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Foreign aid—Economic Growth Nexus in Africa: Does Financial Development Matter?

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ABSTRACT

This study explored the role of financial development in foreign aid (measured by agriculture, humanitarian, health, economic infrastructure and services, and education aid) and economic growth relationship for 37 African countries spanning the 2002–2018 period. Using the instrumental variable generalized method of moments model, our findings indicated that while foreign aid impedes Africa's growth, financial development spurs economic growth. The conditional effect analysis showed that financial development conditions foreign aid to spur economic growth. The country-specific analysis further showed that foreign aid has a higher growth elasticity in countries with relatively better financial systems, such as Mauritius, South Africa, Gabon, Tunisia, and Botswana, whilst the growth elasticity of aid is smaller in countries with a relatively weak financial system such as Malawi, Guinea Bissau, Sierra Leone, and the Democratic Republic of Congo. The study recommended the need for policymakers in Africa to implement innovative ways to improve domestic revenue mobilization. The study also recommended that policymakers in Africa should create an enabling environment that will enhance the development of Africa's financial system to mitigate the adverse effect of aid on economic growth.

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1. Introduction

Whether foreign aid (hereafter, aid) promotes economic growth in developing countries continues to dominate policy discussions and academic research. Developing countries have accrued high levels of aid in recent times, from US$ 127.3 billion in 2010 to US$ 145.7 billion in 2018; however, whether aid actually drives developing countries' economic

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growth remains ambiguous (Maruta et al., 2020; Tahir et al., 2019). For instance, some scholars argue that aid drives economic growth by increasing domestic resources and foreign exchange reserves, human capital and physical investment, technical and managerial know-how, market access, research skills, and technology transfer (Ang, 2010; Burnside & Dollar, 2000; Kumi, 2020; Sethi et al., 2019), whilst others argue that aid impedes economic growth by driving corruption, hampering domestic production, exacerbating conflicts, and promoting dependence syndrome (Ang, 2010; Burnside & Dollar, 2000; Kumi, 2020; Maruta et al., 2020; Sethi et al., 2019). These inconsistencies have been attributed mainly to the recipient countries' conditions, such as the quality of institutions, geography, climate, financial liberalization, and macroeconomic policies (Ang, 2010; Asongu, 2015; Burnside & Dollar, 2000; Maruta et al., 2020; Ram, 2004). However, whether the host countries' financial system serves as a pre-condition for aid effectiveness remains underexplored in the aid-economic growth literature.

The financial system plays an essential role in economic development by transferring funds from the surplus units to deficit units (Appiah-Otoo & Song, 2020). This facilitates savings and investment, thereby advancing economic growth (Appiah-Otoo & Song, 2020). Financial intermediaries also bring borrowers and lenders together and reduce the problem of risks associated with the transfer of funds (Ang, 2008). Thus, the financial system reduces transactions cost and information asymmetry problems (Ang, 2008). Financial intermediaries also provide monitoring and corporate governance leading to economic growth (Botev et al., 2019). This implies that countries with a developed financial system will successfully allocate aid inflows to firms and households. Also, the financial system will effectively mitigate the undesirable effects of aid on economic growth, such as the appreciation of the real exchange rate.

Nevertheless, the financial system in most developing economies, especially African countries, remains underdeveloped, and it is mainly dominated by government-owned banks, with a weak legal and regulatory system, high levels of corruption, insufficient accounting measures, and inefficient allocation of funds (Acquah and Ibrahim, 2019; Allen, Otchere and Senbet, 2011; Appiah-Otoo and Song, 2020; Chikalipah and Makina, 2019 2020). To this end, this study is motivated to explore the role of financial development in the aid-economic growth nexus in Africa for the period spanning 2002–2018. In this study, we seek to address the question: '*does financial development serves as a pre-condition for aid effectiveness in Africa?*' Addressing this question is significant given that policymakers are interested in attaining high and sustainable development in Africa (Anyanwu, 2014, Asongu and Odhiambo, 2020). According to Anyanwu (2014) and Asongu and Odhiambo (2020), high and sustainable economic success propels investment, employment, improves household consumption and welfare, reduces poverty, helps support health care and education that policymakers aspire to achieve. Thus, if aid is found to hamper economic growth and financial development mitigates the negative impact of aid on economic growth, then African countries can break out from their over-reliance on aid. On the contrary, if aid drives economic growth and financial development mitigates the positive impact of aid on economic growth, then this will imply that African countries will forever stay in underdevelopment. This will help reforms to be initiated in the financial sector to stimulate financial development in Africa.

This study contributes significantly to the aid-economic growth literature on the following fronts: First, we used five different measures of aid: agriculture, humanitarian, health,

economic infrastructure and services, and education aid. As argued by Maruta (2019), '*the question of aid effectiveness has shifted from "Is aggregated aid helpful?" to "Which type of aid is more helpful?" Also, donors have repeatedly stressed that they pursue multiple aims when delivering aid*'. Thus, the need to explore the differential effect of different forms of aid on economic growth in Africa. Second, this study contributes to the literature by examining the moderating role of financial development proxied by domestic credit to the private sector and money supply in the aid-economic growth nexus. Besides, this study presents the country-specific marginal effect of the moderating role of financial development in the aid-growth nexus. Furthermore, to produce reliable results, this study relied on the instrumental variable generalized method of moments (IV-GMM) technique to estimate the effect conditional and unconditional effect of financial development and aid on economic growth in Africa. This econometric technique produces efficient results since it addresses endogeneity issues that emanate from reverse causality, variable omissions bias, and mismeasurements (Acheampong, Amponsah and Boateng, 2020; Appiah-Otoo and Song, 2021a, 2021b). Finally, the results from this study will provide new insights for policy reforms in Africa. Using the IV-GMM model, our findings indicated that foreign aid in the form of agriculture, humanitarian, health, economic infrastructure and services, and education aid impedes Africa's growth, but a well-developed financial system enables aid management, thus enhancing aid effectiveness. However, the conditional analysis suggested that financial development conditions foreign aid to improve economic growth in Africa.

The remainder of the study comprises the literature review in section 2, methodology in section 3, the results and discussion in section 4, whilst the conclusion and policy recommendations are in section 5.

2. Literature Review

2.1. Foreign aid and Economic Growth

The Organization for Economic Co-operation and Development (OECD) defines foreign aid or official development assistance (ODA) to the government as planned to improve the welfare and the economic development of developing countries. Aid might be given bilaterally, alternatively channelling from donor to receiver through a multilateral development agency, the World Bank, or the United Nations. Aid incorporates grants, "soft" credits (where the grant component is at least 25% of the sum), and the provision of technical assistance". ODA might be disbursed under various headings, namely, social (which incorporates education, health, water supply, sanitation, and social infrastructure), economic (communications and transport, energy, banking, business, and different services), production (agriculture, fishing, and forestry, industry, mining and construction, and trade and tourism), and humanitarian reasons.

The links between aid and economic growth have been extensively studied, albeit the conflicting theoretical and empirical findings. For instance, some scholars documented that aid drives economic growth (Maruta, Banerjee and Cavoli, 2020; Tahir, Estrada and Afridi, 2019), while others have demonstrated that aid impedes economic growth (Babalola and Shittu, 2020; Sothan, 2018). The final group of studies has either documented an indirect or an inconclusive impact of aid on economic growth (Albiman, 2016; Alemu and Lee,

2015; Ang, 2010; Asongu, 2015; Burnside and Dollar, 2000; Ekanayake and Chatrna, 2017; Maruta, Banerjee and Cavoli, 2020; Nkusu and Sayek, 2004; Ram, 2004; Tsaurai, 2018). For instance, Tahir, Estrada and Afridi (2019) studied the aid-growth nexus for South Asian Association for Regional Cooperation (SAARC) countries from 2008 to 2015 and discovered that aid increases economic growth. Also, Maruta, Banerjee and Cavoli (2020) found that education aid drives South America's economic growth; health aid drives Asia's economic growth, whilst agriculture aid drives Africa's economic growth for a panel of 74 developing countries. Nwaogu and Ryan (2015) further explored the aid-growth nexus using a panel of 53 African and 34 Latin American countries. Using dynamic spatial econometrics models, the study indicated that aid drives economic growth in Africa, whilst the reverse exists in Latin American countries. Bird and Choi (2020) confirmed Nwaogu and Ryan's (2015) findings using the fixed effects model. Karras (2006) also found aid to spur economic growth for 71 developing countries from 1960 to 1997, using the fixed effects and the ordinary least squares model. Conversely, using the pooled mean group estimator, Babalola and Shittu (2020) found aid to impede West African countries' economic growth in the long run. Sothan (2018) reached the same conclusions for Cambodia. Albiman (2016) studied the aid-growth nexus using Tanzania as a case study and found aid to have an insignificant effect on Tanzania's economic growth in the short-run, while aid impedes Tanzania's economic growth in the long-run. Also focusing on 39 African countries further classified into middle-and low-income countries, Alemu and Lee (2015) found that aid has an insignificant effect on middle-income countries' economic growth while aid enhances low-income countries' economic growth. Nkusu and Sayek (2004) studied the role of financial development in the aid-growth nexus for 86 developing countries from 1970 to 1999 and found that aid impedes economic growth, but a well-developed financial system mitigates the negative impact while using the Ordinary Least Squares (OLS) estimator. Tsaurai (2018) reached the same findings while focusing on emerging markets and using the Fully Modified OLS technique.

2.2. Finance and Economic Growth

Financial development refers to the process of getting information at the most reduced cost, realizing contracts, and undertaking transactions that bring about the development of financial contracts, markets, and intermediaries (Akinlo, Yinusa and Adejumo, 2020). Financial development assumes a significant part in countries' economic development (Alexiou and Vogiazas, 2018). According to Sutton and Jenkins (2007), the financial sector is arguably the most significant in the world as far as earning is concerned. It is the backbone of other economic sectors and the most regulated sector (Sutton and Jenkins, 2007).

There exist a plethora of empirical studies on the relationship between financial development and economic growth. However, the empirical findings on the finance-growth nexus are ambiguous. Some studies document that finance boosts economic growth (Demetriades and James, 2011; Peia and Roszbach, 2015; Pradhan et al., 2017; Salah, Sjö and Shahbaz, 2013; Seven and Yetkiner, 2016; Zhang, Wang and Wang, 2012), while others document that finance retards economic growth (Acquah and Ibrahim, 2019; Appiah-Otoo and Song, 2020; Swamy, 2018). The final group of scholars documents a threshold or insignificant impact of finance on economic growth (Caporale et al., 2014; Ductor

and Grechyna, 2015; Hook and Singh, 2014; Jalil, Feridun and Ma, 2010; Law and Singh, 2014; Shen and Lee, 2015; Wahyoe, Iftekhar and Nuruzzaman, 2017). For example, Seven and Yetkiner (2016), using the system generalized method of moments (sys-GMM) technique, established that banking development spurs economic growth in low and middle-income countries. The study also revealed that stock market development drives economic growth in middle and high-income countries using 146 countries. Demetriades and James (2011) also documented that banking development promotes economic growth using 18 Sub-Saharan African countries from 1975 to 2006.

Also, Pradhan et al. (2017), using the panel vector auto-regression technique, established that financial development drives economic growth in ASEAN Regional Forum countries. Beck and Levine (2004) used a panel of 40 countries spanning 1976–1998 to examine the effects of the stock market and banking development on economic growth. Using the sys-GMM estimator, the study indicated that the stock market and banks drive economic growth. Peia and Roszbach (2015) confirmed Beck and Levine's (2004) findings using 22 developed countries. Salah, Sjö and Shahbaz (2013) also found that financial development contributes to economic growth in Kenya, in the long run, using the autoregressive distributed lag (ARDL) model. Also, Zhang, Wang and Wang (2012) and Jalil, Feridun and Ma (2010) found the same results in the case of China.

Conversely, Appiah-Otoo and Song (2020), using the ARDL model, documented that financial development (a composite index from banks, stocks, and insurance) impedes Ghana's economic growth in the short and long runs. Swamy (2018) and Samargandi, Fidrmuc and Ghosh (2015) also reached the same findings for 24 and 52 countries. Also, Law and Singh (2014) indicated that financial development has a nonlinear effect on economic growth for 87 developed and developing countries from 1980 to 2010. Similarly, Hook and Singh (2014) found a threshold relationship between finance and economic growth for 87 countries covering the 1980–2010 period. The study of Wahyoe, Iftekhar and Nuruzzaman (2017) also revealed that financial deepening and financial intermediation have an inverted U-shaped association with economic growth in Indonesia. Chen, Wu and Wen (2013) also examined the non-linearity between financial development and economic growth in China and found that financial development drives economic growth in high-income provinces but impedes economic growth in low-income provinces. For ten new European Union member countries, Caporale et al. (2014) revealed that the stock and credit market have an insignificant effect on economic growth, whilst liquid liabilities spur economic growth. Rousseau and Wachtel (2011) also concluded that financial deepening spur economic growth, given a stable financial environment; however, in periods of crisis, the positive effect disappears for 84 countries. Shen and Lee (2015) re-estimated the finance-growth links for 48 countries from 1976 to 2001 and found that stock market development spurs economic growth, whilst banking development impedes economic growth. Finally, Kar, Nazlioğlu and Ağir (2011) examined the causal nexus between finance and economic growth for 15 MENA countries from 1980 to 2017 and found no evidence of causality between finance and economic growth.

2.3. Foreign aid and Financial Development

It is acknowledged that foreign aid stimulates financial development by promoting creativity and innovation, transparency, accountability and fairness, greater links with the

private sector, reducing bureaucracy, leveraging resource allocation via public and private partnership, and expanding skills and technical know-how (Maruta 2019). In a recent study, Maruta (2019) indicated that aid to the financial sector stimulates financial development using data for 70 developing countries from 1980 to 2016. Agapova and Vishwasrao (2020) also found that aid to the financial sector promotes credit to the public sector; however, it impedes credit to the private sector.

From the literature review, it is obvious that a heterogeneous relationship exists between foreign aid and economic growth, financial development and economic growth, and foreign aid and financial development. There are limited studies on the complementarity between foreign aid, financial development, and economic development. Accordingly, this study contributes to the scarce literature on the complementarity between foreign aid, financial development, and economic growth by focusing on a sample of 37 African countries. This study also used five different measures of aid: agriculture, humanitarian, health, economic infrastructure and services, and education aid. Moreover, this study relied on domestic credit to the private sector and money supply as the financial development proxies. Furthermore, the country-specific marginal effect of the moderating role of financial development in the aid-growth nexus was presented. Finally, this study used the IV-GMM technique for the empirical analysis and a more recent dataset.

3. Data and Methodology

3.1. Data

This study used a panel of 37 African countries[1] from 2002 to 2018. These countries were selected given data availability on the various aid measures for the study period. Also, the study period was influenced by the availability of aid data from the OECD database. Given their dominant values, we used agriculture, health, education, humanitarian, economic infrastructure and services aids for our aid proxies. We used real GDP per capita to proxy economic growth, total labor force to represent labor and gross fixed capital formation as a proxy for investment. Also, following Acquah and Ibrahim (2019), we used domestic credit to the private sector (credit) and broad money supply as the financial development proxies. We obtained the aid data from the OECD database, while we sourced the data on economic growth, labor, investment, credit, and money supply from the World Development Indicators Database.

Table 1 shows the original data's variables, unit of measurement, definition, and descriptive statistics before their transformation into a log form. Real GDP per capita has an average of $1,967.506 with a maximum of $10,577.200. Credit recorded an average of 21.175%, with a maximum of 160.125%. At the country-level, South Africa (141.643%), Mauritius (84.274%), Tunisia (68.876%), Egypt (37.966%), Kenya (28.189%), and Botswana (26.852%) have a relatively highly developed financial system, whilst Guinea Bissau (7.117%), Guinea (5.938%), Chad (5.418%), Sierra Leone (5.093%), and DRC (3.951%)

[1] Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, Democratic Republic of Congo (DRC), Egypt, Eswatini, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Tanzania, Togo, and Tunisia.

Table 1. Descriptive Statistics.

Variable	Definition	Unit of Measurement	Obs.	Mean	Std. Dev.	Min	Max
gdp	Economic growth	Constant US$	629	1967.506	2334.849	210.804	10577.200
k	Investment	% of GDP	623	21.153	7.828	3.949	59.723
l	Labor	Total	629	8000000	1.00e+07	300000	5.84e+07
bm	Money supply	% of GDP	620	31.601	21.377	2.917	115.327
dcps	Domestic credit to the private sector	% of GDP	619	21.175	26.339	0.491	160.125
health	Health aid	Constant US$	624	1.845	2.725	0.000	34.499
educ	Education aid	Constant US$	629	3.843	3.615	0.086	20.275
econ	Economic infrastructure and services aid	Constant US$	628	2.806	4.888	−1.496	55.730
agric	Agriculture aid	Constant US$	628	1.726	1.828	0.000	13.674
huma	Humanitarian aid	Constant US$	614	3.955	8.357	0.000	80.892

Note: The values in this table are the raw values of the variables. However, for the empirical estimation, we follow Maruta, Banerjee and Cavoli (2020), the aid proxies were divided by real GDP and multiplied by 100.

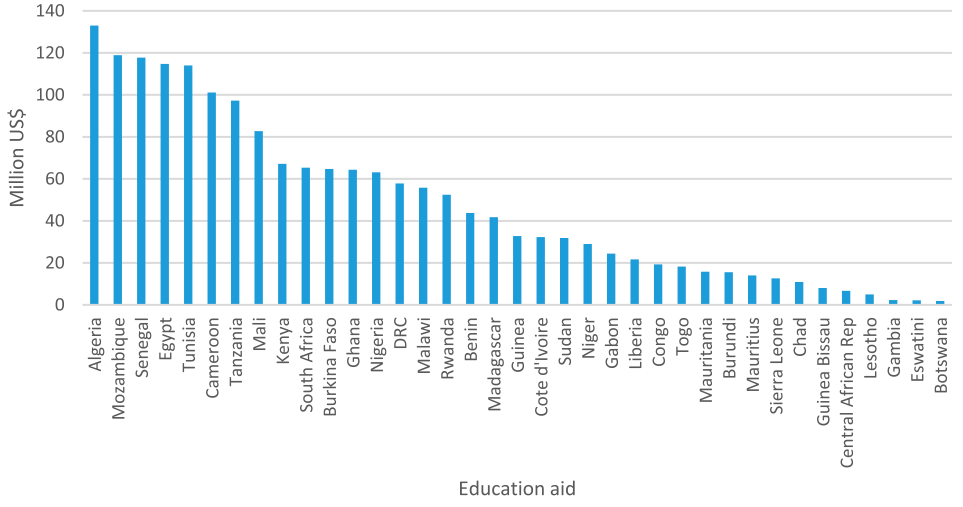

Figure 1. Country-specific averages of education aid from 2002-2018.

have a weak financial system. Concerning the aid proxies, humanitarian aid has the highest average, followed by education aid, economic infrastructure and services aid, health aid, with agriculture aid having the lowest average. At the country-level, Algeria has the highest average of education aid, whilst Tanzania, Egypt, Ghana, and Sudan have the highest averages of health, economic infrastructure and services, agriculture, and humanitarian aid, respectively (see Figures 1–5)

Figure 6 shows the correlation between financial development (credit, broad money supply), foreign aid (health aid, agriculture aid, education aid, humanitarian aid, economic infrastructure, and services aid), and economic growth. The results show that financial development (credit and broad money supply) has a strong positive correlation with economic growth, whilst aid (health, agriculture, education, humanitarian, and economic infrastructure and services aid) has a strong negative correlation with economic growth. Thus, an increase in credit and broad money supply will raise economic growth, whilst an

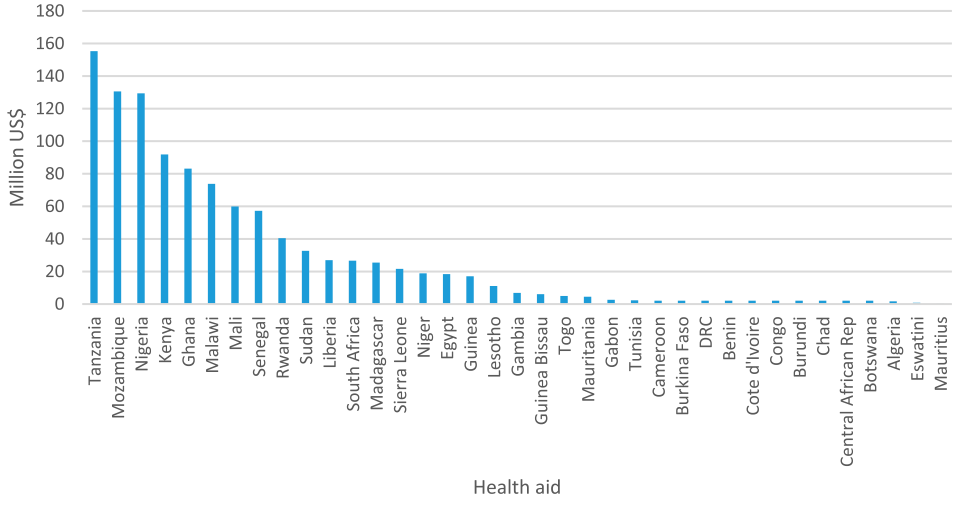

Figure 2. Country-specific averages of health aid from 2002-2018.

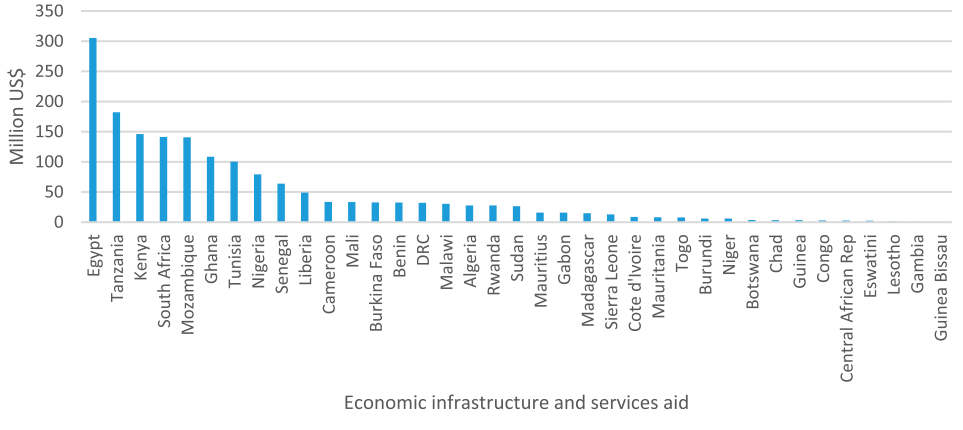

Figure 3. Country-specific averages of economic infrastructure and services aid from 2002-2018.

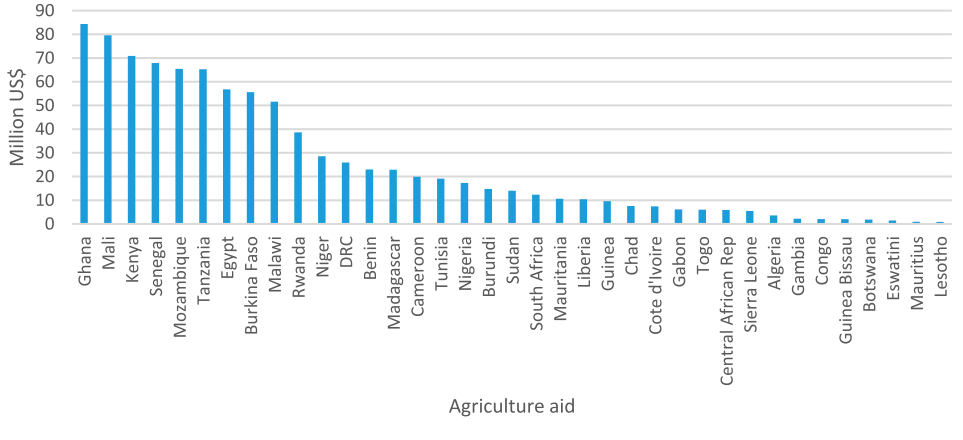

Figure 4. Country-specific averages of agriculture aid from 2002-2018.

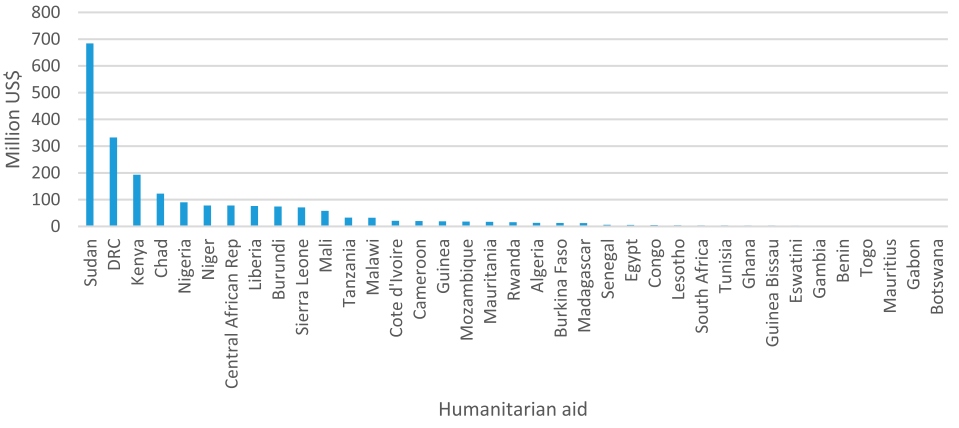

Figure 5. Country-specific averages of humanitarian aid from 2002-2018.

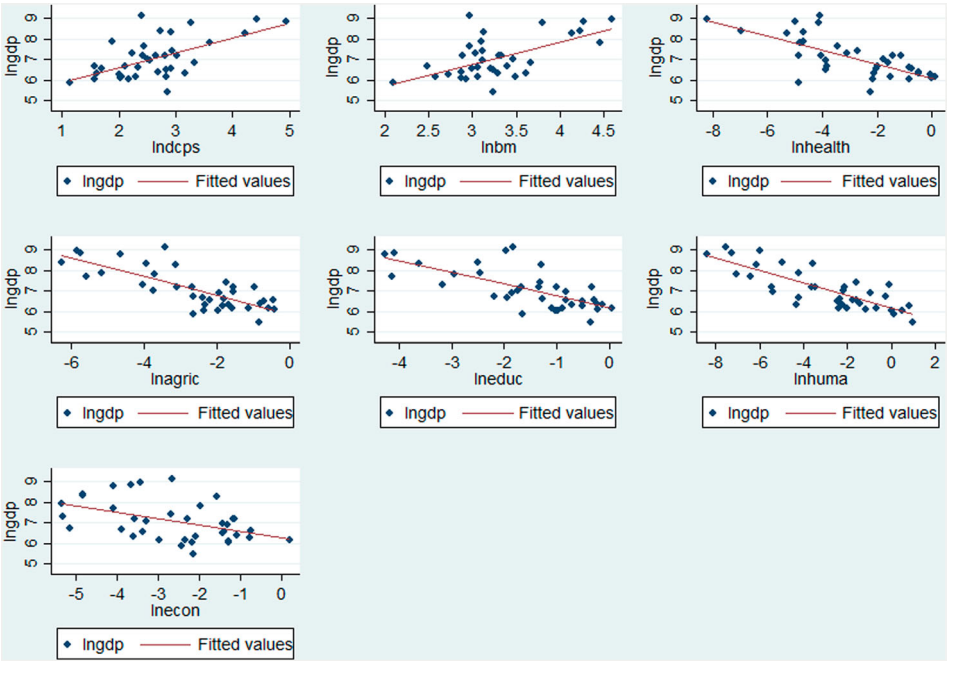

Figure 6. Bivariate relationship between credit, broad money supply, health aid, agriculture aid, education aid, humanitarian aid, economic infrastructure and services aid, and economic growth.

increase in health, agriculture, education, humanitarian, and economic infrastructure and services aid will decrease economic growth.

3.2. Theoretical Model and Hypothesis Development

The neoclassical Aggregate Production Function (APF) of Solow (1956) serves as the theoretical basis of this study. The APF examines the relationship between output and inputs used in production (Appiah-Otoo and Song, 2021b; Peprah, Ofori and Asomani, 2019).

The model is stated as Eq. (1)

$$Y_{it} = A_{it} \times f(k_{it}, l_{it}) \tag{1}$$

Where Y_{it} depicts output, k_{it} depicts capital stock, and l_{it} depicts labor. A_{it} depicts total factor productivity (TFP). i represents country, and t signifies time. In this study, capital stock is denoted by investment as a share of GDP given the unavailability of capital stock data for developing countries (Albiman, 2016). This proxy has also been extensively used in economic growth studies (see Appiah-Otoo and Song, 2021b; Ekanayake and Chatrna, 2017; Maruta, Banerjee and Cavoli, 2020; Peprah, Ofori and Asomani, 2019). To examine foreign aid, financial development, and the interaction of foreign aid and financial development influence on economic growth, we substitute foreign aid, financial development and the interaction between foreign aid and financial development intoA_{it}: Eq. (2). The justification for substituting foreign aid, financial development and the interaction between foreign aid and financial development intoA_{it} stems from the fact that A_{it}denotes other factors that drive capital stock and labor to enhance economic growth and foreign aid, financial development and the interaction between foreign aid and financial development have been shown to influence economic growth (see Nkusu and Sayek, 2004; Seven and Yetkiner, 2016; Tsaurai, 2018).

$$A_{it} = f(aid_{it}, fd_{it}, aid_{it} \times fd_{it}) \tag{2}$$

Substituting Eq. (2) into Eq. (1) gives Eq. (3)

$$Y_{it} = f(k_{it}, l_{it}, aid_{it}, fd_{it}, aid_{it} \times fd_{it}) \tag{3}$$

Stating Eq. (3) in econometrics gives Eq. (4)

$$y_{it} = b_o + b_1 k_{it} + b_2 l_{it} + b_3 aid_{it} + b_4 fd_{it} + b_5 aid_{it} \times fd_{it} + \varepsilon_{it} \tag{4}$$

Transforming Eq. (4) into log form gives Eq. (5)

$$\ln y_{it} = b_o + b_1 \ln k_{it} + b_2 \ln l_{it} + b_3 \ln aid_{it} + b_4 \ln fd_{it} + b_5 \ln aid_{it} \times \ln fd_{it} + \varepsilon_{it} \tag{5}$$

From Eq. (5), we employ the following growth equation: Eq. (6)

$$\ln gdp_{it} = b_o + b_1 \ln k_{it} + b_2 \ln l_{it} + b_3 \ln aid_{it} + b_4 \ln fd_{it} + b_5 \ln aid_{it} \times \ln fd_{it} + \varepsilon_{it} \tag{6}$$

From Eqn. (6), we obtained the following marginal effect of aid on economic growth Eq. (7)

$$\frac{\Delta lngdp_{it}}{\Delta lnaid_{it}} = b_3 + b_5 \ln fd_{it} \tag{7}$$

We test the following conditional hypotheses:

- If $b_3 > 0$ and $b_5 > 0$, Aid measured by agriculture, health, education, humanitarian, and economic infrastructure and services have a positive impact on economic growth and financial development measured by credit and money supply affect favorably that positive impact.

- If $b_3 > 0$ and $b_5 < 0$, Aid has a positive effect on economic growth, whilst financial development reduces the positive effect.
- If $b_3 < 0$ and $b_5 > 0$, Aid harms economic growth, whilst financial development mitigates the negative effect.
- If $b_3 < 0$ and $b_5 < 0$, Aid harms economic growth, and financial development worsens the negative effect.

3.3. Estimation Strategy

We employed the Baum, Schaer and Stillman (2002) IV-GMM technique to estimate the above-stated equations. This technique produces efficient results since it addresses endogeneity sources such as omitted variable issues, measurement errors, or reverse causality. Also, since the IV-GMM technique applies the orthogonality condition, its estimates are robust to autocorrelation and efficient in the presence of unknown heteroscedasticity (Baum, Schaer and Stillman, 2002). This method is also appropriate since the study period is smaller than the countries studied (Stock, Wright and Yogo, 2012). For post estimation analysis, we relied on the Hansen statistics and the Cragg-Donald/Kleibergen-Paap F-statistics to test the appropriateness of the instruments. The Hansen statistics test the assumption that the null hypothesis of instrument over-identification restriction should not be rejected (Baum, Schaffer and Stillman, 2003). This technique has recently been utilized in much-applied research (seeAcheampong, Appiah-Otoo, et al., 2021a; Appiah-Otoo et al., 2021; Appiah-Otoo and Song, 2021b)

Also, we applied the Lewbel (2012) two-stage least squares (2SLS) estimator to test the robustness of the IV-GMM estimates. The Lewbel 2SLS technique is applied when appropriate instruments are not available or weak for identifying structural parameters in the regression models with endogenous or mismeasured regressors. The Lewbel 2SLS technique includes internally constructed heteroskedasticity-based instruments generated from the residuals of the auxiliary equation, which is multiplied by each of the included exogenous variables in mean-centered form (Lewbel, 2012). One usefulness of the Lewbel 2SLS technique is that it does not rely on satisfying standard exclusion restrictions and has recently been utilized in many empirical studies (see, for instance, Acheampong, Erdiaw-Kwasie, et al., 2021c Awaworyi Churchill and Smyth, 2017; Mishra and Smyth, 2015).

4. Results and Discussion

4.1. IV-GMM Results

Table 2 presents our baseline results without the interaction effect. The results suggest that all the foreign aid measures (health, agriculture, education, humanitarian, and economic infrastructure and services aid) have a negative and significant effect on economic growth. The estimates show that a 1% increase in health, agriculture, education, humanitarian, and economic infrastructure and services aid reduces economic growth by 0.30, 0.36, 0.53, 0.27, and 0.19%, respectively, at the 1% significance level. Thus, foreign aid in any other forms stymies Africa's economic growth, and this could be due to African countries' weak institutions such as corruption, political instability, lack of transparency, and poor economic

Table 2. Baseline results without interaction effects (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lnk	0.599***	0.526***	0.515***	0.407***	0.789***	0.608***	0.642***
	(0.075)	(0.076)	(0.071)	(0.071)	(0.091)	(0.092)	(0.090)
lnl	−0.154***	−0.130***	−0.199***	−0.104***	−0.104***	−0.188***	−0.164***
	(0.028)	(0.025)	(0.025)	(0.027)	(0.037)	(0.030)	(0.033)
lnhealth	−0.297***						
	(0.012)						
lnagric		−0.364***					
		(0.015)					
lneduc			−0.532***				
			(0.020)				
lnhuma				−0.274***			
				(0.012)			
lnecon					−0.190***		
					(0.023)		
lndcps						0.644***	
						(0.035)	
lnbm							0.962***
							(0.051)
Constant	6.792***	6.538***	7.751***	6.644***	5.820***	6.386***	4.478***
	(0.421)	(0.394)	(0.411)	(0.494)	(0.587)	(0.462)	(0.564)
Observations	541	548	551	522	542	538	538
R^2	0.500	0.550	0.563	0.517	0.219	0.401	0.413
RMSE	0.668	0.646	0.644	0.636	0.856	0.759	0.752
F	273.137	248.898	315.493	225.467	61.733	164.795	173.658
J	14.628	5.678	0.454	1.824	0.952	7.314	8.525
JP	0.001	0.058	0.500	0.177	0.329	0.007	0.004

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments in the models with aid, whilst the lag values of the financial development proxies were treated as instruments in the models with financial development. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses. The post estimation statistics suggest that the IV-GMM models pass the instrument over-identification restriction in Models 2-5, except Models 1, 6, and 7; however, the F-statistics show that the instruments used are not weak. $*\,p < 0.1$, $**\,p < 0.05$, $***\,p < 0.01$

policies, which adversely affect the effectiveness of foreign aid in the region (Burnside & Dollar, 2000; Dollar & Easterly, 1999). The negative effect of aid on economic growth could also imply that aid promotes dependency syndrome and probably represents a small percentage of total financial resources needed to facilitate Africa's economic growth. This supports the findings of Babalola and Shittu (2020) and Sothan (2018).

The results indicate that financial development proxied by credit and money supply has a positive and significant effect on economic growth. The estimates show that a 1% increase in credit and money supply increase Africa's economic growth by 0.64% and 0.96%, respectively, at the 1% significance level. The positive and significant impact of financial development on economic growth supports the findings of (Aluko and Ibrahim, 2020; Demetriades and James, 2011; Olalekan, Sunday and Oladeji, 2021; Peia and Roszbach, 2015; Pradhan et al., 2017; Salah, Sjö and Shahbaz, 2013; Seven and Yetkiner, 2016; Zhang, Wang and Wang, 2012). These findings could be attributed to the following: First, a developed financial system lessens information asymmetry, which helps channel savings into a profitable investment (Ang, 2008). Second, a developed financial system enhances corporate governance and thus increases investment projects productivity (Botev, Egert and Jawadi, 2019). Also, a developed financial system enhances transparency and thus improves hedging against risk (Murinde, 2012). Furthermore, a developed financial system enhances capital accumulation through savings mobilization (Emara and El Said, 2021). Finally, an

Table 3. Foreign aid, credit, and economic growth (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.456***	0.295***	0.349***	0.308***	0.459***
	(0.074)	(0.076)	(0.071)	(0.073)	(0.101)
lnl	−0.185***	−0.166***	−0.216***	−0.112***	−0.145***
	(0.026)	(0.021)	(0.021)	(0.026)	(0.030)
lndcps	0.435***	0.880***	0.571***	0.534***	1.337***
	(0.088)	(0.154)	(0.077)	(0.115)	(0.260)
lnhealth	−0.276***				
	(0.066)				
lnhealth × lndcps	0.003				
	(0.022)				
lnagric		−0.688***			
		(0.134)			
lnagric × lndcps		0.121***			
		(0.043)			
lneduc			−0.654***		
			(0.101)		
lneduc × lndcps			0.064**		
			(0.033)		
lnhuma				−0.432***	
				(0.092)	
lnhuma × lndcps				0.073**	
				(0.032)	
lnecon					−0.874***
					(0.259)
lnecon × lndcps					0.244***
					(0.091)
Constant	6.623***	5.476***	7.065***	5.810***	3.736***
	(0.374)	(0.450)	(0.388)	(0.579)	(0.857)
Observations	534	541	544	515	535
R^2	0.620	0.653	0.694	0.501	0.383
RMSE	0.584	0.569	0.539	0.648	0.763
F	333.877	349.397	407.912	126.647	104.474
J	2.910	0.161	0.017	1.865	2.582
JP	0.088	0.688	0.897	0.172	0.108

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses. The IV-GMM models are robust to instrument over-identification restriction since the probability values of the Hansen test are above 5%. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

expanded financial system facilitates trade and enhances specialization that boosts labor productivity (Levine, 2005).

This study also established that investment significantly increases economic growth in all the models. An increase in investment increases Africa's economic growth within 0.41% to 0.79% at the 1% significance level. This supports the endogenous growth theory and the findings of Olalekan, Sunday and Oladeji (2021), Sepehrdoust and Ghorbanseresht (2019), Haftu (2019) and Adeleye and Eboagu (2019), which showed that investment spurs economic growth. There are various reasons for this result. First, investment such as the transport infrastructure contributes to economic growth directly by promoting easier access to inputs at a reduced transaction cost. It indirectly facilitates extra input to different sectors. Also, a developed transport network gives faster, affordable, more efficient, and flexible transport facilities that can enable greater productivity in manufacturing and production (Meersman and Nazemzadeh, 2017).

The findings show that labor has a negative and significant effect on economic growth in all the models at the 1% significance level. The results show that a 1% rise in labor

Table 4. Foreign aid, money supply, and economic growth (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.506***	0.507***	0.427***	0.338***	0.644***
	(0.069)	(0.082)	(0.067)	(0.092)	(0.097)
lnl	−0.162***	−0.140***	−0.187***	−0.065*	−0.146***
	(0.026)	(0.024)	(0.023)	(0.037)	(0.035)
lnbm	1.038***	1.443***	0.940***	1.511***	2.133***
	(0.226)	(0.430)	(0.244)	(0.370)	(0.565)
lnhealth	−0.614***				
	(0.197)				
lnhealth×lnbm	0.104*				
	(0.056)				
lnagric		−1.208***			
		(0.429)			
lnagric×lnbm		0.260**			
		(0.123)			
lneduc			−0.947**		
			(0.406)		
lneduc×lnbm			0.145		
			(0.119)		
lnhuma				−1.274***	
				(0.355)	
lnhuma×lnbm				0.317***	
				(0.106)	
lnecon					−1.612**
					(0.676)
lnecon×lnbm					0.432**
					(0.199)
Constant	3.890***	2.129	4.849***	1.649	−0.130
	(0.852)	(1.523)	(0.930)	(1.494)	(1.833)
Observations	534	541	544	515	535
R^2	0.593	0.566	0.676	0.204	0.308
RMSE	0.606	0.637	0.556	0.820	0.809
F	325.218	197.143	372.641	63.715	75.721
J	1.500	0.073	0.016	1.455	2.096
JP	0.221	0.787	0.898	0.228	0.148

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses. The IV-GMM models pass the instrument over-identification restriction given the probability values of the Hansen test. $*\ p < 0.1, **\ p < 0.05, ***\ p < 0.01$.

decreases Africa's economic growth within the ranges of 0.10% to 0.20%. This conflicts with the endogenous growth theory, which claims that labor is an essential factor of production. This could be attributed to brain drain, low productivity, and unskilled labor (Acheampong, Boateng, et al., 2021b).

Table 3 presents our interaction effect results when credit was used as the financial development proxy. The results suggest that agriculture, education, humanitarian, and economic infrastructure and services aid interact with credit to boost economic growth significantly. However, health aid and credit interaction is positive but not statistically significant. Generally, this finding implies that financial development measured by credit mitigate the adverse influence of health, agriculture, education, humanitarian, and economic infrastructure and services aid on Africa's economic growth. Thus, Africa's financial system could isolate the negative effect of aid on economic growth when it ensures good corporate control, provides risk management and ensures efficient resource allocation. In

Table 5. Foreign aid, credit, and economic growth without South Africa, Mauritius, Tunisia, Egypt, Kenya, and Botswana (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lnk	0.620***	0.585***	0.596***	0.482***	0.797***	0.689***	0.678***
	(0.076)	(0.075)	(0.074)	(0.070)	(0.088)	(0.100)	(0.097)
lnl	−0.204***	−0.173***	−0.202***	−0.132***	−0.153***	−0.193***	−0.174***
	(0.034)	(0.029)	(0.028)	(0.029)	(0.038)	(0.041)	(0.044)
lnhealth	−0.245***						
	(0.012)						
lnagric		−0.291***					
		(0.016)					
lneduc			−0.451***				
			(0.022)				
lnhuma				−0.236***			
				(0.013)			
lnecon					−0.163***		
					(0.020)		
lndcps						0.368***	
						(0.049)	
lnbm							0.605***
							(0.075)
Constant	7.504***	7.095***	7.587***	6.854***	6.428***	6.833***	5.589***
	(0.463)	(0.418)	(0.408)	(0.497)	(0.547)	(0.569)	(0.688)
Observations	476	476	476	463	470	463	463
R^2	0.474	0.471	0.469	0.437	0.264	0.232	0.252
RMSE	0.616	0.618	0.619	0.593	0.731	0.750	0.743
F	188.157	158.501	174.586	139.632	61.082	58.244	60.054
J	11.143	2.351	0.247	1.543	0.555	5.817	6.144
JP	0.004	0.309	0.619	0.214	0.456	0.016	0.013

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses.

other words, implementing favorable financial regulatory policies that ensure the stability and effectiveness of the African financial system could condition aid to spur economic growth.

In Table 4, we used money supply as the financial development indicator. The interaction effect results suggest that health, agriculture, humanitarian, and economic infrastructure and services aid interact with money supply to enhance economic growth significantly. However, the interaction between education aid and credit is positive but not statistically significant. These results indicate that financial development proxied by money supply mitigates the negative impact of health, agriculture, education, humanitarian, and economic infrastructure and services aid on Africa's economic growth. These findings are not different from our results reported in Table 3.

4.2. Sensitivity Checks

From the individual country descriptive statistics, it is observed that the financial system in South Africa, Mauritius, Tunisia, Egypt, Kenya, and Botswana is relatively well developed compared to their counterparts in Africa. Thus, their presence might bias the results derived in Tables 2–4. Accordingly, we omitted these countries and re-estimated our analysis. The results presented in Tables 5–7 are not significantly different from those obtained in Tables 2–4. This implies that our results are robust irrespective of outliers.

Table 6. Foreign aid, credit, and economic growth without South Africa, Mauritius, Tunisia, Egypt, Kenya, and Botswana (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.478***	0.364***	0.399***	0.451***	0.519***
	(0.082)	(0.081)	(0.080)	(0.084)	(0.114)
lnl	−0.212***	−0.186***	−0.229***	−0.115***	−0.159***
	(0.034)	(0.029)	(0.031)	(0.034)	(0.040)
lndcps	0.399***	0.960***	0.682***	0.644***	1.184***
	(0.099)	(0.266)	(0.186)	(0.180)	(0.340)
lnhealth	−0.343***				
	(0.082)				
lnhealth × lndcps	0.035				
	(0.029)				
lnagric		−0.853***			
		(0.270)			
lnagric × lndcps		0.203**			
		(0.100)			
lneduc			−1.018***		
			(0.351)		
lneduc × lndcps			0.210		
			(0.134)		
lnhuma				−0.804***	
				(0.191)	
lnhuma × lndcps				0.230***	
				(0.075)	
lnecon					−0.955***
					(0.346)
lnecon × lndcps					0.298**
					(0.131)
Constant	7.043***	5.422***	6.832***	5.228***	4.207***
	(0.443)	(0.675)	(0.462)	(0.861)	(1.003)
Observations	469	469	469	456	463
R^2	0.514	0.505	0.540	0.154	0.210
RMSE	0.594	0.599	0.577	0.728	0.759
F	220.964	124.052	121.504	48.705	43.214
J	2.545	0.000	0.129	1.195	1.643
JP	0.111	0.984	0.719	0.274	0.200

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses.

4.3. Robustness Check Using the Lewbel 2SLS stimator

We used Lewbel's 2SLS model to re-estimate our results. The results are presented in Tables 8–10. Consistent with our results in Tables 2–4, all the aid measures (health, education, humanitarian, and economic infrastructure and services aid) significantly retard economic growth while the financial development indicators significantly enhance economic growth. The interaction effect results also indicate that most foreign aid measures interact with credit and money supply to significantly increase economic growth, except for the interaction effect of education and humanitarian aid and money supply on economic growth, which showed an insignificant positive impact.

4.4. Country-specific Analysis

Given the differences in financial development and aid inflows, we used the IV-GMM results in Table 3 to present the country-specific marginal effect of aid on economic growth.

Table 7. Foreign aid, money supply, and economic growth without South Africa, Mauritius, Tunisia, Egypt, Kenya, and Botswana (IV-GMM Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.532***	0.596***	0.518***	0.532***	0.634***
	(0.077)	(0.098)	(0.081)	(0.092)	(0.106)
lnl	−0.182***	−0.154***	−0.188***	−0.091***	−0.147***
	(0.034)	(0.031)	(0.030)	(0.035)	(0.042)
lnbm	0.911***	1.378**	1.175***	1.337***	1.826***
	(0.259)	(0.583)	(0.409)	(0.296)	(0.705)
lnhealth	−0.655***				
	(0.234)				
lnhealth × lnbm	0.122*				
	(0.069)				
lnagric		−1.339**			
		(0.623)			
lnagric × lnbm		0.318*			
		(0.187)			
lneduc			−1.653**		
			(0.809)		
lneduc × lnbm			0.379		
			(0.255)		
lnhuma				−1.500***	
				(0.326)	
lnhuma × lnbm				0.411***	
				(0.102)	
lnecon					−1.558**
					(0.788)
lnecon × lnbm					0.432*
					(0.240)
Constant	4.505***	2.357	3.893***	2.126*	0.964
	(1.049)	(2.174)	(1.414)	(1.244)	(2.266)
Observations	469	469	469	456	463
R^2	0.496	0.437	0.504	0.052	0.176
RMSE	0.606	0.641	0.602	0.774	0.778
F	251.338	69.214	120.946	36.773	32.330
J	1.503	0.001	0.096	1.576	1.582
JP	0.220	0.976	0.757	0.209	0.208

Notes: To address endogeneity concerns, the lag values of the aid proxies were treated as instruments. Hansen J-statistics J, Hansen J-statistics *p*-value JP, F-statistics represent weak instrument identification. RMSE is the root mean squared error. Robust standard errors in parentheses.

The results are presented in Figures 7–11. The results show that the mean marginal effect of aid on economic growth is positive in all the countries. However, we observed that Mauritius, South Africa, Gabon, Tunisia, and Botswana have a high effect of aid on economic growth. This can be ascribed to their developed financial system (Allen, Otchere and Senbet, 2011). We also found that Malawi, Guinea Bissau, Sierra Leone, and DRC have the lowest effect. This could also be attributed to their underdeveloped financial system (Allen, Otchere and Senbet, 2011). These are novel findings that have significant implications for practice in Africa.

5. Conclusion and Policy Recommendation

This study examines the role of financial development in foreign aid (measured by agriculture, humanitarian, health, education, and economic infrastructure and services aid) and economic growth nexus in Africa using a more recent dataset for 2002–2018. First, this study contributes to the literature by using five different measures of aid: agriculture,

Table 8. Baseline results (Lewbel 2SLS Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lnk	0.620***	0.585***	0.541***	0.444***	0.783***	0.690***	0.621***
	(0.076)	(0.075)	(0.069)	(0.065)	(0.083)	(0.097)	(0.095)
lnl	−0.204***	−0.173***	−0.193***	−0.141***	−0.153***	−0.193***	−0.151***
	(0.034)	(0.029)	(0.028)	(0.028)	(0.038)	(0.039)	(0.043)
lnhealth	−0.245***						
	(0.012)						
lnagric		−0.291***					
		(0.016)					
lneduc			−0.451***				
			(0.022)				
lnhuma				−0.235***			
				(0.013)			
lnecon					−0.161***		
					(0.020)		
lndcps						0.385***	
						(0.046)	
lnbm							0.648***
							(0.072)
Constant	7.504***	7.095***	7.609***	7.120***	6.441***	6.777***	5.243***
	(0.463)	(0.418)	(0.406)	(0.451)	(0.535)	(0.519)	(0.680)
Observations	476	476	476	463	470	463	463
R2	0.474	0.471	0.468	0.438	0.263	0.231	0.248
RMSE	0.616	0.618	0.619	0.593	0.732	0.751	0.745

Heteroscedasticity robust standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$

Table 9. Foreign aid, credit and economic growth (Lewbel 2SLS Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.109**	0.155***	0.191***	0.222***	0.341***
	(0.055)	(0.046)	(0.039)	(0.046)	(0.056)
lnl	−0.125***	−0.080***	−0.089***	−0.078***	−0.104***
	(0.018)	(0.012)	(0.013)	(0.017)	(0.016)
lndcps	0.331***	0.291***	−0.023	0.255***	0.217***
	(0.030)	(0.026)	(0.033)	(0.037)	(0.037)
lnhealth	−0.772***				
	(0.027)				
lnhealth × lndcps	0.258***				
	(0.012)				
lnagric		−0.811***			
		(0.033)			
lnagric × lndcps		0.249***			
		(0.016)			
lneduc			−0.807***		
			(0.018)		
lneduc × lndcps			0.217***		
			(0.010)		
lnhuma				−0.654***	
				(0.036)	
lnhuma × lndcps				0.192***	
				(0.016)	
lnecon					−0.674***
					(0.032)
lnecon × lndcps					0.222***
					(0.014)
Constant	5.860***	5.004***	6.094***	5.360***	5.258***
	(0.290)	(0.204)	(0.208)	(0.343)	(0.277)
Observations	534	541	544	515	535
R^2	0.771	0.848	0.865	0.706	0.798
RMSE	0.454	0.377	0.358	0.497	0.436

Heteroscedasticity robust standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$

Table 10. Foreign aid, money supply and economic growth (Lewbel 2SLS Results).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
lnk	0.443***	0.444***	0.446***	0.389***	0.682***
	(0.062)	(0.066)	(0.061)	(0.069)	(0.088)
lnl	−0.139***	−0.134***	−0.196***	−0.105***	−0.111***
	(0.025)	(0.022)	(0.022)	(0.025)	(0.031)
lnbm	1.455***	0.867***	0.707***	0.558***	1.218***
	(0.189)	(0.140)	(0.095)	(0.128)	(0.106)
lnhealth	−1.025***				
	(0.163)				
lnhealth × lnbm	0.223***				
	(0.046)				
lnagric		−0.629***			
		(0.146)			
lnagric × lnbm		0.095**			
		(0.041)			
lneduc			−0.560***		
			(0.131)		
lneduc × lnbm			0.032		
			(0.039)		
lnhuma				−0.280**	
				(0.113)	
lnhuma × lnbm				0.022	
				(0.034)	
lnecon					−0.585***
					(0.105)
lnecon × lnbm					0.123***
					(0.029)
Constant	2.324***	4.132***	5.709***	5.090***	2.271***
	(0.683)	(0.557)	(0.484)	(0.629)	(0.614)
Observations	534	541	544	515	535
R^2	0.536	0.628	0.692	0.579	0.468
RMSE	0.647	0.590	0.542	0.597	0.709

Heteroscedasticity robust standard errors in parentheses. $*\ p < 0.10$, $**\ p < 0.05$, $***\ p < 0.01$

humanitarian, health, economic infrastructure and services, and education aid. The use of these different forms of aid measures is backed by Maruta (2019) call that '*the question of aid effectiveness has shifted from "Is aggregated aid helpful?" to "Which type of aid is more helpful?" Also, donors have repeatedly stressed that they pursue multiple aims when delivering aid*'. Thus, the need to explore the differential effect of different forms of aid on economic growth in Africa. Second, this study extends the literature by probing the conditional effect relationship between financial development and foreign aid on Africa's economic growth. Finally, our study contributes to the literature by examining the country-specific marginal effect of the moderating role of financial development in the aid-growth nexus.

Using the IV-GMM technique, our findings indicated that (i) while foreign aid (measured by agriculture, humanitarian, health, education, and economic infrastructure and services aid) impedes Africa's growth, financial development (measured by domestic credit to the private sector, and money supply) spurs economic growth. (ii) the conditional effect analysis showed that financial development conditions foreign aid to spur economic growth. (iii) the country-specific analysis further showed that foreign aid has a higher growth elasticity in countries with relatively better financial systems, such as Mauritius, South Africa, Gabon, Tunisia, and Botswana, whilst the growth elasticity of aid is smaller in countries with a relatively weak financial system such as Malawi, Guinea Bissau, Sierra

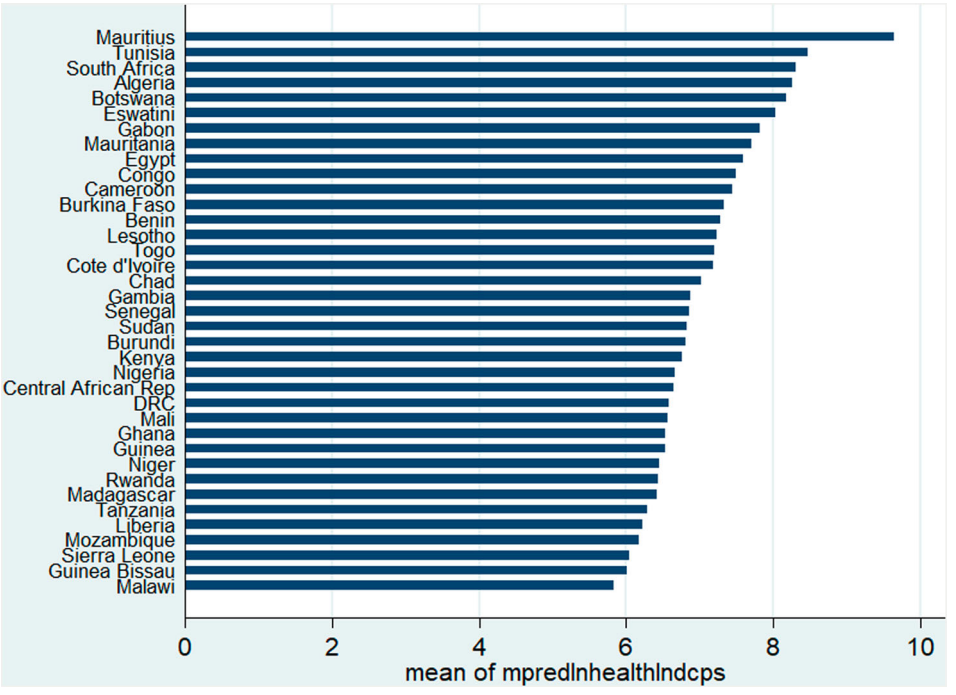

Figure 7. Marginal effect of health aid.

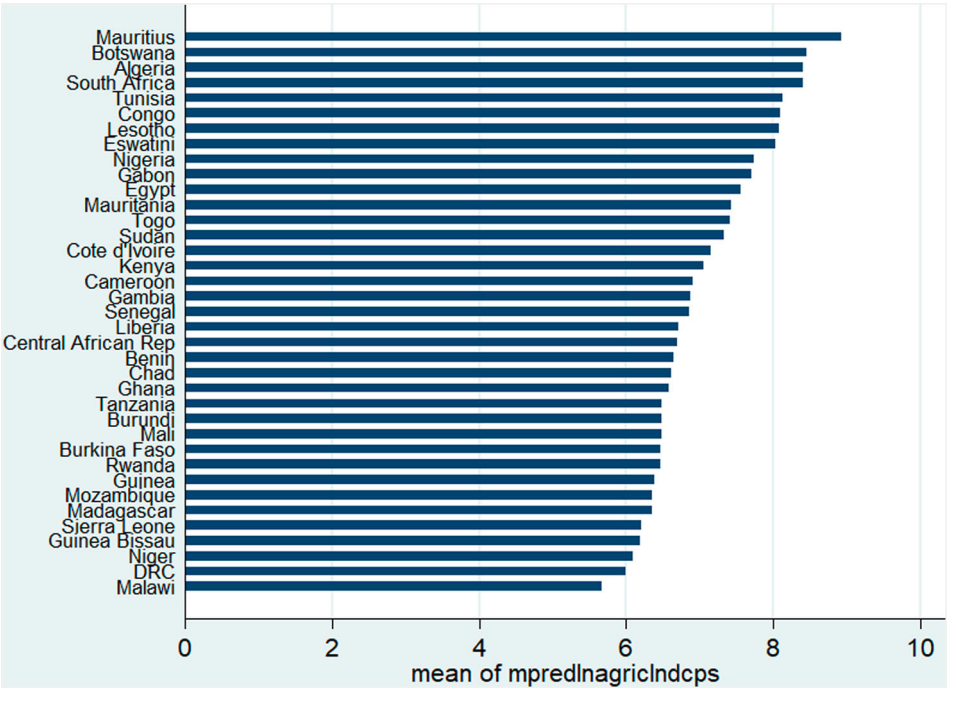

Figure 8. Marginal effect of agriculture aid.

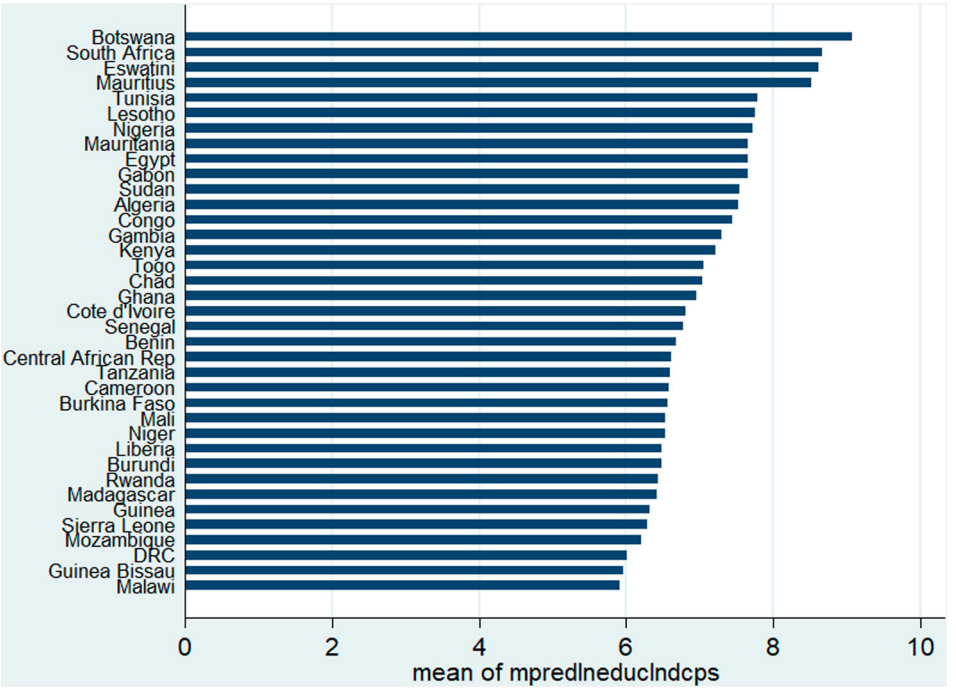

Figure 9. Marginal effect of education aid.

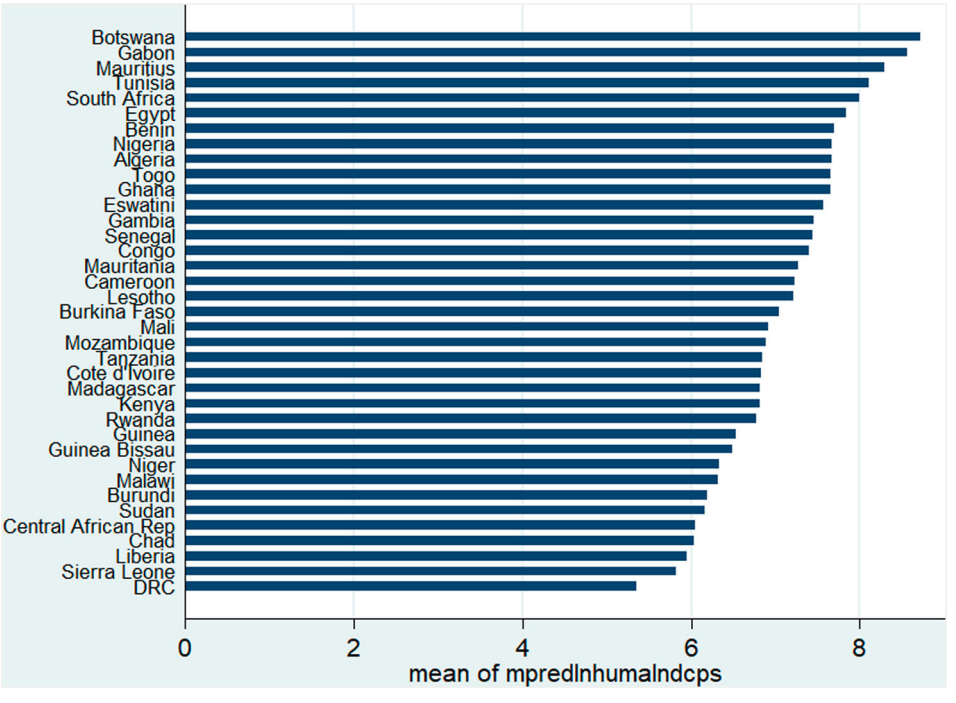

Figure 10. Marginal effect of humanitarian aid.

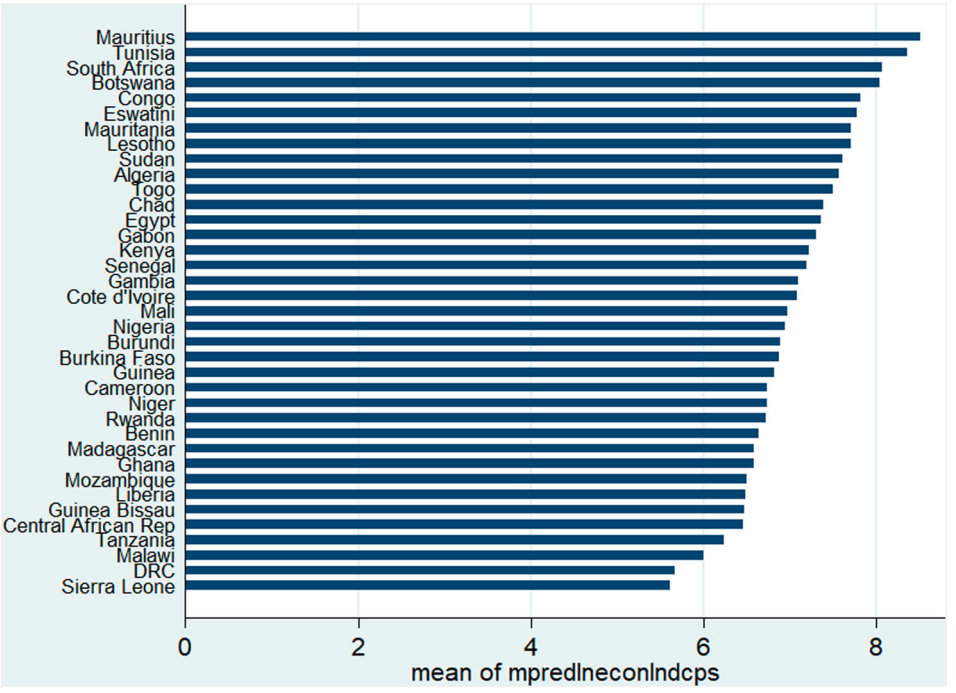

Figure 11. Marginal effect of economic infrastructure and services aid.

Leone, and the Democratic Republic of Congo. (iv) these results are robust to outliers and alternative econometric estimation approaches.

These findings offer important practical implications for policymakers in Africa. The conclusions of this study show that aid specificity such as agriculture, humanitarian, health, education, and economic infrastructure and services aids hamper economic growth in Africa. This observation could be attributed to the general observation that foreign aid inhibits economic growth in Africa since the region has weak institutions due to a high level of corruption, lack of transparency, poor regulatory system, government ineffectiveness, and poor economic policies. This suggests that improving aid effectiveness in Africa requires policymakers to strengthen and enhance existing domestic institutions. Thus, institutional reforms and implementation of good domestic economic policies remain critical for enhancing aid effectiveness in Africa. It is also argued that foreign aid has promoted dependence syndrome in Africa, thus hampering its domestic revenue mobilizations. The policy implication is that African countries should implement innovative ways to improve domestic revenue mobilization and stay away from foreign aid. Increasing domestic revenue mobilization requires digitizing African economies. Also, enhancing and empowering domestic tax mobilization authorities remains imperative for increasing tax revenue in Africa.

The findings suggest that financial development direct facilitates economic growth in Africa since a developed financial system lessens information asymmetry, channels savings into a profitable investment, promote good corporate governance, enhances transparency and hedging against risks, increases capital accumulation, and facilitates trade and labor productivity (Ang, 2008; Botev, Egert and Jawadi, 2019; Emara and El Said, 2021; Levine,

2005). These suggest that any impediments to Africa's financial system would be detrimental to the region's economic growth. Therefore, implementing policies that will ensure financial liberalization and stability in Africa is vital for driving the technological innovation needed to promote Africa's economic growth. It should be noted that creating enabling environment that will enhance the development of Africa's financial system would mitigate the adverse effect of aid on economic growth in the region.

This study focused on Africa; thus, future investigations should extend this study to other developing countries such as Asia and South America. Future studies should also use private demand as an alternative measure of economic growth since aid's overall goal is to augment the private sector's economic performance.

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References

Acheampong, A. O., Amponsah, M., & Boateng, E. (2020). Does financial development mitigate carbon emissions? Evidence from heterogeneous financial economies. *Energy Economics*, *88*, 104768. https://doi.org/10.1016/j.eneco.2020.104768

Acheampong, A. O., Appiah-Otoo, I., Dzator, J., & Agyemang, K. K. (2021a). Remittances, financial development and poverty reduction in Sub-Saharan Africa: Implications for post-COVID-19 macroeconomic policies. *Journal of Policy Modeling*, *43*. https://doi.org/10.1016/J.JPOLMOD.2021.09.005

Acheampong, A. O., Boateng, E., Amponsah, M., & Dzator, J. (2021b). Revisiting the economic growth–energy consumption nexus: Does globalization matter? *Energy Economics*, *102*, 105472. https://doi.org/10.1016/J.ENECO.2021.105472

Acheampong, A. O., Erdiaw-Kwasie, M. O., & Abunyewah, M. (2021c). Does energy accessibility improve human development? Evidence from energy-poor regions. *Energy Economics*, *96*, 105–165. https://doi.org/10.1016/j.eneco.2021.105165

Acquah, A. M., & Ibrahim, M. (2019). Foreign direct investment, economic growth and financial sector development in Africa. *Journal of Sustainable Finance & Investment*, *10*(0), 1–20. https://doi.org/10.1080/20430795.2019.1683504

Adeleye, N., & Eboagu, C. (2019). Evaluation of ICT development and economic growth in Africa. *NETNOMICS: Economic Research and Electronic Networking*, *20*, 31–53. https://doi.org/10.1007/s11066-019-09131-6.

Agapova, A., & Vishwasrao, S. (2020). Financial sector foreign aid and financial intermediation. *International Review of Financial Analysis*, *72*(September), 101589. https://doi.org/10.1016/j.irfa.2020.101589

Akinlo, T., Yinusa, D. O., & Adejumo, A. V. (2020). *Financial development and real sector in sub-Saharan Africa*. *Economic Change and Restructuring*, *54*, 417–455. https://doi.org/10.1007/s10644-020-09283-8.

Albiman, M. (2016). What are the impact of foreign Aid to the economic growth? Time series analysis with New evidence from Tanzania. *Business and Economics Journal*, *7*(3), 1–7https://doi.org/10.4172/2151-6219.1000237.

Alemu, A. M., & Lee, J. S. (2015). Foreign aid on economic growth in Africa: A comparison of low and middle-income countries. *South African Journal of Economic and Management Sciences*, *18*(4), 449–462. https://doi.org/10.17159/2222-3436/2015/V18N4A1

Alexiou, C., & Vogiazas, S. (2018). 'Reassessing the relationship between the financial sector and economic growth: Dynamic panel evidence', (May 2016), pp. 1–19. doi: 10.1002/ijfe.1609.

Allen, F., Otchere, I., & Senbet, L. W. (2011). African financial systems: A review. *Review of Development Finance*, *1*(2), 79–113. https://doi.org/10.1016/J.RDF.2011.03.003

Aluko, O. A., & Ibrahim, M. (2020). Institutions and the financial development – economic growth nexus in sub - Saharan Africa. *Economic Notes*, *49*(3), 1–16. https://doi.org/10.1111/ecno.12163.

Ang, J. B. (2008). A survey of recent developments in the literature of finance and growth. *Journal of Economic Surveys*, *22*(3), 536–576. https://doi.org/10.1111/j.1467-6419.2007.00542.x

Ang, J. B. (2010). Does foreign aid promote growth? exploring the role of financial liberalization. *Review of Development Economics*, *14*(2), 197–212. https://doi.org/10.1111/j.1467-9361.2010.00547.x

Anyanwu, J. C. (2014). Factors affecting economic growth in Africa: Are There any lessons from China? *African Development Review*, *26*(September 2014), 468–493. https://doi.org/10.1111/1467-8268.12105

Appiah-Otoo, I., & Song, N. (2020). Finance-growth nexus: New insight from Ghana. *International Journal of Finance and Economics*(September), 1–42. https://doi.org/10.1002/ijfe.2294

Appiah-Otoo, I., & Song, N. (2021a). The impact of fintech on poverty reduction: evidence from China. *Sustainability (Switzerland)*, *13*(9), 1–13. https://doi.org/10.3390/su13095225.

Appiah-Otoo, I., & Song, N. (2021b). The impact of ICT on economic growth-comparing rich and poor countries. *Telecommunications Policy*, *45*(2), 102082. https://doi.org/10.1016/j.telpol.2020.102082

Appiah-Otoo, I., Song, N., Acheampong, A.O., & Yao, X. (2021). Crowdfunding and renewable energy development: What does the data say? *International Journal of Energy Research*, *43*(2), 1837–1852. https://doi.org/10.1002/ER.7301.

Asongu, S. A. (2015). Institutional benchmarking of foreign aid effectiveness in Africa. *International Journal of Social Economics*, *42*(6), 543–565. https://doi.org/10.1108/IJSE-12-2013-0286

Asongu, S. A., & Odhiambo, N. M. (2020). Foreign direct investment, information technology and economic growth dynamics in Sub-Saharan Africa. *Telecommunications Policy*, *44*(1), 101838. https://doi.org/10.1016/j.telpol.2019.101838

Awaworyi Churchill, S., & Smyth, R. (2017). Ethnic Diversity and Poverty. *World Development*, *95*, 285–302. https://doi.org/10.1016/j.worlddev.2017.02.032

Babalola, S., & Shittu, W. (2020). Foreign Aid and economic growth in West Africa: Examining the roles of institutions. *International Economic Journal*, *34*(3), 534–552. https://doi.org/10.1080/10168737.2020.1780292

Baum, C. F., Schaer, M. E., & Stillman, S. (2002). Instrumental variables and GMM: Estimation and testing. Working Paper. Boston College Economics.

Baum, C. F., Schaffer, M. E., & Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *The Stata Journal: Promoting Communications on Statistics and Stata*, *3*(1), 1–31. https://doi.org/10.1177/1536867(0300300101

Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking and Finance*, *28*(3), 423–442. https://doi.org/10.1016/S0378-4266(02)00408-9

Bird, G., & Choi, Y. (2020). The effects of remittances, foreign direct investment, and foreign aid on economic growth: An empirical analysis. *Review of Development Economics*, *24*(1), 1–30. https://doi.org/10.1111/rode.12630

Botev, J., Egert, B., & Jawadi, F. (2019). The nonlinear relationship between economic growth and fi nancial development: evidence from developing, emerging and advanced economies a. *International Economics*, *160*(July), 3–13. https://doi.org/10.1016/j.inteco.2019.06.004

Burnside, C., & Dollar, D. (2000). Aid, policies, and growth. *The American Economic Review*, *90*(4), 847–868. https://doi.org/10.1257/aer.90.4.847

Caporale, G. M., Rault, C., Sova, A.D., & Sova, R. (2014). Financial development and economic growth: Evidence from 10 New European Union Members. *International Journal of Finance and Economics*, *20*(1), 48–6010.1002/ijfe.1498.

Chen, K. C., Wu, L., & Wen, J. (2013). The relationship between fi nance and growth in China. *Global Finance Journal*, *24*(1), 1–12. https://doi.org/10.1016/j.gfj.2013.03.006

Chikalipah, S., & Makina, D. (2019). *Extending Financial Inclusion in Africa.* (pp. 89–111). Elsevier. https://doi.org/10.1016/B978-0-12-814164-9.00005-0.

Demetriades, P. O., & James, G. A. (2011). Finance and growth in Africa: The broken link. *Economics Letters*, *113*(3), 263–265. https://doi.org/10.1016/j.econlet.2011.08.007

Dollar, D., & Easterly, W. (1999). The search for the key: aid, investment and policies in Africa. *Journal of African Economies*, *8*(4), 546–577.

Ductor, L., & Grechyna, D. (2015). Financial development, real sector, and economic growth. *International Review of Economics and Finance*, *37*(May 2015), 393–405. https://doi.org/10.1016/j.iref.2015.01.001.

Ekanayake, E. M., & Chatrna, D. (2017). The effects of foreign aid on economic growth in developing countries. *Journal of International Business and Cultural Studies*, *51*(3), 153–171. https://doi.org/10.1353/jda.2017.0066

Emara, N., & El Said, A. (2021). Financial inclusion and economic growth: The role of governance in selected MENA countries. *International Review of Economics and Finance*, *75*(February), 34–54. https://doi.org/10.1016/j.iref.2021.03.014

Haftu, G. G. (2019). Information communications technology and economic growth in Sub-Saharan Africa: A panel data approach. *Telecommunications Policy*, *43*(1), 88–99. https://doi.org/10.1016/j.telpol.2018.03.010

Hook, S., & Singh, N. (2014). Does too much finance harm economic growth? *Journal of Banking Finance*, *41*, 36–44. https://doi.org/10.1016/j.jbankfin.2013.12.020

Jalil, A., Feridun, M., & Ma, Y. (2010). Finance-growth nexus in China revisited: new evidence from principal components and ARDL bounds tests. *International Review of Economics and Finance*, *19*(2), 189–195. https://doi.org/10.1016/j.iref.2009.10.005

Kar, M., Nazlioğlu, Ş, & Ağir, H. (2011). Financial development and economic growth nexus in the MENA countries: Bootstrap panel granger causality analysis. *Economic Modelling*, *28*(1–2), 685–693. https://doi.org/10.1016/j.econmod.2010.05.015

Karras, G. (2006). Foreign aid and long-run economic growth: Empirical evidence for a panel of developing countries. *Journal of International Development*, *18*(1), 15–28. https://doi.org/10.1002/jid.1187

Kumi, E. (2020). From donor darling to beyond aid? Public perceptions of "Ghana beyond Aid". *Journal of Modern African Studies*, *58*(1), 67–90. https://doi.org/10.1017/S0022278X19000570

Law, S. H., & Singh, N. (2014). Does too much finance harm economic growth? *Journal of Banking and Finance*, *41*(1), 36–44. https://doi.org/10.1016/j.jbankfin.2013.12.020

Levine, R. (2005). Chapter 12 Finance and growth: Theory and evidence. *Handbook of Economic Growth*, *1*(SUPPL. PART A), 865–934. https://doi.org/10.1016/S1574-0684(05)01012-9

Lewbel, A. (2012). Using Heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. *Journal of Business and Economic Statistics*, *30*(1), https://doi.org/10.1080/07350015.2012.643126

Maruta, A. A. (2019). Can aid for financial sector buy financial development? *Journal of Macroeconomics*, *62*(November 2018), 103075. https://doi.org/10.1016/j.jmacro.2018.11.003

Maruta, A. A., Banerjee, R., & Cavoli, T. (2020). Foreign aid, institutional quality and economic growth: evidence from the developing world. *Economic Modelling*, *89*(May 2019), 444–463. https://doi.org/10.1016/j.econmod.2019.11.008

Meersman, H., & Nazemzadeh, M. (2017). The contribution of transport infrastructure to economic activity: The case of Belgium. *Case Studies on Transport Policy*, *5*(2), 316–324. https://doi.org/10.1016/j.cstp.2017.03.009

Mishra, V., & Smyth, R. (2015). Estimating returns to schooling in urban China using conventional and heteroskedasticity-based instruments. *Economic Modelling*, *47*, 166–173. https://doi.org/10.1016/j.econmod.2015.02.002

Murinde, V. (2012). Financial development and economic growth: Global and African evidence. *Journal of African Economies*, *21*(SUPPL.1), i10–i56. https://doi.org/10.1093/jae/ejr042.

Nkusu, M., & Sayek, S. (2004). Local financial development and the aid-growth relationship.

Nwaogu, U. G., & Ryan, M. J. (2015). FDI, foreign Aid, remittance and economic growth in developing countries. *Review of Development Economics*, *19*(1), 100–115. https://doi.org/10.1111/rode.12130

Olalekan, C., Sunday, O., & Oladeji, I. (2021). Moderating the effect of institutional quality on the finance-growth nexus: insights from West African countries. *Economic Change and Restructuring*, *54*, 43–74. https://doi.org/10.1007/s10644-020-09275-8.

Peia, O., & Roszbach, K. (2015). Finance and growth: time series evidence on causality. *Journal of Financial Stability*, *19*, 105–118. https://doi.org/10.1016/j.jfs.2014.11.005

Peprah, J. A., Ofori, I. K., & Asomani, A. N. (2019). Financial development, remittances and economic growth: A threshold analysis. *Cogent Economics and Finance*, *7*(1), https://doi.org/10.1080/23322039.2019.1625107

Pradhan, R. P., Mak, B.A., Bahmani, S, et al. (2017). Finance and growth: Evidence from the ARF countries. *Quarterly Review of Economics and Finance*, *66*, 136–148. https://doi.org/10.1016/j.qref.2017.01.011

Ram, R. (2004). 'Recipient country's "policies" and the effect of foreign aid on economic growth in developing countries: Additional evidence'. *Journal of International Development*, *16*(2), 201–211. https://doi.org/10.1002/jid.1071

Rousseau, P. L., & Wachtel, P. (2011). What is happening to the impact of financial deepening on economic growth? *Economic Inquiry*, *49*(1), 276–288. https://doi.org/10.1111/j.1465-7295.2009.00197.x

Salah, G., Sjö, B., & Shahbaz, M. (2013). The causal nexus between financial development and economic growth in Kenya. *Economic Modelling*, *35*, 701–707. https://doi.org/10.1016/j.econmod.2013.08.031

Samargandi, N., Fidrmuc, J., & Ghosh, S. (2015). Is the relationship between financial development and economic growth monotonic? evidence from a sample of middle-income countries. *World Development*, *68*, 66–81. https://doi.org/10.1016/j.worlddev.2014.11.010

Sepehrdoust, H., & Ghorbanseresht, M. (2019). Impact of information and communication technology and financial development on economic growth of OPEC developing economies. *Kasetsart Journal of Social Sciences*, *40*(3), 546–551. https://doi.org/10.1016/j.kjss.2018.01.008

Sethi, N., Bhujabal, P., Das, A., & Sucharita, S. (2019). Foreign aid and growth nexus: empirical evidence from India and Sri Lanka. *Economic Analysis and Policy*, *64*, 1–12. https://doi.org/10.1016/j.eap.2019.07.002

Seven, Ü. & Yetkiner, H. (2016). Financial intermediation and economic growth: does income matter?. *Economic Systems*, https://doi.org/10.1016/j.ecosys.2015.09.004

Shen, C., & Lee, C. (2015). Same financial development yet different economic growth-why? *Journal of Money, Credit, and Banking*, *38*(7), 1907–1944. https://doi.org/10.1353/mcb.2006.0095

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, *70*(1), 65–94. https://doi.org/10.2307/1884513

Sothan, S. (2018). Foreign aid and economic growth: Evidence from Cambodia. *Journal of International Trade and Economic Development*, *27*(2), 168–183. https://doi.org/10.1080/09638199.2017.1349167

Stock, J. H., Wright, J. H., & Yogo, M. (2012). A Survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics*, *20*(4), 518–529. https://doi.org/10.1198/073500102288618658

Sutton, C. N., & Jenkins, B. (2007). The Role of the financial services sector in expanding economic opportunity.

Swamy, V. (2018). 'An alternate approach in exploring the causal link between financial development and economic growth — Evidence from advanced economies', (September 2017), pp. 55–76. doi:10.1002/ijfe.1604.

Tahir, M., Estrada, M. A. R., & Afridi, A. (2019). Foreign inflows and economic growth: An emiprical study of the SAARC region. *Economic Systems*, *43*(3-4), 100702. https://doi.org/10.1016/j.ecosys.2019.100702.

Tsaurai, K. (2018). Complementarity between foreign aid and financial development as a driver of economic growth in selected emerging markets. *Comparative Economic Research. Central and Eastern Europe*, *21*(4), 45–61. https://doi.org/10.2478/cer-2018-0026

Wahyoe, S., Iftekhar, H., & Nuruzzaman, A. (2017). Non-linearity in the finance-growth nexus: evidence from Indonesia. *International Economics*, *150*(December 2016), 19–35. https://doi.org/10.1016/j.inteco.2016.11.003

Zhang, J., Wang, L., & Wang, S. (2012). Financial development and economic growth: Recent evidence from China. *Journal of Comparative Economics*, *40*(3), 393–412. https://doi.org/10.1016/j.jce.2012.01.001