016/j.telpol.2014.02.003

Sinha, M., & Sengupta, P. P. (2022). FDI Inflow, ICT Expansion, and Economic Growth: An Empirical Study on Asia-Pacific Developing Countries. *Global Business Review*, *23*(3), 804–821. https://doi.org/10.1177/0972150919873839

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth Author (s): Robert M . Solow Source. *The Quarterly Journal of Economics*, *70*(1), 65–94.

Stephan, A. (1997). The impact of road infrastructure on productivity and growth: some preliminary results for the German manufacturing sector.

Tchamyou, Vanessa; Asongu, Simplice; Odhiambo, N. M. (2019). The role of ICT in modulating the effect of education and lifelong learning on income inequality and economic growth in Africa,. In *AGDI Working Paper, No. WP/19/054, African Governance and Development Institute (AGDI), Yaoundé*.

The International Monetary Fund. (2023). Digital Trade for Development. In *Digital Trade for Development*. https://doi.org/10.30875/9789287075437

The World Bank. (2021). World bank list of economies, 2021. *World Bank List of Economies*, *June*. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Wamboye, E., Tochkov, K., & Sergi, B. S. (2015). Technology adoption and growth in sub-Saharan African countries. *Comparative Economic Studies*, *57*(1), 136–167. https://doi.org/10.1057/ces.2014.38

Wang, W., Ning, Z., Shu, Y., Riti, M. J., & Sunday, J. (2023). ICT interaction with trade , FDI and financial inclusion on inclusive growth in top African nations ranked by ICT development. *Telecommunications Policy*, *47*(4), 102490. https://doi.org/10.1016/j.telpol.2023.102490

Xiaoyang, T. (2021). Adaptation , innovation , and industrialization : the impact of Chinese investments on skill development in the Zambian and Malawian cotton sectors. *Journal of Chinese Economic and Business Studies*, *00*(00), 1–19. https://doi.org/10.1080/14765284.2021.1943734

Xu, C., Yang, Y., Amègnonna, T., Dossou, M., Berhe, W., & Kambaye, E. N. (2022). Current Issues in Tourism Does corruption undermine tourism development in Africa ? *Current Issues in Tourism*, *May*, 1–18. https://doi.org/10.1080/13683500.2022.2069553

Yameogo, C. E. W., & Omojolaibi, J. A. (2021). Trade liberalisation, economic growth and poverty level in sub-Saharan Africa (SSA). *Economic Research-Ekonomska Istrazivanja* , *34*(1), 754–774.

https://doi.org/10.1080/1331677X.2020.1804428

Yanne Sylvaire, D. D., Qing, W. H., Ran, C. H., Kassai, D. L., Vincent, N., Candide Douce, D. A., Frank, O. K., Nicaise, N. P., Traore, F., & Boris, A. F. (2022). The impact of China's foreign direct investment on Africa's inclusive development. *Social Sciences and Humanities Open*, *6*(1), 100276. https://doi.org/10.1016/j.ssaho.2022.100276

Yao, S., Wei, K., & Kailei, W. (n.d.). *Economic Growth in the Presence of FDI: The Perspective of Newly Industrialising Economies*.

Yoon Jung Park & Xiaoyang, T. (2021). Chinese FDI and impacts on technology transfer, linkages, and learning in Africa: evidence from the field. *Journal of Chinese Economic and Business Studies*, *19*(4), 257–268. https://doi.org/10.1080/14765284.2021.1996191

Zakari, A., & Khan, I. (2022). Boosting economic growth through energy in Africa: the role of Chinese investment and institutional quality. *Journal of Chinese Economic and Business Studies*, *20*(1), 1–21. https://doi.org/10.1080/14765284.2021.1968709