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RESEARCH ARTICLE

Digital Economy and Poverty Reduction in Africa: The Role of Governance Quality

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ABSTRACT

This research explores the relationship between the digital economy and poverty in Africa, with a focus on the role of governance quality. Utilizing data from 37 African countries from 2009 to 2022, the study employs robust statistical techniques, such as Panel-Corrected Standard Errors and Instrumental Variable Two-Stage Least Squares estimation. The results indicate a significant association between the digital economy index and reduced poverty levels. Additionally, the study highlights the necessity of improving governance quality to maximize the positive effects of digital economic initiatives on poverty alleviation. By elucidating these interrelated dynamics, this research seeks to provide actionable policy recommendations tailored to the unique developmental challenges faced by African countries.

Keywords: Africa, Digital economy, Governance quality, Poverty.

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1. Introduction

Despite the establishment of the Sustainable Development Goals (SDGs) agenda in 2015, aimed at eradicating global poverty, Africa continues to struggle with high poverty levels exacerbated by the COVID-19 pandemic. The Digital Economy for Africa initiative underscores the potential of the digital economy in advancing the SDGs[1]. Crespo *et al*. (2018) emphasize the necessity of additional development policies to overcome obstacles to achieving the primary SDG goal. Therefore, a thorough examination of governance quality is crucial in addressing these challenges.

Various key factors have been associated with positive outcomes in poverty reduction studies, such as infrastructure development, technological innovations, and digital-based payment system innovations (Kakeu *et al*., 2024). However, there remains a notable dearth of studies examining the mediating influence of governance quality within the relationship between the digital economy and poverty reduction, particularly within the African context. This research gap has motivated the present study to investigate the role of governance quality in mediating this connection, constituting the primary contribution of this paper.

The structure of this paper is as follows: Section 2 presents a review of the existing literature, Section 3 delineates the methodology and data utilized, followed by a discussion of the findings in Section 4, and concludes with the presentation of policy implications in the final section.

2. Literature Review

2.1. Theoretical Literature Review

Williamson (1998) first introduced new institutional economics theories, which examine how institutions, such as governance frameworks, shape economic behavior and outcomes (Acemoglu & Robinson, 2010). Research underscores the profound impact of governance quality and institutions on poverty alleviation and the effectiveness of digital interventions (Fagbemi *et al*., 2020). Robust democratic accountability, adherence to the rule of law, and sound governance are imperative for assuaging poverty, as they influence governmental strategies for poverty alleviation and education. Therefore, enhancing governance quality is a crucial prerequisite for the success of digital initiatives aimed at addressing poverty.

The theory of information economics suggests that better access to information and digital resources can impact poverty reduction efforts, but their influence depends on the relevance of information and the power and motivations of individuals to act on it (Avilés *et al*., 2016).

In conclusion, governance quality and institutional structures play a critical role in shaping the connection between the digital economy and poverty alleviation. Understanding these relationships is essential for

[1] https://www.worldbank.org/en/programs/all-africa-digital-transformation.

successful poverty reduction efforts, highlighting the interconnectedness of digital technologies, economic growth, information accessibility, and governance.

2.2. *Empirical Literature Review*

Empirically, the influence of the digital economy (proxied by internet technologies) on poverty alleviation remains uncertain, exhibiting potential advantages for advanced economies but uncertain outcomes for less advanced ones (Galperin & Fernanda Viecens, 2017). However, factors such as mobile penetration, internet usage, per capita income, employment rate, and agricultural exports have been positively associated with poverty reduction (Kelikume, 2021). Conversely, ICT goods exported, environmental quality, and the yield gap among smallholder farmers have been found to have adverse effects on poverty rates (Dzator *et al*., 2023).

These findings underscore the multifaceted nature of poverty reduction and the importance of considering various economic, technological, and social factors in the development and implementation of effective poverty alleviation strategies. While they highlight the significant potential of the digital economy in reducing poverty, they do not sufficiently emphasize the importance of governance in this relationship, which is crucial for achieving sustainable development in developing countries.

Our research endeavors to bridge this gap through empirical analysis, seeking to make a substantive contribution. Addressing this research gap is crucial due to its relevance to the overarching goal of attaining sustainable development, as articulated in the SDG 2030 agenda. Therefore, to further analyze and comprehensively understand the nuanced relationship between the digital economy, governance quality, and poverty reduction in Africa, we hypothesize that:

H1: The digital economy contributes to poverty reduction in Africa.

H2: The enhancement of governance quality is a crucial prerequisite for digital initiatives to successfully fight poverty in Africa.

3. Methodology

3.1. *Empirical Model Specification*

The primary focus of this paper is to demystify the effect of the digital economy on poverty across different countries in Africa and the role of governance quality. Thus our model can be written as follows:

$$POV_{it} = \alpha_0 + \alpha_1 DE_{it} + \alpha_2 GOV_{it} + \alpha_3 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where POV is poverty, DE is the proxy for the digital economy index, and GOV is governance quality, X is the control variable, μ and λ are the country and time effects, and ε is the error term.

To capture the moderating effect of governance quality on the relationship between poverty and the digital economy, (1) can be extended as follows:

$$POV_{it} = \alpha_0 + \alpha_1 DE_{it} + \alpha_2 (DE \times GOV)_{it} + \alpha_3 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where $DE \times GOV$ is the interaction between the digital economy index and governance quality. Following the study by Pan *et al*. (2022) and Dossou *et al*. (2023), the net effect of the digital economy on poverty can be computed as follows:

$$\frac{\Delta POV}{\Delta DE} = \alpha_1 + \alpha_2 \overline{GOV} \quad (3)$$

where $\overline{GOV}$ is the mean value of governance quality.

3.2. *Data*

The temporal scope of this study centers on the years 2009 to 2022, focusing on a panel comprising 37 African countries. Some values were missing in our data set for some variables in some countries, therefore we used the imputation technique to solve this issue following the work of Dang *et al*. (2019). The information of the chosen variables cited below are available in Table I.

3.2.1. *Dependent Variable*

Poverty is commonly understood as the failure to achieve basic living standards. The interpretation of what constitutes an inability to meet these standards varies across different regions worldwide. According to the latest World Bank standards, extreme poverty is defined as living on less than $1.9 per day, while the moderate poverty line is less than $3.2. Therefore, the proxy used for poverty in this study is the poverty headcount ratio at $3.65 a day (2017 PPP) (the percentage of people in poverty), which is commonly used in an empirical study (Fields, 2023). This choice is predominantly caused by the availability of data.

TABLE I: Data Description

Variable	Description	Source
POV	Poverty: the poverty headcount ratio at $3.5 a day (2017 PPP) (% of people in poverty)	World Bank World development indicators
DE	Global Innovation Index, which measures countries' innovation inputs and outputs	WIPO
GOV	Governance quality: rule of law, control of corruption, governance effectiveness, voice and accountability, regulatory quality, and political stability	World Bank World Governance Indicator
HUM	Human capital index	Penn World Table
CO_2	Carbon dioxide emissions (kg/2011 PPP USD GDP)	World Bank World development indicators
GINI	Gini index	World Bank World development indicators
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank World development indicators

3.2.2. *Core Independent Variables*

Following the work of Afolabi (2023), the primary independent variable in this study is the digital economy index, which is quantified using the Global Innovation Index (GII) provided annually by WIPO[2]. A contentious issue in the literature pertains to the most suitable measure of the digital economy. Variations in measures, such as internet penetration, fixed broadband subscriptions, ICT output, patents, and telephone lines (Skiter *et al*., 2021), have resulted in conflicting findings and conclusions. The restricted scope and inadequacy of these measures in comprehensively capturing the digital economy underscore the need to devise a more comprehensive and inclusive measure. WIPO's GII is advocated as a comprehensive gauge of the digital economy, as it integrates the aforementioned measures and encompasses both innovation inputs (demand-side variables) and outputs (supply-side variables) of an economy.

The second independent variable is governance quality. Following the study of Pan *et al*. (2022) we use six governance indicators which are developed by Kaufmann *et al*. (2011), namely: Control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, voice, and accountability.

3.2.3. *Control Variables*

Human capital index: Theoretically, the level of human capital within a population, including factors such as education and health, directly influences productivity and economic advancement (Becker, 2009). Human capital can enhance individuals' ability to secure higher-paying employment, thereby contributing to poverty reduction.

Carbon dioxide (CO_2) emissions: The complex interactions between environmental quality and socioeconomic conditions explain that rising CO_2 emissions contribute to climate change, leading to environmental degradation, natural disasters, and disruptions in agricultural productivity. These effects, directly and indirectly, affect the livelihoods of communities reliant on natural resource-based activities (especially in Africa), exacerbating poverty levels (Pérez-Peña *et al*., 2021). However, Awad (2023) argued that an improvement in environmental quality increased the poverty rate

Gini indexes: As the Gini index increases, a larger percentage of a nation's income is concentrated among a small fraction of the population, leaving a larger proportion of individuals and households with limited resources and opportunities (Kuznets, 1955). This concentration of wealth can lead to disparities in access to essential services, further perpetuating poverty.

Foreign direct investment: FDI can help in building infrastructure, such as roads, ports, and utilities, which in turn can improve living standards in host countries (Rakotondrazaka, 2024). However, the impact of FDI on poverty alleviation is contingent on various factors, such as the nature of the investment.

3.3. *Estimation Method*

Following the method used by Dossou *et al*. (2023), this study will employ the panel-corrected standard errors (PCSE) estimation technique, as advanced by Jönsson (2005), to address cross-sectional dependency. Then, the IV-2SLS estimation technique will be utilized to account for endogeneity.

[2]https://doi.org/10.34667/tind.46596.

4. Result and Discussions

4.1. *The Baseline Results*

The effect of the digital economy, governance quality, and control variables on poverty are displayed in Table II. The result unveils that the impact of the digital economy on poverty is negative and statistically significant, meaning that promoting the digital economy is associated with a 0.41% reduction in the poverty rate (column 1). This finding supports our first hypothesis and echoes the argument that technological innovations significantly reduce poverty in sub-Saharan Africa (Kakeu *et al*., 2024).

The results also show that the impact of governance quality (rule of law, control of corruption, governance effectiveness, voice and accountability, regulatory quality, and political stability) on poverty is all negative and significant. This means that as governance quality increases, the poverty rate decreases, similar to the finding of Ochi *et al*. (2023).

Furthermore, the result indicates that human capital has a negative and significant effect on poverty, aligning with the argument that healthy human capital can help developing countries escape the poverty trap (Wang *et al*., 2021). Additionally, CO_2 emissions promote poverty reduction, while income inequality increases the poverty rate. However, FDI inflow does not contribute to poverty reduction in the African sample.

Moreover, we consider our second hypothesis by investigating the moderating role of governance quality on the digital economy—poverty reduction nexus (Table III).

The results show that the interaction between the digital economy index and governance quality has a negative impact on poverty, but is only significant for the rule of law, voice and accountability, and political stability. This means that improving these governance quality indexes will promote the poverty reduction effect of the digital economy. Considering column (8), the net effect calculation indicates that the digital economy has a significant negative impact on poverty reduction when governance quality is high.

$$\frac{\Delta POV}{\Delta DE} = \alpha_1 + \alpha_2 \overline{GOV} = [-0.295 + (-0.37 \times -0.5)] = -0.48$$

where −0.295 represents the unconditional effect of the digital economy on poverty; −0.37 denotes the conditional impact of the digital economy on poverty; −0.5 is the average value of rule of law. This means that at the average level value of the existing rule of law in our sample, governance quality enhances the poverty reduction effect of the digital economy. A possible explanation for this phenomenon is that when the rules of society are effectively enforced, it reduces corruption, encourages investment, and promotes fair and equitable access to digital resources and opportunities, thereby contributing to poverty reduction.

TABLE II: The Baseline Results for Direct Effect, (1–7)

	(1) POV	(2) POV	(3) POV	(4) POV	(5) POV	(6) POV	(7) POV
DE	−0.408***						
	(0.114)						
HUM	−8.400***	−6.885***	−8.347***	-6.040***	−9.171***	−7.599***	−8.029***
	(0.694)	(0.747)	(0.575)	(0.636)	(0.730)	(0.649)	(0.817)
CO_2	−92.36***	−93.42***	−85.91***	−84.42***	−88.55***	−98.72***	−90.53***
	(3.061)	(3.586)	(3.164)	(3.592)	(3.202)	(3.668)	(3.590)
GINI	1.261***	1.444***	1.420***	1.393***	1.406***	1.523***	1.586***
	(0.0677)	(0.0816)	(0.0738)	(0.0838)	(0.0788)	(0.0903)	(0.130)
FDI	0.0397	0.0901	0.121	0.125	0.0886	0.0738	0.172
	(0.108)	(0.108)	(0.104)	(0.0981)	(0.110)	(0.101)	(0.113)
rl		−16.69***					
		(0.702)					
cc			−12.75***				
			(0.489)				
ge				−20.17***			
				(0.936)			
va					−6.821***		
					(0.556)		
rq						−15.75***	
						(0.906)	
ps							−8.963***
							(1.312)
cons	42.35***	14.22***	19.01***	9.593**	25.50***	13.66***	13.58**
	(2.508)	(3.676)	(3.224)	(3.881)	(3.600)	(4.262)	(6.255)
N	518	518	518	518	518	518	518
R^2	0.396	0.480	0.449	0.517	0.403	0.464	0.436

Note: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

TABLE III: The Baseline Results for Moderating Effect, (8–13)

	(8) POV	(9) POV	(10) POV	(11) POV	(12) POV	(13) POV
DE	−0.295***	−0.361***	−0.223***	−0.416***	−0.269***	−0.478***
	(0.0847)	(0.111)	(0.0665)	(0.122)	(0.0845)	(0.120)
Controls	YES	YES	YES	YES	YES	YES
rl_DE	−0.370**					
	(0.162)					
cc_DE		−0.215				
		(0.193)				
ge_DE			−0.249			
			(0.154)			
va_DE				−0.341***		
				(0.131)		
rq_DE					−0.222	
					(0.148)	
ps_DE						−0.375***
						(0.113)
cons	21.52***	26.22***	15.33***	34.62***	20.18***	22.87***
	(3.495)	(3.359)	(3.765)	(3.454)	(4.241)	(5.369)
N	518	518	518	518	518	518
R^2	0.488	0.458	0.521	0.419	0.470	0.460

Note: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

Considering column (11):

$$\frac{\Delta POV}{\Delta DE} = \alpha_1 + \alpha_2 \overline{GOV} = [-0.416 + (-0.34 \times -0.44)]$$
$$= -0.471$$

where −0.416 represents the unconditional effect of the digital economy on poverty; −0.34 denotes the conditional impact of the digital economy on poverty; −0.44 is the average value of voice and accountability. One explanation for this effect might occur when citizens can participate in selecting their government, express their opinions, and hold their leaders accountable; it promotes transparency, responsiveness, and effective policy-making. In the context of the digital economy, this translates to policies and regulations that support digital inclusion, bridge the digital

TABLE IV: Robustness Check for Direct Effect, (1–7)

	(1) POV	(2) POV	(3) POV	(4) POV	(5) POV	(6) POV	(7) POV
DE	−0.155***						
	(0.0544)						
Controls	YES	YES	YES	YES	YES	YES	YES
rl		−19.29***					
		(1.009)					
cc			−17.37***				
			(0.997)				
ge				−24.07***			
				(0.909)			
va					−4.778***		
					(1.044)		
rq						−17.58***	
						(0.962)	
ps							−8.021***
							(0.737)
cons	26.66***	3.858	4.843*	−2.923	16.85***	1.029	12.87***
	(2.452)	(2.881)	(2.578)	(2.505)	(3.230)	(2.819)	(3.010)
N	518	518	518	518	518	518	518

Note: Standard errors in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE V: Robustness Check for Direct Effect, (8–13)

	(8) POV	(9) POV	(10) POV	(11) POV	(12) POV	(13) POV
DE	−0.145**	−0.170***	−0.0737	−0.226***	−0.174**	−0.256***
	(0.0732)	(0.0652)	(0.0699)	(0.0761)	(0.0740)	(0.0684)
Controls	YES	YES	YES	YES	YES	YES
rl	−13.77***					
	(2.371)					
cc		−13.23***				
		(2.516)				
ge			−20.38***			
			(2.249)			
va				1.290		
				(2.145)		
rq					−13.65***	
					(2.321)	
ps						−2.387*
						(1.446)
rl_DE	−0.207**					
	(0.0992)					
cc_DE		−0.129				
		(0.105)				
ge_DE			−0.129			
			(0.0868)			
va_DE				−0.228**		
				(0.0907)		
rq_DE					−0.121	
					(0.0938)	
ps_DE						−0.240***
						(0.0657)
cons	6.357*	7.916***	−0.700	21.98***	5.094	16.00***
	(3.348)	(2.969)	(3.074)	(3.608)	(3.273)	(3.078)
N	518	518	518	518	518	518

Note: Standard errors in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE VI: IV-2SLS ESTIMATION RESULT

	(1) POV	(2) POV	(3) POV	(4) POV	(5) POV	(6) POV	(7) POV
DE	−2.476***	−2.170***	−2.232***	−1.950***	−2.580***	−2.230***	−2.326***
	(0.325)	(0.404)	(0.357)	(0.389)	(0.414)	(0.409)	(0.319)
Controls	YES	YES	YES	YES	YES	YES	YES
rl		−6.897**					
		(3.475)					
cc			−6.738**				
			(2.722)				
ge				−11.14***			
				(3.355)			
va					2.164		
					(2.805)		
rq						−5.865*	
						(3.468)	
ps							−6.268***
							(1.692)
cons	69.15***	55.74***	56.44***	47.16***	74.16***	57.24***	50.78***
	(8.189)	(11.64)	(10.21)	(11.32)	(11.77)	(12.22)	(9.765)
N	518	518	518	518	518	518	518
Cragg-Donald Wald F statistic	143.9	106.7	126.3	104.5	112.2	109.3	138.5

Note: Standard errors in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$; the critical values at the 10% level of the Stock-Yogo weak ID test is 16.38.

divide, and ensure equitable access to digital technologies and services. Similarly from column (13):

$$\frac{\Delta POV}{\Delta DE} = \alpha_1 + \alpha_2 \overline{GOV} = [-0.478 + (-0.375 \times -0.54)] = -0.68$$

where −0.478 represents the unconditional effect of the digital economy on poverty; −0.375 denotes the conditional impact of the digital economy on poverty; −0.54 is the average value of political stability. Because political stability and the absence of violence ensure a secure and predictable environment for digital businesses and investments, it encourages both domestic and foreign investors to participate in the digital economy, resulting in increased job opportunities, income generation, and poverty reduction. Furthermore, a stable political climate reduces the risk of disruptive events, such as cyberattacks or government crackdowns, that could hinder the growth of the digital economy and negatively impact poverty reduction efforts.

4.2. Robustness Check

For the robustness check, we explore different estimation methods by employing FGLS (Feasible Generalized Least Squares) estimation. This technique estimates the covariance matrix of errors and improves the efficiency of the model equations (Afolabi, 2022). As detailed in Tables IV and V, the result is closely aligned with our baseline findings.

4.3. Endogeneity Test

In this study, we explore the link between the digital economy and poverty in Africa, considering the role of governance quality. To address potential endogeneity, we use the IV-2SLS method with the ICT infrastructure composite index as an instrument variable. This instrument is valid as it can influence the digital economy without directly impacting poverty levels. Results indicate that both the digital economy and governance quality negatively affect poverty significantly (see Table VI). The validity of the instrument is supported by rejecting the null hypothesis of weak instrumentality.

5. Conclusion and Policy Implication

This study examines the impact of the digital economy on poverty and the role of governance quality in 37 African countries from 2009 to 2022. Using the panel-corrected standard errors (PCSE) estimator, we find a negative and significant effect of the digital economy on poverty rates. Governance quality also plays a crucial role in poverty alleviation, with the interaction term showing a significant impact on poverty reduction. Policy implications include prioritizing investments in digital infrastructure, improving governance quality to ensure poverty alleviation through enhancing transparency, and accountability, addressing the digital divide by providing affordable access to ICTs, and promoting collaboration for poverty reduction.

Limitations of the study, such as the focus on a specific number of African countries and exclusion of upper-middle-income countries, may impact the generalizability of the findings. Future research could expand sample sizes, incorporate qualitative insights, and conduct comparative analyses to gain a deeper understanding of the relationship between the digital economy, governance quality, and poverty dynamics in Africa and beyond.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

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