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Article

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Asymmetric and shock effects of foreign AID on economic growth and employment generation

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ABSTRACT

The implications of foreign aid on economic growth and employment have been subjected to intense debate, with most studies focused on aggregated aid. However, different types of aid will probably affect growth and employment differently. Therefore, aggregating aid flows are most likely to provide ambiguous conclusions on their implication on employment and economic growth. The study investigates the asymmetric and shock effect of aggregated aid inflows and sectoral aid disbursement on growth and employment in Nigeria using a Non-linear Autoregressive Distributed Lags and Vector Error Correction Model. Evidence from the result shows that positive and negative shocks in aggregate aid increase and reduce growth in the long run, respectively, while negative shocks reduce growth in the short run. Likewise, positive shock reduces employment in the long run. And positive and negative shocks in aggregate aid reduce and promote employment, respectively, in the short run. However, the implications of the asymmetric effects of sectoral aid differ on growth and employment. The study reveals that positive shock in education and health aid increases employment in the long run, while positive shock in health and industry aid undermines growth in the short run. Also, positive shock in infrastructural aid decreases employment in the long run, while positive and negative shocks in infrastructural aid instigate employment in the short run. And these results confirm the asymmetry of sectoral and aggregated aid on employment and growth. In addition, evidence from the variance decomposition tables shows that aggregated aid shock affects economic growth more than employment. Also, education and infrastructural aid affect economic growth more than employment. At the same time, health and industry aid affect employment more than economic growth. Based on the outcome of the findings, the study suggests the need to safeguard the aid inflow into the country and channel it to promote pro-growth in human capital formation to ensure long-term employment growth, especially education and health aid.

Introduction

Promoting economic growth is the short-term macroeconomic objective of many nations worldwide. It is necessary for attaining sustainable economic development that will increase aggregate welfare (Asaleye & Strydom, 2022). However, there are theoretical linkages between aid, output, and employment (Nchofoung et al., 2022; Milgrom & Roberts, 1995; Keynes & de Largentaye, 1942). The Keynesian theory of employment creates a concept that is the primary driver of output by emphasising demand. As a result, aggregate demand is a key factor in determining the degree of employment in the economy. Incorporating Keynes's idea of quantity demanded with the complementarity theory, which holds that job growth is a function of consumption anticipated by output sectors complementing by aid consumption (Milgrom & Roberts,

1995; Keynes & de Largentaye, 1942). From this theory, the connection between foreign aid, on the one hand, and output and employment, on the other hand, can be established.

Empirically, the implications of foreign aid on economic growth and employment have been subjected to intense debate (Asafo-Agyei & Kodongo (2022); Nchofoung et al., 2022; Xu & Zhang, 2022). However, foreign aid is presumed to advance developing nations' welfare and economic growth (OECD, 2022). Subsequently, the empirical literature has argued that foreign aid to poorer countries helps to engage in restructuring, rehabilitation, or structural reforms that would improve the people's economic development and standard of living (Munyanyi & Churchill, 2022; Fashina et al., 2018). It is one of the significant sources of finance for most African and less-developed economies, including Nigeria. In addition, an important aspect of the policy discourse has

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Table 1a
Data Sources and Description.

Variable	Coeff.	Description	Sources	Empirical Justification	Expected Sign
Output	GDP	GDP per capital	WDI	Dependent Variable	Dependent variable
Employment	LAB	Sum of employment	WDI	Nchofoung et al. (2021)	+ with GDP
Capital	CAP	Gross capital formation	WDI	Adebayo and Beton Kalmaz (2020)	+ with GDP
Human Capital	HUC	Secondary enrollment	WDI	Fashina et al. (2018)	+ with GDP
Vale added	VLA	Value added	WDI	Chen et al. (2012)	+ with LAB
Wages	WAG	Wages received	WDI	Asaleye et al. (2021)	+ with LAB
Aid (aggregated)	AID	Aggregated aid received	OECD	Boateng et al. (2021)	+ with GDP & LAB
Aid (disaggregated)					
Education	EDD	Aid on education	OCED	Boateng et al. (2021)	+ with GDP & LAB
Health	HED	Aid on health	OECD	Boateng et al. (2021)	+ with GDP & LAB
Industry	IND	Aid in industry	OECD	Boateng et al. (2021)	+ with GDP & LAB
Infrastructural	IFD	Aid on Infrastructural	OECD	Boateng et al. (2021)	+ with GDP & LAB
Control Variables					
Trade openness	TRO	Inflow of goods/GDP	WDI	Babalola et al (2019)	+ or – with GDP & LAB
Exchange rate	EXC	Real exchange rate	WDI	Ogunjobi et al (2022)	+ or – with GDP & LAB
Interest rate	INT	Real interest rate	WDI	Ogunjobi et al (2022)	- with GDP & LAB
Institutional Quality	INQ	Institutional Quality Index	WGI	Dzhumashev & Hailemariam (2021)	+ with GDP & LAB

WDI – World Bank Database.

OECD – Organisation for Economic Co-operation and Development, Credit reporting.

WGI – World Governance Indicators.

Source: Author’s computation.

Table 1b
Descriptive statistics and Correlation Results.

Descriptive statistics															
	AID	CAP	EDD	EXC	GDP	HED	HUC	IFD	IND	INT	LAB	TRO	VLA	WAG	INQ
Mean	2.87	12.08	1.75	2.00	5.52	2.12	6.93	1.76	0.83	5.80	1.74	1.88	13.73	1.22	-0.70
Median	3.06	12.16	1.87	2.00	5.54	2.17	6.99	1.94	0.99	5.78	1.76	1.84	13.77	1.25	-0.66
Max.	4.10	12.41	2.12	2.10	5.59	3.09	7.10	2.28	1.79	19.43	1.77	2.27	13.87	1.31	-0.53
Min.	-0.10	11.66	0.36	1.86	5.38	1.41	6.56	-0.02	-1.44	-7.06	1.68	1.58	13.48	1.02	-1.02
Std. Dev.	0.84	0.23	0.32	0.07	0.06	0.31	0.14	0.46	0.75	5.78	0.03	0.17	0.12	0.08	0.13
Skewness	-2.18	-0.59	-1.68	-0.51	-0.82	0.22	-0.90	-1.47	-1.15	-0.06	-0.47	0.35	-0.61	-0.84	-1.00
Kurtosis	8.60	2.01	7.01	2.26	2.43	3.86	2.89	5.23	3.95	2.92	1.62	2.54	1.96	2.71	3.27
Obs.	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Correlation Analysis															
	AID	CAP	EDD	EXC	GDP	HED	HUC	IFD	IND	INT	LAB	TRO	VLA	WAG	INQ
AID	1														
CAP	0.24	1													
EDD	0.66	0.74	1												
EXC	0.34	0.72	0.74	1											
GDP	0.41	0.62	0.64	0.62	1										
HED	-0.40	0.29	0.10	0.36	0.28	1									
HUC	0.29	0.62	0.74	0.83	0.89	0.33	1								
IFD	0.43	0.69	0.85	0.68	0.78	0.22	0.64	1							
IND	0.44	0.75	0.78	0.78	0.87	0.17	0.89	0.77	1						
INT	-0.02	0.28	0.30	0.30	0.38	0.36	0.17	0.52	0.21	1					
LAB	-0.07	-0.79	-0.53	-0.71	-0.63	-0.26	-0.73	-0.48	-0.61	-0.10	1				
TRO	-0.28	-0.61	-0.71	-0.78	-0.62	-0.43	-0.62	-0.64	-0.79	-0.35	0.53	1			
VLA	0.33	0.78	0.61	0.52	0.76	0.26	0.74	0.75	0.67	0.29	-0.81	-0.64	1		
WAG	0.40	0.86	0.81	0.79	0.73	0.12	0.52	0.74	0.68	0.19	-0.72	-0.70	0.77	1	
INQ	0.43	0.71	0.78	0.61	0.86	0.04	0.85	0.70	0.72	0.28	-0.64	-0.52	0.50	0.63	1

Source: Authors’ Computation.

focused on aid effectiveness in reducing poverty and promoting employment and output because many developing nations, especially African countries, still experience financial hardship and depend on foreign aid (OECD, 2022). Despite considerable theoretical and empirical support for the usefulness of foreign aid in spurring economic growth, the empirical issues remain complex and unresolved (Nchofoung et al., 2022; Milgrom & Roberts, 1995; Keynes & de Largentaye, 1942; Dzhumashev & Hailemariam, 2021; Civelli et al., 2018). A strand of literature argued that aid promotes economic growth and employment by relieving developing nations of capital shortage by creating the

physical and human capital required to maintain economic progress and development (Heinrich et al., 2016; Nchofoung et al., 2022). However, another strand of literature contends that giving aid to developing economies hindered economic growth and negatively affected employment by displacing savings, leading to issues with aid dependence (Kamguia et al., 2022).

The over-reliance on petroleum as the major revenue source makes the Nigerian economy susceptible to oil crude prices shock in the global market. Consequently, the annual GDP growth rate decline from 3.52 per cent in 2014 to -0.01 in 2015 signalled the country’s vulnerability

Table 2
Stationary Test Result.

ADF (Augmented Dickey-Fuller) Unit Root Stationarity Test Result					
Series	At Level		At First Difference		Order of Integration
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
AID	-3.593083***	-3.120663	-	-9.283454***	Mixed
CAP	-2.237807	-2.166397	-3.682649**	-3.132905*	I (1)
EDD	-2.821691*	-3.387651*	-5.979102***	-6.057904***	I (1)
EXC	-2.519715	-2.204272	-3.823123**	-3.158624	I (1)
GDP	-2.463669	-1.695859	-3.475979**	-3.023020**	I (1)
HED	-3.434922**	-2.447763*	-	-4.275700***	Mixed
HUC	-2.927572**	-2.084368	-	-5.989782***	I (1)
IFD	-2.730929*	-3.258799*	-10.93003***	-11.18145***	I (1)
IND	-4.636951***	-2.339883	-	-6.925304***	Mixed
INT	-2.293404	-2.375663	-3.883098***	-3.846287**	I (1)
LAB	-0.631812	-2.141808	-4.953139**	-1.740276**	I (1)
TRO	-1.735219	-0.763072	-4.543145**	-4.231630**	I (1)
VLA	-2.432104	-1.507171	-3.552853**	-3.458865**	I (1)
WAG	-1.287934	-1.917202	-3.479264**	-2.519897**	I (1)
INQ	-2.335516	-3.043172	-6.633727***	-6.740052***	I (1)

PP (Phillips-Perron) Unit Root Stationarity Test Result					
Series	At Level		At First Difference		Order of Integration
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
AID	-3.585963***	-3.021971***	-	-	I (0)
CAP	-0.754092	-1.630351	-4.661295***	-4.639976***	I (1)
EDD	-2.376036	-2.634995	-9.739673***	-10.61359***	I (1)
EXC	-1.456209	-1.564950	-4.234835***	-4.345585***	I (1)
GDP	-3.255246***	-0.561086	-	-3.204394**	Mixed
HED	-3.542304***	-3.998956**	-	-	I (0)
HUC	-1.179214	-2.607974	-5.099077***	-5.016538***	I (1)
IFD	-2.621789*	-3.258674*	-10.69964***	-10.93297***	I (1)
IND	-1.831302	-2.505621	-3.548568***	-3.367288**	I (1)
INT	-3.137816**	-3.004838*	-	-5.818356***	Mixed
LAB	0.058264	-2.022954	-3.552082***	-3.478300**	I (1)
TRO	-1.337762	-1.313969	-5.141765***	-5.345551***	I (1)
VLA	-4.008629***	-0.401388	-	-3.412913**	Mixed
WAG	-3.007708**	-2.517952	-	-3.830989**	Mixed
INQ	-2.328496	-3.064880	-8.951702***	-9.005521***	I (1)

KPSS (Kwiatkowski-Phillips-Schmidt-Shin) Unit Root Stationarity Test					
Series	At Level		At First Difference		Order of Integration
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
AID	0.982097	0.306215	0.772364	0.083732***	I (1)
CAP	1.146686	0.244188	0.097373***	0.078255***	I (1)
EDD	0.896623	0.248269	0.248187	0.091176***	I (1)
EXC	0.977909	0.199844*	0.130090***	0.064862***	I (1)
GDP	0.982097	0.306215	0.772364	0.083732***	I (1)
HED	0.257783***	0.123222***	-	-	I (0)
HUC	1.050573	0.232448	0.062430***	0.063619***	I (1)
IFD	0.816322	0.226799	0.101221***	0.042109***	I (1)
IND	0.943822	0.232612	0.044507***	0.026488***	I (1)
INT	0.212145***	0.132302***	-	-	I (0)
LAB	1.117504	0.245343	0.208421***	0.152297**	I (1)
TRO	0.770059	0.255377	0.153758***	0.155792**	I (1)
VLA	1.183523	0.307669	0.794549	0.089888***	I (1)
WAG	1.112076	0.251724	0.307487**	0.087143***	I (1)
INQ	1.032701	0.218662	0.119943***	0.038640***	I(1)

Source: Authors' Computation.

(Ogunjobi et al., 2022). Nonetheless, Nigeria has been an attractive destination for foreign aid. Although, the volume of foreign aid the government has been given has varied in Nigeria over the years. For example, Nigeria's aid receipts progressively declined between 1970 and 1979 (from \$590.47 million to \$28.92 million), then increased to \$473.63 million in 1989. Between 1990 and 2004, there was no clear trend in the quantity of aid received by the country. However, by 2005, Nigeria had seen a significant rise in aid volume. From \$360.78 million in 2004 to \$6400 million in 2005, it decreased to \$1960 million in 2007. However, the aid increased to \$11420 million in 2006. In 2017 and 2018, the value stood at \$3360 million and \$3300 million, respectively. Furthermore, foreign aid to Nigeria was valued at \$3280 million in

2019, compared to the world average of \$840.02 million based on 131 nations (World Bank Group, 2021). Many factors may be attributed to this but mainly due to the increase in aid volume in Nigeria. Likewise, foreign aid increased to 3380 million in 2020 (World Bank Group, 2021).

In addition, despite the increased foreign aid to Nigeria, the macroeconomic indicators towards sustainable growth and development have remained low (World Bank Group, 2021; Asaley et al., 2021). An increase in the unemployment rate has been a prevailing macroeconomic challenge affecting Nigerian's economy for a while, despite various macroeconomic reforms and policies (Ogunjobi et al., 2022). Nigeria's unemployment rate stood at 33 per cent in 2022. And in the

Table 3
Bound Test for the Models.

Using GDP as a Dependent variable				
Null Hypothesis: No cointegration				
Test Statistic	Value	Significance	Lower Bound	Upper Bound
F-statistic	81.67946	10 per cent	1.76	2.77
		5 per cent	1.98	3.04
		2.5 per cent	2.18	3.28
		1 per cent	2.41	3.61
Using employment as a Dependent variable				
Null Hypothesis: No cointegration				
Test Statistic	Value	Significance	Lower Bound	Upper Bound
F-statistic	32.84924	10 per cent	1.76	2.77
		5 per cent	1.98	3.04
		2.5 per cent	2.18	3.28
		1 per cent	2.41	3.61
Using GDP as a Dependent variable				
Null Hypothesis: No cointegration				
Test Statistic	Value	Significance	Lower Bound	Upper Bound
F-statistic	38.55467	10 per cent	1.76	2.77
		5 per cent	1.98	3.04
		2.5 per cent	2.18	3.28
		1 per cent	2.41	3.61
Using employment as a Dependent variable				
Null Hypothesis: No cointegration				
Test Statistic	Value	Significance	Lower Bound	Upper Bound
F-statistic	16.97633	10 per cent	1.76	2.77
		5 per cent	1.98	3.04
		2.5 per cent	2.18	3.28
		1 per cent	2.41	3.61

Source: Authors Computation.

previous year, 2021, the unemployment rate was 32.5 per cent. Also, official statistics have demonstrated that the unemployment rate in Nigeria has been steadily increasing over the previous years (Trading Economics, 2022). Likewise, the Nigerian economy witnessed steady economic growth between 2000 and 2014 at an average of 7 per cent. However, the annual real GDP growth rate decreased to 2.7 per cent in 2015 and -1.6 per cent in 2016 due to the drop of crude oil in the international market; this is a result of the economy's over-reliance on petroleum, which rendered it vulnerable to crude oil prices shock on the world market. However, the growth recovered to 0.8 per cent in 2017, then 1.9 per cent in 2018, before remaining stable at 2 per cent in 2019. In 2020, the growth rate reduced to -1.8 per cent and increased to 3.6 per cent in 2021. However, this growth rate has not transformed into improved welfare and development. So, promoting board-based growth remained the major task for Nigeria's economy.

Foreign aid comprises humanitarian aid and development assistance. Humanitarian aid is mostly used to achieve short-term goals; this type of aid is given when there is a disaster, the need to respond to an incident or event such as during the COVID-19 era, and issues about lives saving. While some scholars share the perspective that humanitarian aid may encourage illicit financial flows in developing economies (Islamaj and Kose, 2022; Owen, 2022). However, development assistance, on the other hand, focuses on long-term goals and is mostly given to developing economies in response to systemic problems to stimulate economic, social and political development. In this study, we streamline the disaggregated or sectoral aid into four: industrial, infrastructural, education, and health. The component of human capital formation, among others, include education and health; this has long been established in literature to promote economic growth and employment (Mankiw et al., 1992; Ogunjobi et al., 2022). In addition, the linkages between industrial and infrastructural development bolster growth and employment

generation have also been documented in the literature (Nkemgha et al., 2023; Jahanger et al., 2022; Appiah et al., 2022). Although, the implications of foreign aid on economic growth and employment have been subjected to intense debate, with most studies focused on aggregated aid (Fashina et al., 2018; Dzhumashev & Hailemariam, 2021; Boateng & Mahmood, 2021). However, different types of aid may probably affect growth and employment differently. Therefore, aggregating aid flows may provide ambiguous conclusions on their implication on employment and economic growth. Thus, in this study, we conducted a comparative analysis of aggregated and disaggregated aid focusing on four sectoral development assistance and its implication on growth and employment in Nigeria.

Consequently, there is broad agreement that Africa's output sectors, especially Nigeria, are still underdeveloped due to inadequate capital, despite various reforms. Nigeria's scarcity of financial resources compels the country to turn to debt. As a result, Nigeria's government debt climbed from 100,069.89 USD in the first quarter of 2022 to 103,312.80 USD in the second quarter (Debt Management Office, 2022). An alternative source of financing is aid. Although, the official statistics have shown that the Nigerian government has benefited from a huge amount of aid over the years. However, given the country's high unemployment rate and low growth rate, there is a need to re-examine the implication of aid on employment and output. In addition, most studies investigated the impact of aid on the aggregate form on the economy using the wavelet coherence approach, two stages least square, error correction model and ordinary least square (Adebayo and Beton Kalmaz, 2020; Saibu & Objoesio, 2017; Oziengbe, 2017; Ugwuegba, Okafor & Akarogbe, 2016).

Although, studies by Babalola, Mohd, Ehigiamusoe and Onikola (2019) and, Ogbuabor, Agu, Odo and Nchege (2017) use autoregressive distributed lags (ARDL). However, both studies neglected the shock impacts of aid on the economy and did not disaggregate the aid data. The mixed result on the implications of aid on the economy has been documented in empirical studies (Boateng et al., 2021; Babalola et al., 2019; Fashina et al., 2018). Many factors may be attributed to this, among other, the error of measurement and technique of estimation. Therefore, this study contributes to empirical literature in three ways. First, investigate the sectoral effects of aid in the long and short run on economic growth and employment in Nigeria; this is necessary given the high unemployment rate in Nigeria and the external shock of COVID and crude oil prices which has affected the output in Nigeria, second, by investigating the asymmetric effect of aid on economic growth and employment using non-linear autoregressive distributed lags. Finally, examine the shock effect of aid on employment and economic growth. The study's broad objective is to investigate aid's impact on economic growth and employment in Nigeria. The three specific objectives are to examine the short-run and long-run effect of disaggregated aid on economic growth and employment in Nigeria, investigate the short-run and long-run impact of aggregated aid on economic growth and employment in Nigeria, and analyse the shock effect of aid on economic growth and employment in Nigeria.

This paper is structured into four sections: Section 1 presents the introduction with the background of the study and a summary of relevant literature. Section 2 discusses the theoretical framework and methodology. Section 3 presents the result and discussion. And the paper is round-up with Section 4, which gives the conclusion and recommendations.

Theoretical framework and methodology

Theoretical framework

The theoretical framework of this study is based on the augmented Solow model by Mankiw Gregory et al. (1992) and the Complementarity theory—the growth model emphasises human capital as one of the components or input of production. It also stated that the driving force of

Table 4
NARDL Result for Model 1 (Using GDP as dependent variable).

Dependent Variable: GDP									
Long-run Estimation					Short run Estimation				
Variable	Coeff.	Std. E.	t-Stat.	Prob.	Variable	Coeff.	Std. E.	t-Stat.	Prob.
CAP_POS	0.129***	0.017	7.399	0.000	CAP_POS	0.219***	0.005	23.600	0.000
CAP_NEG	-0.100**	0.038	-2.628	0.012	CAP_NEG	-0.200***	0.011	-9.323	0.000
LAB_POS	-0.330	0.207	-1.592	0.120	LAB_POS	-0.450***	0.074	-4.485	0.000
LAB_NEG	0.668***	0.097	6.865	0.000	LAB_NEG	0.878***	0.030	21.910	0.000
HUC_POS	0.087***	0.016	5.343	0.000	HUC_POS	0.067***	0.006	13.782	0.000
HUC_NEG	-0.039	0.023	-1.655	0.106	HUC_NEG	-0.045***	0.007	-5.239	0.000
EDD_POS	-0.005	0.003	-1.544	0.131	EDD_POS	0.003	0.009	0.376	0.709
EDD_NEG	-0.005	0.004	-1.447	0.156	EDD_NEG	-0.005***	0.001	-4.757	0.000
HED_POS	0.003	0.002	1.637	0.110	HED_POS	-0.002***	0.001	-2.960	0.005
HED_NEG	-0.004**	0.002	-2.475	0.018	HED_NEG	-0.003	0.035	-0.090	0.929
IND_POS	-0.003***	0.001	-3.787	0.001	IND_POS	-1.429***	0.254	-5.617	0.000
IND_NEG	-0.002	0.002	-1.096	0.280	IND_NEG	0.236***	0.055	4.322	0.000
IFD_POS	0.013***	0.003	4.806	0.000	IFD_POS	0.015***	0.000	34.170	0.000
IFD_NEG	0.001	0.002	0.317	0.753	IFD_NEG	0.008	0.001	1.040	0.305
TRO_POS	-0.053**	0.020	-2.713	0.010	TRO_POS	-0.093***	0.007	-7.092	0.000
TRO_NEG	0.052***	0.016	3.288	0.002	TRO_NEG	0.082***	0.007	7.288	0.000
EXC_POS	0.167***	0.046	3.668	0.001	EXC_POS	0.189***	0.013	12.474	0.000
EXC_NEG	0.133***	0.035	3.798	0.001	EXC_NEG	0.188***	0.013	10.332	0.000
INQ_POS	0.016***	0.005	3.466	0.001	INQ_POS	0.028***	0.002	7.701	0.000
INQ_NEG	-0.006	0.011	-0.553	0.583	INQ_NEG	-0.010	0.016	-0.593	0.557
INT_POS	0.001***	0.000	4.545	0.000	INT_POS	-0.021***	0.003	-6.837	0.000
INT_NEG	0.00001*	0.000	-1.832	0.075	INT_NEG	0.009***	0.000	-5.673	0.000
C	1.175***	0.195	6.021	0.000	CointEq(-1)	-0.222***	0.004	-56.101	0.000

Diagnostic Checks
R-squared: 0.990632
Adjusted R-squared: 0.988175
Durbin-Watson stat: 2.370473
F-statistic: 25847.92 Probability (F-statistic): 0.000000
Histogram Normality Test Jarque- Bera Statistics: 0.848316 Probability: 0.654320
Serial Correlation L.M. Test Obs*R-squared: 8.17225 Prob. Chi-Square: 0.1533
Heteroskedasticity Test Obs*R-squared: 2.42E-05 Prob. Chi-Square: 0.9961

* ** and *** indicate significance at the level of 10 per cent, 5 per cent and 1 per cent, respectively.

Source: Author’s Computation.

productivity is within the economy rather than outside. In this view, aid as an external source of capital can influence aggregate output if channelled into productivity. Also, this growth model anticipates increased technological returns to scale, which translates into long-term knowledge-based growth (Cortright, 2001). The model is given as follows:

$$Y = AK^{\alpha_1} L^{\alpha_2} H^{\alpha_3} \tag{1}$$

In Eq. (1), Y is the output, A is the level of technology, K is the capital input, L is labour input and H is the stock of human capital, while α^s are the share in respective inputs. Eq. (1) is log linearised and given as:

$$\ln Y = a + \alpha_1 \ln K + \alpha_2 \ln L + \alpha_3 \ln H \tag{2}$$

In Eq. (2), $a = \ln A$. Therefore, rewriting Eq. (2) in growth form for this study is given yields the following:

$$GDP_t = a + \alpha_1 CAP_t + \alpha_2 LAB_t + \alpha_3 HUC_t + \mu_{1t} \tag{3}$$

In Eq. (3) $\ln Y, \ln K$ and $\ln H$ are replaced by GDP, CAP and HUC respectively, t is the period of observation and μ is the stochastic or error term. The Complementarity theory shows the link between the aid-output nexus and, by extension, employment (Milgrom & Roberts, 1995)—likewise, the international discussions on donor coordination centre around the complementarities of aid. (Nchofoung et al., 2022) Harmonisation of aid and orientation of giver are frequently viewed as essential elements to improving aid efficiency. In this regard, aid is incorporated into Eq. (3) and results in (4) as:

$$GDP_t = a + \alpha_1 CAP_t + \alpha_2 LAB_t + \alpha_3 HUC_t + \alpha_4 AID + \mu_{1t} \tag{4}$$

The efficiency wage theory shows that wage and productivity levels influence employment. In addition, the substitution effect of production inputs is presumed to have relative effects on capital and labour. Therefore, to achieve the objective of this study, by extension of the Complementarity theory, the employment model is given as follows:

$$LAB_t = b + \beta_1 CAP_t + \beta_2 VLA_t + \beta_3 WAG_t + \beta_4 AID + \mu_{2t} \tag{5}$$

Equations (4) and (5) show the connection between output and employment on aid. The study incorporates aid as part of the output processes, which serves as an input to complement capital production; this becomes necessary in developing economies due to limited capital to achieve sustainable growth and development (Chenery & Strout, 1966).

From this, aid transfers can impact output and employment by raising physical and human capital stock, producing both long-run and short-run growth processes (Bjerg et al., 2011). In Eq. (5), VLA and WAG are value-added and wages, respectively.

Model specification

This study investigates the impact of disaggregated aid on output and employment in Nigeria. The aid is disaggregated into four as follows: education aid (EDD), health aid (HED), industry aid (IND) and infra-structural aid (IFD). Two models were used to achieve objectives 1 and 2. The first model was for disaggregated data of aid, called model 1, and the second model was used for the aggregated data of aid, referred to as model 2.

Table 5
NARDL Result for Model 1 (Using employment as dependent variable).

Long-run Estimation					Short run Estimation				
Variable	Coeff.	Std. E	t-Stat.	Prob.	Variable	Coeff.	Std. E	t-Stat.	Prob.
CAP_POS	0.004	0.028	0.145	0.885	CAP_POS	0.089***	0.005	18.293	0.000
CAP_NEG	-0.103	0.119	-0.864	0.392	CAP_NEG	0.001	0.009	0.145	0.886
VLA_POS	0.675***	0.173	3.910	0.000	VLA_POS	0.755***	0.033	23.029	0.000
VLA_NEG	0.676	0.555	1.218	0.230	VLA_NEG	-0.683***	0.053	-13.005	0.000
WAG_POS	0.284***	0.081	3.524	0.001	WAG_POS	0.014***	0.004	3.711	0.001
WAG_NEG	-0.283	0.257	-1.098	0.278	WAG_NEG	0.004**	0.002	2.631	0.012
EDD_POS	0.031***	0.008	3.747	0.001	EDD_POS	-0.002***	0.001	-3.126	0.003
EDD_NEG	-0.009	0.007	-1.231	0.225	EDD_NEG	-0.030*	0.015	-2.006	0.051
HED_POS	0.046***	0.014	3.373	0.002	HED_POS	-0.006***	0.001	-7.679	0.000
HED_NEG	0.014**	0.006	2.499	0.016	HED_NEG	0.009***	0.001	10.650	0.000
IND_POS	0.001	0.005	0.150	0.881	IND_POS	0.100***	0.031	3.265	0.002
IND_NEG	-0.007***	0.002	-3.039	0.004	IND_NEG	-0.004***	0.001	-8.023	0.000
IFD_POS	-0.011**	0.004	-2.703	0.010	IFD_POS	0.025***	0.005	4.839	0.000
IFD_NEG	0.001	0.004	0.342	0.734	IFD_NEG	0.000***	0.000	-2.897	0.006
TRO_POS	-0.101**	0.049	-2.066	0.045	TRO_POS	-0.004	0.005	-0.812	0.421
TRO_NEG	0.280***	0.056	4.988	0.000	TRO_NEG	0.0001	0.000	-0.501	0.619
EXC_POS	-0.447***	0.074	-6.011	0.000	EXC_POS	0.007	0.011	0.661	0.511
EXC_NEG	0.330***	0.106	3.123	0.003	EXC_NEG	0.039*	0.014	2.708	0.010
INQ_POS	0.082***	0.016	5.157	0.000	INQ_POS	-0.003	0.002	1.363	0.180
INQ_NEG	-0.065**	0.031	-2.065	0.045	INQ_NEG	0.015	0.012	1.264	0.210
INT_POS	-0.001***	0.000	-2.743	0.009	INT_POS	0.000**	0.000	2.616	0.012
INT_NEG	0.0001	0.000	-0.502	0.618	INT_NEG	0.00001***	0.000	9.705	0.000
C	1.748***	0.007	237.377	0.000	CointEq(-1)	-0.302***	0.009	-34.786	0.000

Diagnostic Checks
R-squared: 0.999783
Adjusted R-squared: 0.999612
Durbin-Watson stat: 2.427462
F-statistic: 5835.791 Probability (F-statistic): 0.000000
Histogram Normality Test Jarque- Bera Statistics: 3.08304
Serial Correlation L.M. Test Obs*R-squared: 4.557992 Probability: 0.170510
Heteroskedasticity Test Obs*R-squared: 0.059154 Prob. Chi-Square: 0.1328
Prob. Chi-Square: 0.8078

*, ** and *** indicate significance at the level of 10 per cent, 5 per cent and 1 per cent, respectively.
Source: Author's Computation.

Table 6
NARDL Result for Model 2 (Using GDP as dependent variable).

Long-run Estimation					Short run Estimation				
Variable	Coeff.	Std. E	t-Stat.	Prob.	Variable	Coeff.	Std. E	t-Stat.	Prob.
CAP_POS	0.107	0.084	1.264	0.212	CAP_POS	0.092***	0.008	11.935	0.000
CAP_NEG	-0.187	0.332	-0.565	0.575	CAP_NEG	-0.125***	0.018	-7.002	0.000
LAB_POS	0.915	1.871	0.489	0.627	LAB_POS	0.474***	0.122	3.880	0.000
LAB_NEG	-1.448**	0.662	-2.187	0.034	LAB_NEG	0.852***	0.049	17.419	0.000
HUC_POS	0.261	0.159	1.639	0.108	HUC_POS	0.040***	0.011	3.752	0.001
HUC_NEG	-0.424**	0.199	-2.132	0.038	HUC_NEG	-0.065***	0.010	-6.218	0.000
AID_POS	0.014*	0.008	1.749	0.087	AID_POS	0.0001	0.000	0.943	0.351
AID_NEG	-0.036**	0.016	-2.252	0.029	AID_NEG	-0.002***	0.000	-3.668	0.001
TRO_POS	-0.293**	0.125	-2.344	0.023	TRO_POS	-0.079***	0.011	-6.841	0.000
TRO_NEG	0.541**	0.204	2.655	0.011	TRO_NEG	0.009	0.012	0.760	0.451
EXC_POS	0.284	0.285	0.995	0.325	EXC_POS	0.030	0.024	1.248	0.218
EXC_NEG	-0.046	0.298	-0.153	0.879	EXC_NEG	-0.005	0.030	-0.158	0.875
INQ_POS	0.130	0.093	1.408	0.166	INQ_POS	0.001	0.005	0.194	0.847
INQ_NEG	-0.161***	0.059	-2.722	0.009	INQ_NEG	0.017**	0.007	2.355	0.023
INT_POS	0.001	0.001	1.176	0.245	INT_POS	0.001	0.000	0.887	0.380
INT_NEG	0.001	0.001	1.102	0.276	INT_NEG	0.0001***	0.000	-6.521	0.000
C	5.438***	0.053	102.592	0.000	CointEq(-1)	-0.105***	0.003	-30.656	0.000

Diagnostic Checks
R-squared: 0.965270
Adjusted R-squared: 0.958859
Durbin-Watson stat: 1.967379
F-statistic: 11842.62 Probability (F-statistic): 0.000000
Histogram Normality Test Jarque- Bera Statistics: 5.13273 Probability: 0.810518
Serial Correlation L.M. Test Obs*R-squared: 2.531233 Prob. Chi-Square: 0.1116
Heteroskedasticity Test Obs*R-squared: 0.434005 Prob. Chi-Square: 0.5100

*, ** and *** indicate significance at the level of 10 per cent, 5 per cent and 1 per cent, respectively.
Source: Author's Computation.

Table 7
NARDL Result for Model 2 (Using employment as dependent variable).

Long-run Estimation					Short run Estimation				
Variable	Coeff.	Std. E	t-Stat.	Prob.	Variable	Coeff.	Std. E	t-Stat.	Prob.
CAP_POS	0.047	0.034	1.363	0.179	CAP_POS	0.059***	0.007	7.915	0.000
CAP_NEG	0.107	0.171	0.626	0.534	CAP_NEG	0.016	0.026	0.599	0.552
VLA_POS	0.503*	0.266	1.890	0.064	VLA_POS	0.485***	0.038	12.751	0.000
VLA_NEG	0.238	0.809	0.295	0.770	VLA_NEG	-0.762***	0.073	-10.427	0.000
WAG_POS	0.582**	0.272	2.136	0.037	WAG_POS	0.171***	0.022	7.597	0.000
WAG_NEG	-0.255	0.485	-0.527	0.601	WAG_NEG	-0.037	0.064	-0.588	0.559
AID_POS	-0.013**	0.005	-2.567	0.013	AID_POS	-0.002***	0.000	-4.287	0.000
AID_NEG	0.006	0.004	1.661	0.103	AID_NEG	0.001**	0.000	1.990	0.052
TRO_POS	0.133	0.091	1.464	0.149	TRO_POS	-0.044***	0.007	-6.307	0.000
TRO_NEG	0.131***	0.049	2.698	0.009	TRO_NEG	0.045***	0.005	8.576	0.000
EXC_POS	-0.655***	0.171	-3.831	0.000	EXC_POS	-0.188***	0.016	-12.015	0.000
EXC_NEG	0.735**	0.304	2.420	0.019	EXC_NEG	0.009	0.016	0.576	0.567
INQ_POS	0.219**	0.066	3.327	0.002	INQ_POS	0.032***	0.005	5.883	0.000
INQ_NEG	-0.019	0.047	-0.402	0.689	INQ_NEG	-0.003	0.007	-0.415	0.680
INT_POS	-0.002*	0.001	-1.754	0.085	INT_POS	0.0001**	0.000	-2.335	0.023
INT_NEG	0.0001	0.001	0.715	0.478	INT_NEG	0.00001	0.000	0.812	0.421
C	1.713***	0.024	70.733	0.000	CointEq(-1)	-0.147***	0.007	-20.136	0.000

Diagnostic Checks
R-squared: 0.999556
Adjusted R-squared: 0.999342
Durbin-Watson stat: 1.969987
F-statistic: 4680.995 Probability (F-statistic): 0.000000
Histogram Normality Test Jarque- Bera Statistics: 3.05909 Probability: 0.80504
Serial Correlation L.M. Test Obs*R-squared: 0.383313 Prob. Chi-Square: 0.5358
Heteroskedasticity Test Obs*R-squared: 0.517270 Prob. Chi-Square: 0.4720

*, ** and *** indicate significance at the level of 10 per cent, 5 per cent and 1 per cent, respectively.
Source: Author’s Computation.

Model 1: Model Specification for disaggregated data (objective 1)

$$GDP_t = \lambda_0 + \lambda_1 CAP_t + \lambda_2 LAB_t + \lambda_3 HUC_t + \lambda_4 EDD_t + \lambda_5 HED_t + \lambda_6 IND_t + \lambda_7 IFD_t + \lambda_8 TRO_t + \lambda_9 EXC_t + \lambda_{10} INQ_t + \lambda_{11} INT_t + \mu_{3t} \tag{6}$$

$$LAB_t = c_0 + c_1 CAP_t + c_2 VLA_t + c_3 WAG_t + c_4 EDD_t + c_5 HED_t + c_6 IND_t + c_7 IFD_t + c_8 TRO_t + c_9 EXC_t + c_{10} INQ_t + c_{11} INT_t + \mu_{4t} \tag{7}$$

In Eqs. (6) and (7), c_0 are the intercept or constant terms. TRO , EXC , INQ and INT are trade openness, exchange rate, institutional quality and interest (which are control variables), their inclusion is a result of their relevance as identified in the literature (Ogunjobi et al., 2022; Mahalik et al., 2021; Babalola et al., 2019). Also, $\lambda_1, \lambda_2, \dots, \lambda_{14}$ are the respective parameters of the coefficients in Eq. (6). While c_1, c_2, \dots, c_{14} are the respective parameters of the coefficients in Eq. (7). The other variables remained the same, as explained previously.

Model 2: Model Specification for aggregated data (objective 2)

$$GDP_t = q_0 + q_1 CAP_t + q_2 LAB_t + q_3 HUC_t + q_4 AID_t + q_5 TRO_t + q_6 EXC_t + q_7 INQ_t + q_8 INT_t + \mu_{5t} \tag{8}$$

$$LAB_t = p_0 + p_1 CAP_t + p_2 VLA_t + p_3 WAG_t + p_4 AID_t + p_5 TRO_t + p_6 EXC_t + p_7 INQ_t + p_8 INT_t + \mu_{6t} \tag{9}$$

In Eqs. (8) and (9), q_0 and p_0 are the intercept or constant terms, respectively. q_1, q_2, \dots, q_8 are the respective parameters of the coefficients in Eq. (8). Likewise, p_1, p_2, \dots, p_8 are the respective parameters of the coefficients in Eq. (9). The other variable remained the same, as explained previously.

Model 3: Model Specification for the shock impact (objective 3)

The shock effect of aggregated and disaggregated aid on output and employment will be analysed using the vector correlation model (VECM). The study follows the model by Asaleye et al. (2021) will slight adjustments to achieve the study’s objective of ordering the variables in the VECM. The model in the VECM is given as follows:

Table 8
Shock effect of Aid on economic growth and employment.

Variance Decomposition of AID									
Period	S.E.	CAP	AID	GDP	TRO	EXC	INT	HUC	LAB
2	0.545080	1.084682	97.422240	0.007133	0.054160	0.124516	0.056284	1.244656	0.006327
4	0.717463	0.664975	95.533030	0.338588	0.071306	0.101335	1.382646	1.869992	0.038124
6	0.845736	0.532736	91.265790	1.489909	0.559402	0.180736	1.881712	4.005570	0.084150
8	0.978005	0.530255	87.905870	2.650706	1.181082	0.160616	1.623737	5.351900	0.595837
10	1.105378	0.485599	86.484970	3.285417	1.318193	0.125991	1.403252	5.556437	1.340141

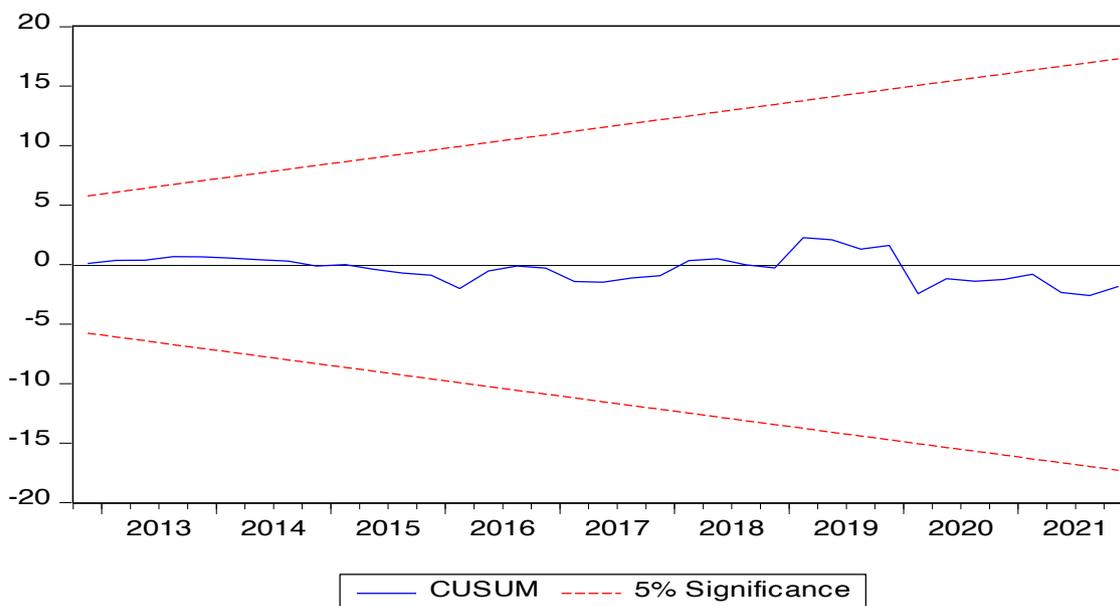
Variance Decomposition of EDD									
Period	S.E.	CAP	EDD	GDP	TRO	EXC	INT	HUC	LAB
2	0.170351	1.791861	97.99747	0.116064	0.012373	0.000522	0.065358	0.01096	0.005396
4	0.237037	3.293095	93.52585	2.142878	0.515824	0.01882	0.272998	0.014239	0.216294
6	0.279573	4.213347	8.89E + 01	4.447468	1.214355	0.378581	0.564558	0.012891	0.247004
8	0.316838	4.685944	85.50797	5.99863	1.647978	1.189433	0.729868	0.015784	0.224398
10	0.349877	5.05868	82.91758	7.040521	1.817697	1.977882	0.734126	0.014956	0.438558

Variance Decomposition of HED									
Period	S.E.	CAP	HED	GDP	TRO	EXC	INT	HUC	LAB
2	0.20633	1.695645	97.07088	0.007043	0.261635	0.17927	0.003538	0.517261	0.264734
4	0.282783	4.435221	9.05E + 01	0.012692	0.990564	0.139025	1.107064	1.623044	1.156552
6	0.342481	5.912646	84.56979	0.068625	1.920439	0.46257	3.097931	2.136796	1.831203
8	0.384634	6.813744	79.15118	0.18753	3.063927	0.970896	5.156483	2.046367	2.60987
10	0.421321	7.2759	75.46800	0.36738	3.93727	1.26819	6.46168	1.85019	3.37139

Variance Decomposition of IFD									
Period	S.E.	CAP	IFD	GDP	TRO	EXC	INT	HUC	LAB
2	0.303831	0.26921	9.85E + 01	0.007678	0.80898	0.000426	0.009874	0.32250	0.1296
4	0.41242	1.523066	92.11189	0.662964	4.654942	0.329579	0.106937	0.19424	0.416372
6	0.500519	2.376269	85.91408	1.130942	8.47847	0.564706	0.773277	0.20064	0.561615
8	0.576076	2.93251	81.8438	1.28311	10.9212	0.47573	1.520012	0.37867	0.64498
10	0.64155	3.27531	79.5039	1.22698	12.3509	0.38417	1.912539	0.53532	0.81089

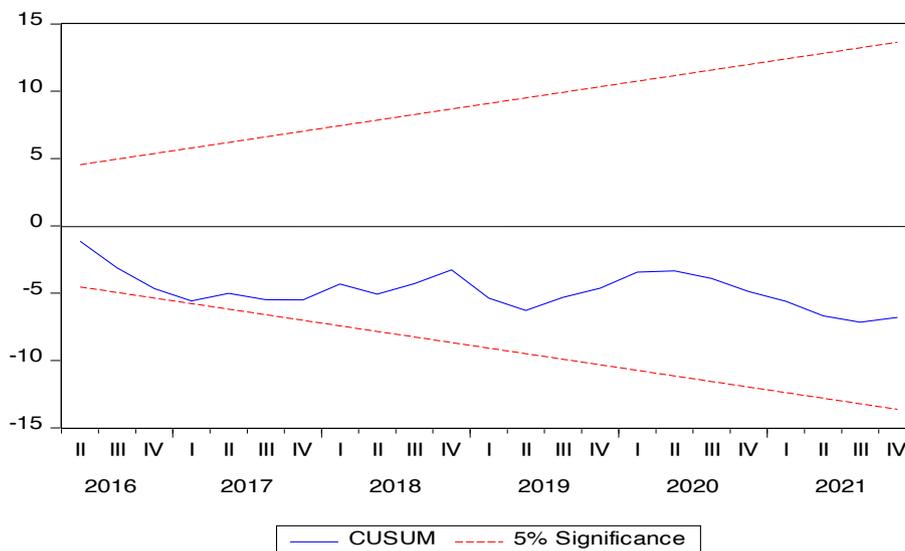
Variance Decomposition of IND									
Period	S.E.	CAP	IND	GDP	TRO	EXC	INT	HUC	LAB
2	0.259756	3.172906	90.71564	0.617784	0.176592	0.310367	3.492082	1.332377	0.18226
4	0.388357	3.596798	65.52459	1.771384	0.926777	0.314545	13.32958	8.746769	5.78956
6	0.492948	2.44448	44.3106	2.54097	1.484188	0.27858	26.48669	13.9823	8.47222
8	0.596574	2.61445	39.181	2.85626	1.030312	0.25954	34.24328	12.6375	7.17768
10	0.693208	2.40954	39.4611	2.60915	0.784893	1.07569	35.1429	11.4009	7.11584

Source: Author's Computation.



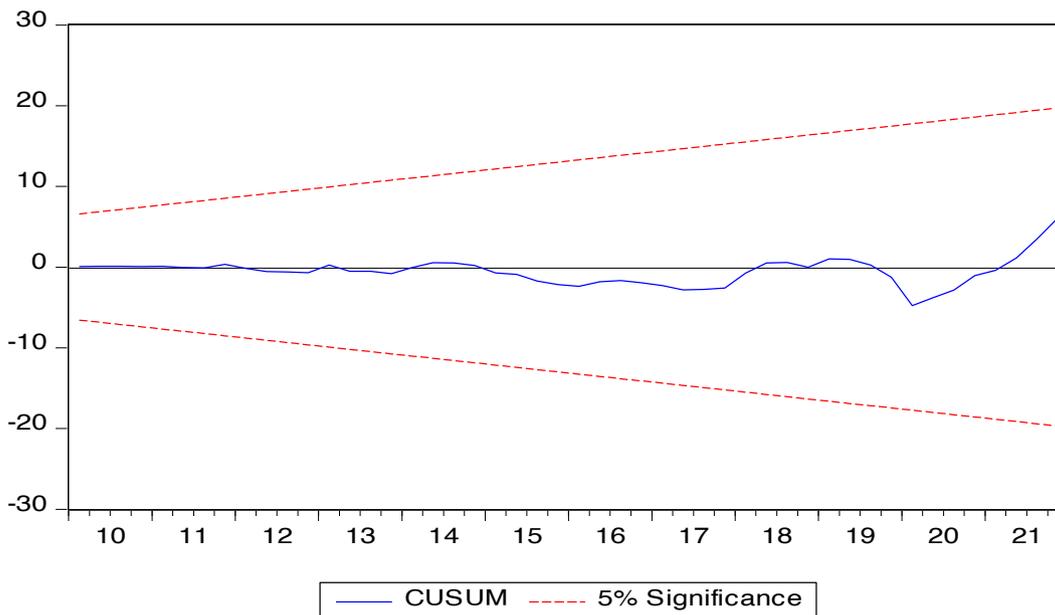
Source: Author's Computation

Fig. 1. Stability Diagnostic for Model 1 (Using GDP as a dependent Variable). Source: Author's Computation.



Source: Author’s Computation

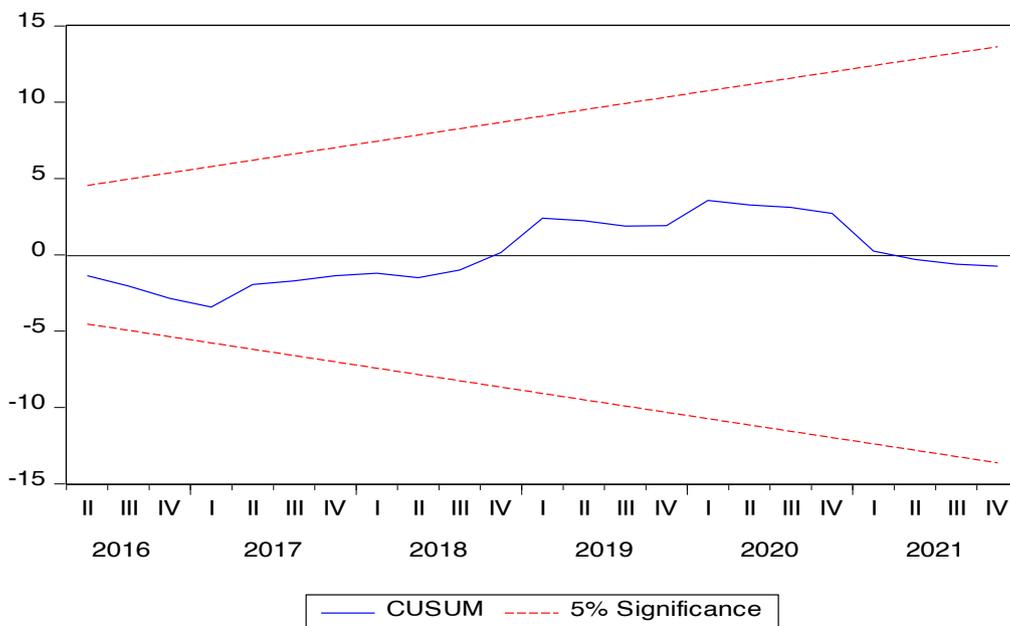
Fig. 2. Stability Diagnostic for Model 1 (Using Employment as dependent Variable). Source: Author’s Computation.



Source: Author’s Computation

Fig. 3. Stability Diagnostic for Model 2 (Using GDP as a dependent Variable). Source: Author’s Computation.

$$[I - Z] \begin{pmatrix} CAP \\ AID \\ GDP \\ TRO \\ EXC \\ INT \\ HUC \\ LAB \end{pmatrix} = \begin{pmatrix} j_1 \\ j_2 \\ j_3 \\ j_4 \\ j_5 \\ j_6 \\ j_7 \\ j_8 \end{pmatrix} + \sum_{i=1}^n (I - Z) \begin{pmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \lambda_{14} & \gamma_{15} & \gamma_{16} & \gamma_{17} & \gamma_{18} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} & \gamma_{25} & \gamma_{26} & \gamma_{27} & \gamma_{28} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} & \gamma_{35} & \gamma_{36} & \gamma_{37} & \gamma_{38} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} & \gamma_{45} & \gamma_{46} & \gamma_{47} & \gamma_{48} \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & \gamma_{55} & \gamma_{56} & \gamma_{57} & \gamma_{58} \\ \gamma_{61} & \gamma_{62} & \gamma_{63} & \gamma_{64} & \gamma_{65} & \gamma_{66} & \gamma_{67} & \gamma_{68} \\ \gamma_{71} & \gamma_{72} & \gamma_{73} & \gamma_{74} & \gamma_{75} & \gamma_{76} & \gamma_{77} & \gamma_{78} \\ \gamma_{81} & \gamma_{82} & \gamma_{83} & \gamma_{84} & \gamma_{85} & \gamma_{86} & \gamma_{87} & \gamma_{88} \end{pmatrix} k \begin{pmatrix} CAP_{t-1} \\ AID_{t-1} \\ GDP_{t-1} \\ TRO_{t-1} \\ EXC_{t-1} \\ INT_{t-1} \\ HUC_{t-1} \\ LAB_{t-1} \end{pmatrix} + [ECM_{t-1}] \begin{pmatrix} \phi_{1t} \\ \phi_{2t} \\ \phi_{3t} \\ \phi_{4t} \\ \phi_{5t} \\ \phi_{6t} \\ \phi_{7t} \\ \phi_{8t} \end{pmatrix} + \begin{pmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \\ v_{4t} \\ v_{5t} \\ v_{6t} \\ v_{7t} \\ v_{8t} \end{pmatrix} \tag{10}$$



Source: Author’s Computation

Fig. 4. Stability Diagnostic for Model 2 (Using Employment as a dependent Variable). Source: Author’s Computation.

Techniques of estimation

Objectives (1) and (2) were analysed using the Non-linear Auto Regressive Distributive Lag (NARDL). According to Shin et al. (2014), the NARDL for model 2 is presented as follows:

For output model

$$\Delta GDP_t = x_0 + x_1 GDP_t + x_2^+ CAP_{t-1}^+ + x_3^- CAP_{t-1}^- + x_4^+ LAB_{t-1}^+ + x_5^- LAB_{t-1}^- + x_6^+ HUC_{t-1}^+ + x_7^- HUC_{t-1}^- + x_8^+ AID_{t-1}^+ + x_9^- AID_{t-1}^- + x_{10}^+ TRO_{t-1}^+ + x_{11}^- TRO_{t-1}^-$$

$$+ x_{12}^+ EXC_{t-1}^+ + x_{13}^- EXC_{t-1}^- + x_{14}^+ INQ_{t-1}^+ + x_{15}^- INQ_{t-1}^- + x_{16}^+ INT_{t-1}^+ + x_{17}^- INT_{t-1}^- + \sum_{i=0}^n y_1 \Delta GDP_t + \sum_{i=0}^n y_2 \Delta CAP_{t-1}^+ + \sum_{i=0}^n y_3 \Delta CAP_{t-1}^- + \sum_{i=0}^n y_4 \Delta LAB_{t-1}^+$$

$$+ \sum_{i=0}^n y_5 \Delta LAB_{t-1}^- + \sum_{i=0}^n y_6 \Delta HUC_{t-1}^+ + \sum_{i=0}^n y_7 \Delta HUC_{t-1}^- + \sum_{i=0}^n y_8 \Delta AID_{t-1}^+ + \sum_{i=0}^n y_9 \Delta AID_{t-1}^- + \sum_{i=0}^n y_{10} \Delta TRO_{t-1}^+ + \sum_{i=0}^n y_{11} \Delta TRO_{t-1}^- + \sum_{i=0}^n y_{12} \Delta EXC_{t-1}^+ + \sum_{i=0}^n y_{13} \Delta EXC_{t-1}^- + \sum_{i=0}^n y_{14} \Delta INQ_{t-1}^+ + \sum_{i=0}^n y_{15} \Delta INQ_{t-1}^- + \sum_{i=0}^n y_{16} \Delta INT_{t-1}^+ + \sum_{i=0}^n y_{17} \Delta INT_{t-1}^- + \varepsilon_{1t}$$

For employment model

$$\Delta LAB_t = a_0 + a_1 LAB_t + a_2^+ CAP_{t-1}^+ + a_3^- CAP_{t-1}^- + a_4^+ VLA_{t-1}^+ + a_5^- VLA_{t-1}^- + a_6^+ WAG_{t-1}^+ + a_7^- WAG_{t-1}^- + a_8^+ AID_{t-1}^+ + a_9^- AID_{t-1}^- + a_{10}^+ TRO_{t-1}^+ + a_{11}^- TRO_{t-1}^-$$

$$+ a_{12}^+ EXC_{t-1}^+ + a_{13}^- EXC_{t-1}^- + a_{14}^+ INQ_{t-1}^+ + a_{15}^- INQ_{t-1}^- + a_{16}^+ INT_{t-1}^+ + a_{17}^- INT_{t-1}^- + \sum_{i=0}^n b_1 \Delta LAB_t + \sum_{i=0}^n b_2 \Delta CAP_{t-1}^+ + \sum_{i=0}^n b_3 \Delta CAP_{t-1}^- + \sum_{i=0}^n b_4 \Delta VLA_{t-1}^+ + \sum_{i=0}^n b_5 \Delta VLA_{t-1}^- + \sum_{i=0}^n b_6 \Delta WAG_{t-1}^+ + \sum_{i=0}^n b_7 \Delta WAG_{t-1}^- + \sum_{i=0}^n b_8 \Delta AID_{t-1}^+ + \sum_{i=0}^n b_9 \Delta AID_{t-1}^- + \sum_{i=0}^n b_{10} \Delta TRO_{t-1}^+ + \sum_{i=0}^n b_{11} \Delta TRO_{t-1}^- + \sum_{i=0}^n b_{12} \Delta EXC_{t-1}^+ + \sum_{i=0}^n b_{13} \Delta EXC_{t-1}^- + \sum_{i=0}^n b_{14} \Delta INQ_{t-1}^+ + \sum_{i=0}^n b_{15} \Delta INQ_{t-1}^- + \sum_{i=0}^n b_{16} \Delta INT_{t-1}^+ + \sum_{i=0}^n b_{17} \Delta INT_{t-1}^- + \varepsilon_{2t}$$

(12)

In Eqs. (11) and (12), x_i and a_i ($i = 1, \dots, 17$) show the long-run coefficients while y_i and b_i ($i = 1, \dots, 17$) show the short-run coefficients. In addition, the short-run and long-run analyses are concerned with the immediate impact of independent factors shocks on the dependent variables, the evaluation of disequilibrium, and the speed of recovering back to the initial equilibrium level. The variables are the same as stated before. Also, 'n' in Eqs. (11) and (12) is the number of lags that was determined using the Hanna-Quinn criterion (H.Q.). In this study, the WALD test was used to examine the variable term asymmetries, which are given for the long run ($x = x^+ = x^-$) and ($a = a^+ = a^-$) while the short run are given as ($y = y^+ = y^-$) and ($b = b^+ = b^-$). The influence of independent variable shocks on the dependent variable is divided into positive and negative impacts. The NARDL model for Eqs. (6) and (7) (that is, for objective 1 – Model 1) takes the same approach, only for the aid is in disaggregated form.

The Vector Error Correction Model (VECM) was used to investigate the shock effect of aid on economic growth and employment in Nigeria. The VECM is given as follows:

Table 9
VECM Lag Exclusion Table.

AID: Chi-squared test statistics for lag exclusion:									
	D(CAP)	D(AID)	D(GDP)	D(TRO)	D(EXC)	D(INT)	D(HUC)	D(LAB)	Joint
DLag 1	11.80720 [0.1600]	1.060162 [0.9978]	27.20715*** [0.0007]	18.62505** [0.0170]	14.13070* [0.0784]	7.902135 [0.4431]	26.63586*** [0.0008]	19.72330* [0.0114]	164.7810*** [0.0000]
DLag 2	1.869385 [0.9848]	5.374023 [0.7170]	3.854495 [0.8700]	3.598126 [0.8914]	2.390628 [0.9666]	0.776933 [0.9993]	11.75727 [0.1624]	2.163305 [0.9756]	45.44734 [0.9618]
EDD: Chi-squared test statistics for lag exclusion:									
	D(CAP)	D(EDD)	D(GDP)	D(TRO)	D(EXC)	D(INT)	D(HUC)	D(LAB)	Joint
DLag 1	12.14287 [0.1449]	5.428095 [0.7110]	26.17991*** [0.0010]	22.36844*** [0.0043]	16.84484** [0.0318]	11.19961 [0.1906]	26.24851*** [0.0010]	21.01378*** [0.0071]	170.6029*** [0.0000]
DLag 2	1.328085 [0.9952]	7.289035 [0.5058]	3.320784 [0.9126]	5.935609 [0.6544]	4.249375 [0.8340]	2.260389 [0.9720]	11.53560 [0.1732]	2.796515 [0.9465]	42.20034 [0.9839]
HED: Chi-squared test statistics for lag exclusion:									
	D(CAP)	D(HED)	D(GDP)	D(TRO)	D(EXC)	D(INT)	D(HUC)	D(LAB)	Joint
DLag 1	12.81339 [0.1184]	2.214166 [0.9737]	27.62993*** [0.0005]	62.00320*** [0.0000]	16.35408** [0.0376]	12.58118 [0.1271]	122.2730*** [0.0000]	20.19133*** [0.0096]	312.5485*** [0.0000]
DLag 2	1.541680 [0.9920]	4.082684 [0.8496]	6.564445 [0.5843]	4.975299 [0.7602]	4.264815 [0.8325]	1.917946 [0.9834]	16.79748** [0.0323]	3.030052 [0.9325]	50.40175 [0.8924]
IFD: Chi-squared test statistics for lag exclusion:									
	D(CAP)	D(IFD)	D(GDP)	D(TRO)	D(EXC)	D(INT)	D(HUC)	D(LAB)	Joint
DLag 1	11.69238 [0.1655]	1.291868 [0.9956]	24.62533*** [0.0018]	26.13490*** [0.0010]	17.50943** [0.0252]	11.33279 [0.1835]	28.02705*** [0.0005]	20.18793*** [0.0096]	175.7829*** [0.0000]
DLag 2	1.896495 [0.9840]	2.026624 [0.9802]	2.477823 [0.9628]	6.212019 [0.6235]	3.659273 [0.8865]	1.943781 [0.9827]	12.33064 [0.1371]	2.489317 [0.9622]	37.94532 [0.9961]
IND: Chi-squared test statistics for lag exclusion:									
	D(CAP)	D(IND)	D(GDP)	D(TRO)	D(EXC)	D(INT)	D(HUC)	D(LAB)	Joint
DLag 1	11.14888 [0.1934]	46.60505*** [0.0000]	28.11116*** [0.0005]	17.78134** [0.0229]	17.87518** [0.0222]	17.45734** [0.0257]	15.62856** [0.0480]	24.46345*** [0.0019]	202.4190*** [0.0000]
DLag 2	1.287590 [0.9957]	18.12475** [0.0203]	6.586879 [0.5818]	2.181778 [0.9749]	3.598348 [0.8914]	4.403141 [0.8190]	4.067766 [0.8510]	7.435789 [0.4904]	46.57676 [0.9502]
df	8	8	8	8	8	8	8	8	64

Numbers in [] are p-values

*,** and *** indicate significance at the level of 10 per cent, 5 per cent and 1 per cent, respectively.

$$\Delta k_t = d_0 + d_1 \Delta k_{t-1} + d_2 k_{t-1} + \dots + k_n k_{t-q} + ET + \epsilon_t \tag{13}$$

In Eq. (15), k represents the series used in this study, which is assumed not to be stationary at order (0); however, the linear combination of the series is stationary at the integration of order (1). Furthermore, the study used the variance decomposition table to show aid shocks' effect on the targeted economic growth and employment variables.

Before the estimation analysis in this study, the following tests will be carried out as preliminary analyses; the unit root using the Augmented Dickey-Fuller test (ADF), Phillip Perron (PP) and Kwiatkowski Phillips-Schmidt-Shin (KPSS). Likewise, the correlation and the descriptive statistics. And the Johansen cointegration (the result is available upon request) before the estimation of the VECM.

Information about data sources and description

Table 1a presents information about data sources and measurements. This study uses quarterly data ranging from 2002 to 2021. The rationale for choosing the period of investigation is due to data availability. All data are extracted from the World Bank website except aid data and

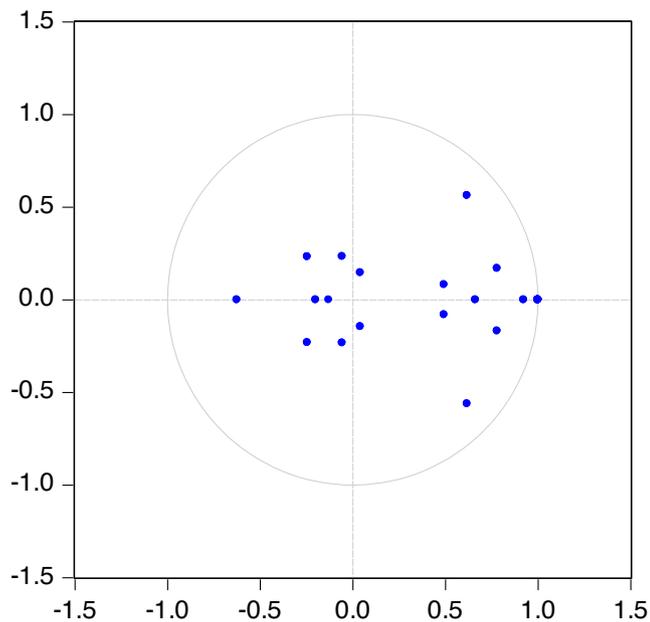
institutional quality extracted from the Organisation for Economic Cooperation and Development, Credit reporting and World Governance Indicators. The sample data is presented yearly frequencies from 2002 to 2021; however, this will result in a limited number of observations resulting in a small-sample problem. The original time series' short timeframe (annual frequencies may not help assess the likely shift in the long-run relationship (Johansen, 2002). As a result, this study overcomes the small-sample problem by converting the yearly time series data into quarterly frequencies using the quadratic match-sum approach, which will improve the evaluation of the cointegration among aid, employment and output. The approach has been adopted in empirical work studying different long-run relationships (Tursoy & Faisal, 2018; Kisswani & Harraf, 2021; Rej, Bandyopadhyay, Mahmood, Murshed & Mahmud, 2022; Suki, Suki, Sharif & Afshan, 2021).

Presentation of result

Preliminary analyses

Table 1b presents the descriptive statistics and correlation analysis

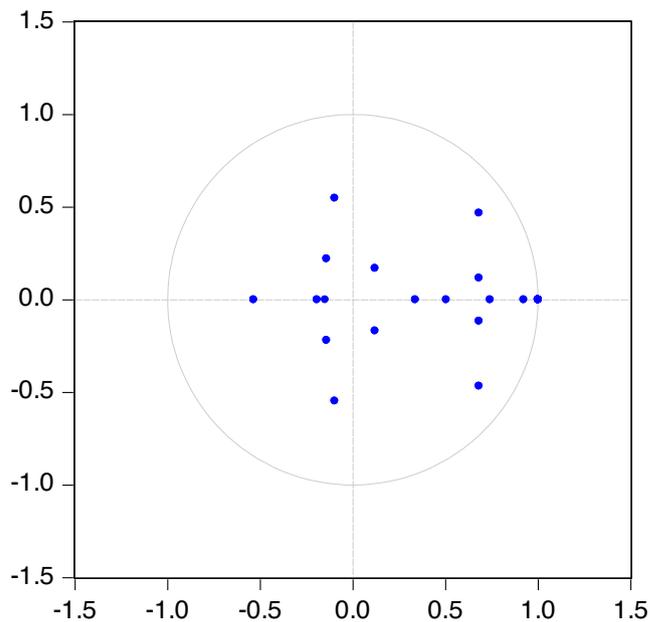
Inverse Roots of AR Characteristic Polynomial



Source: Author's Computation

Fig. 5. Inverse Roots of AR Characteristic Polynomial for Aggregated Aid. Source: Author's Computation.

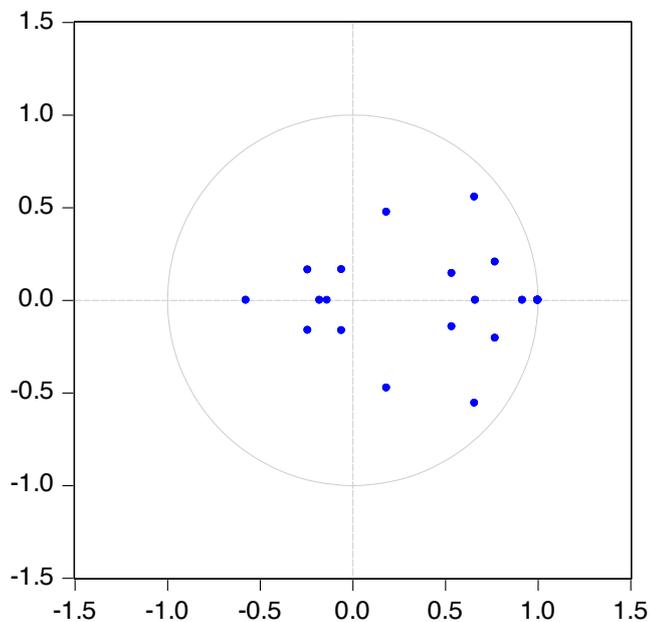
Inverse Roots of AR Characteristic Polynomial



Source: Author's Computation

Fig. 7. Inverse Roots of AR Characteristic Polynomial for Health Aid. Source: Author's Computation.

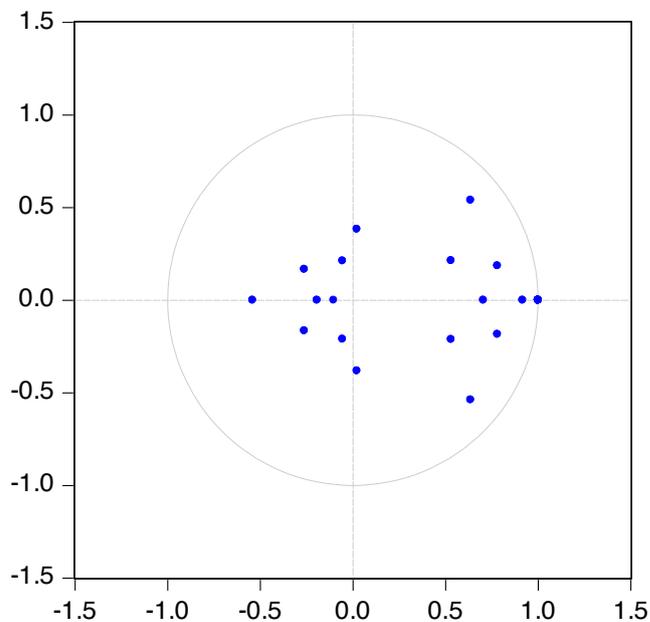
Inverse Roots of AR Characteristic Polynomial



Source: Author's Computation

Fig. 6. Inverse Roots of AR Characteristic Polynomial for Education Aid. Source: Author's Computation.

Inverse Roots of AR Characteristic Polynomial



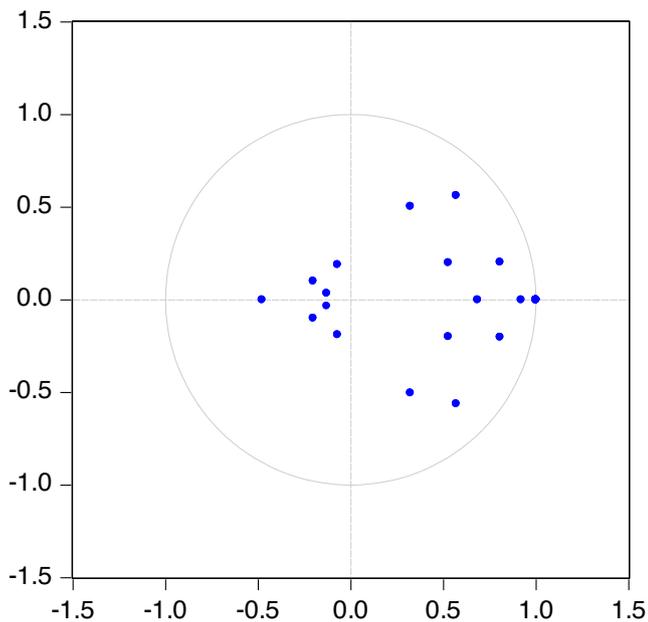
Source: Author's Computation

Fig. 8. Inverse Roots of AR Characteristic Polynomial for Infrastructure Aid. Source: Author's Computation.

results of the series used in this study. Value added (VLA) has the highest mean value of 13.73, followed by capital with a value of 12.08, while institutional quality (INQ) has the lowest mean value of -0.70. The mean values for aggregated aid (AID), education aid (EDD), the

exchange rate (EXC), economic growth (GDP), health aid (HED), human capital (HUC), infrastructural aid (IFD), industrial aid (IND), interest rate (INT), employment (LAB), trade openness (TRO) and, wages and salaries (WAG) are 2.87, 1.75, 2.00, 5.52, 2.12, 6.93, 1.76, 0.83, 5.80,

Inverse Roots of AR Characteristic Polynomial



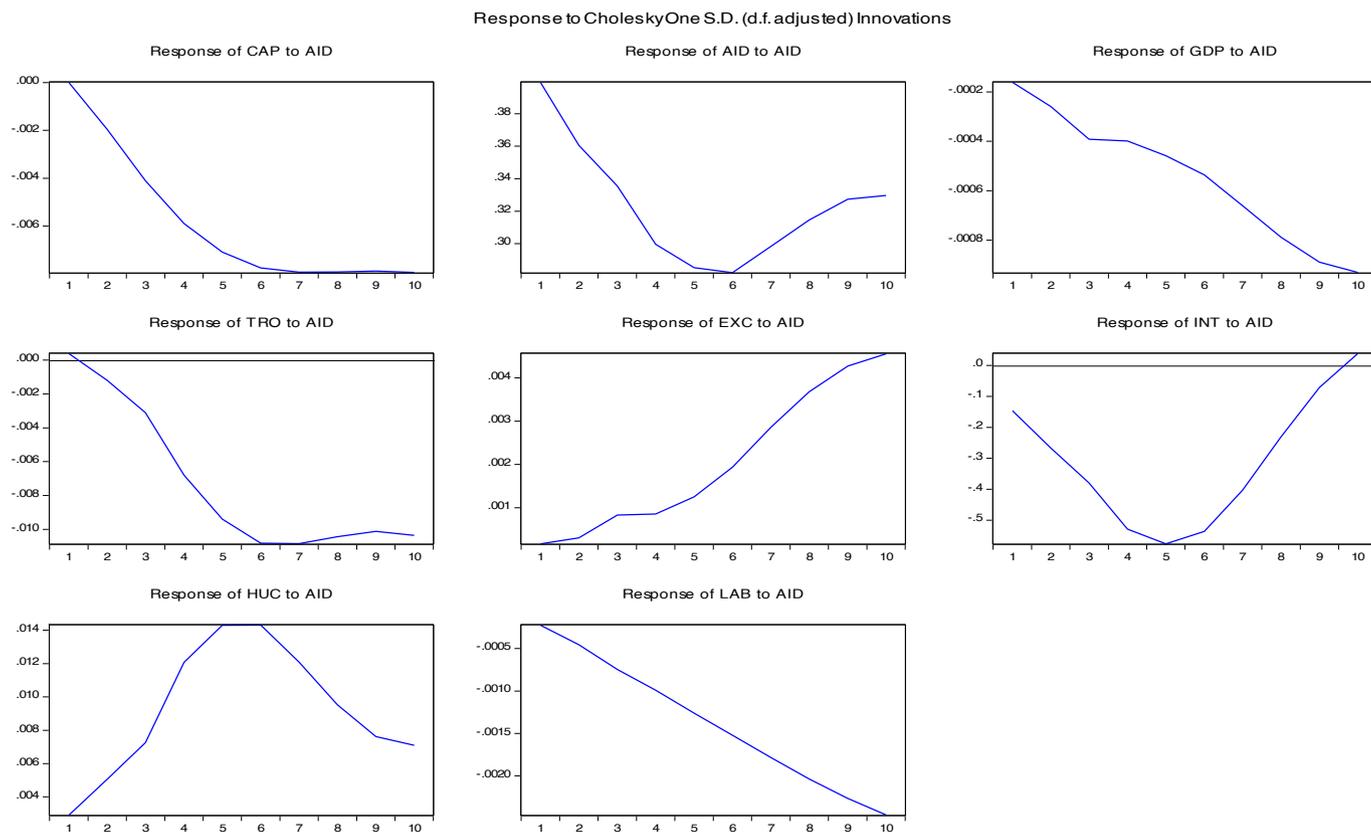
Source: Author's Computation

Fig. 9. Inverse Roots of AR Characteristic Polynomial for Industrial Aid Source: Author's Computation.

1.74, 1.88 and 1.22 respectively. Likewise, the correlation analysis shows that GDP & HUC and HUC & IND have the highest correlation values at 0.89. In contrast, employment (LAB) and trade openness (TRO) have the lowest value at -0.81 . Other variables' correlation ranges from 0.89 to -0.81 .

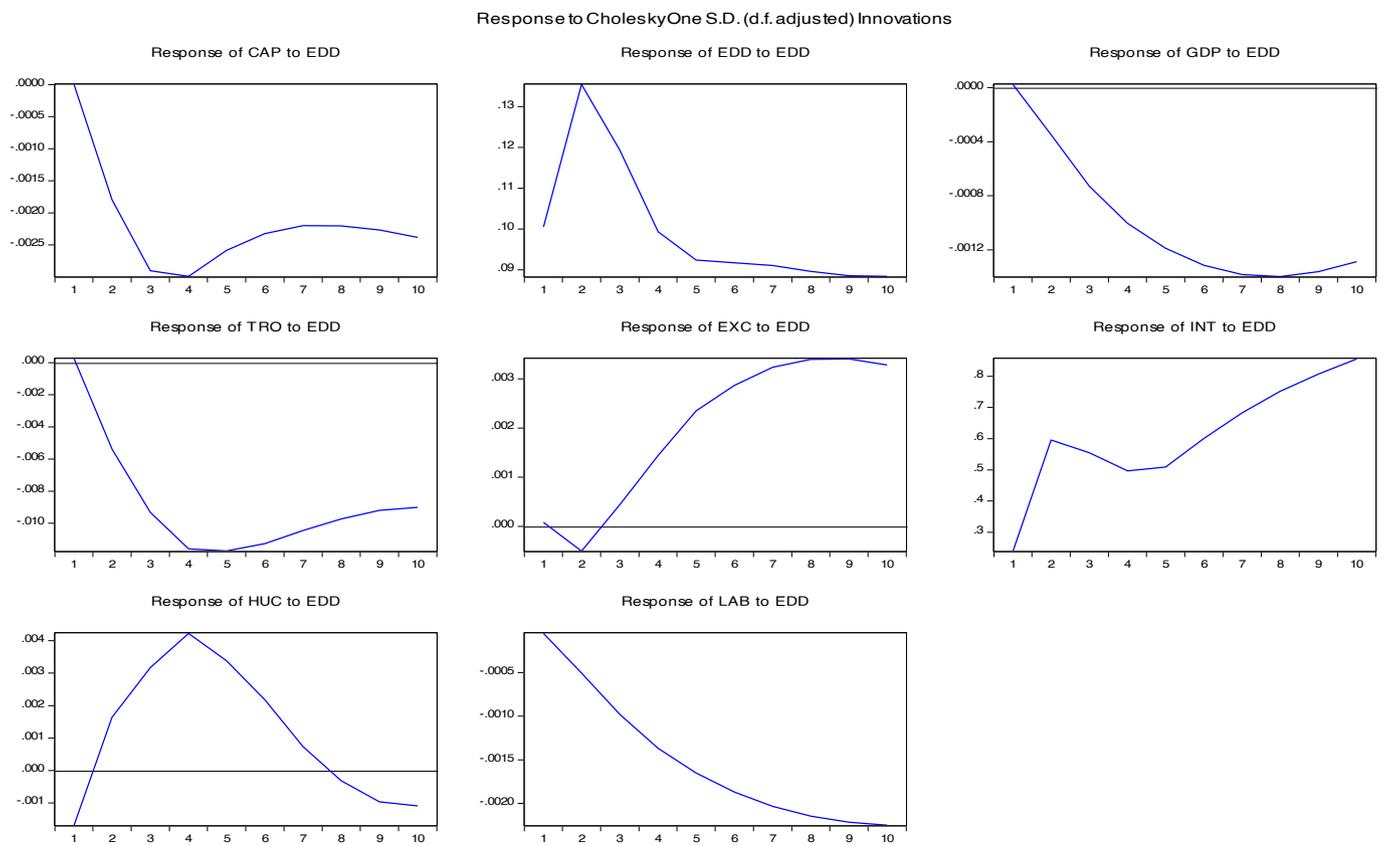
Table 2 presents the unit root result using ADF (Augmented Dickey-Fuller), PP (Phillips-Perron) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin). The rationale behind our chosen unit root test is based on their strength. For example, compared to the Dickey-Fuller test, the ADF is more efficient and can handle more complicated models. While PP is close to ADF, its strength lies in a non-parametric test; specification of lags may not be needed during analysis. Finally, the KPSS preferred when determining if a series is stationary around a deterministic trend (Asaleye et al., 2020; Oloni et al., 2017). Evidence from the result shows that the series are integrated of order one and zero. Based on this, we proceed to estimate NARDL.

Table 3 presents the bound test result for the models. Two estimations are carried out in each of the two models. The first involves using GDP and employment as the dependent, disaggregated aid as the independent, and other control variables (shown in the upper part). And the second one with aggregated aid as the independent variable and other control variables (shown in the lower part of the table in 3). The null hypothesis is that there is no cointegration among the series. The F-statistics of the four estimations are greater than the upper bound values. There are three scenarios for the validation of the hypothesis. First, when the F-statistics is lower than lower bound critical values, it means no cointegration. Secondly, when the F-statistics is in between the lower and upper critical values, it shows an inconclusive outcome to validate whether there is cointegration. Finally, when the F-statistics is above the upper critical values shows the presence of cointegration. In the case of the result presented in Table 3, both the F-statistics values are



Source: Author's Computation

Fig. 10. Impulse Response function for Aggregate Aid. Source: Author's Computation.



Source: Author’s Computation

Fig. 11. Impulse Response function for Education Aid. Source: Author’s Computation.

higher at the upper bound critical values at 10 per cent, 5 per cent, 2.5 per cent and 1 per cent (with values of 2.77, 3.04, 3.28 and 3.61, respectively). Hence, the null hypothesis of no cointegration cannot be accepted. The outcome of the cointegration is similar to the study by Babalola et al. 2019 that documented the cointegration relationship among foreign aid, investment, trade and economic growth in Nigeria.

Long-run and Short-run results

NARDL result for model 1 (Using GDP as dependent variable)

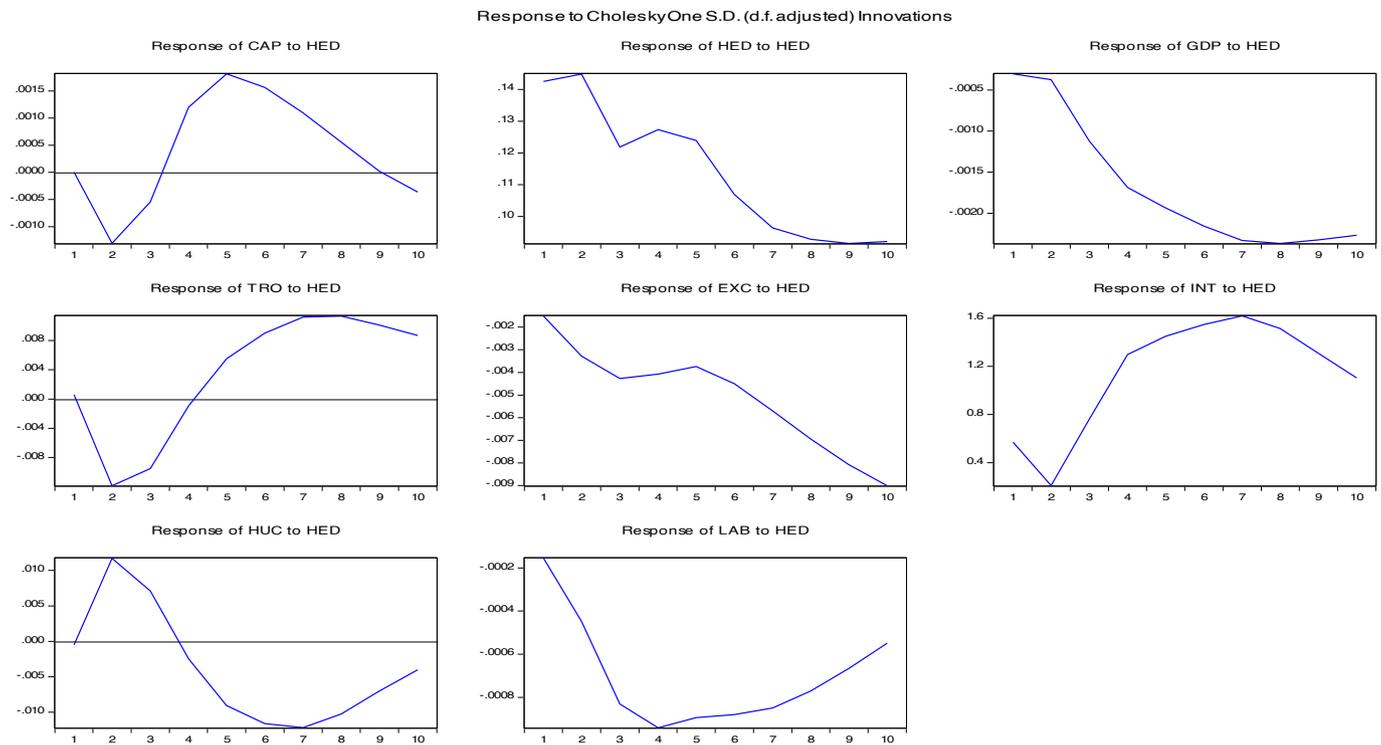
The long-run estimation

Table 4 shows that an increased capital (CAP) led to a 0.13 per cent increase in economic growth (GDP). However, a one per cent reduction in CAP will result in 0.1 per cent in GDP; both are significant. Capital is an important factor in production; the outcome of the result conforms to the output model, which stresses the importance of capital in production processes. This outcome is similar to the findings of Babalola et al. (2019) and Adebayo and Beton Kalmaz (2020). A percentage increase in labour (LAB) will lead to about 0.33 per cent reduction in GDP, although it is not statistically significant. And one per cent reduction in LAB will lead to 0.67 increase in GDP. The implication of the result may be a substitution effect of capital for labour in the production process, even though there are arguments in the empirical literature that economic growth in Nigeria has not promoted employment opportunities, referred to as jobless growth. This finding contradicts the study by Nchofoung et al. (2021) that document a positive relationship between output and employment. Also, a one per cent upsurge in human capital (HUC) is statistically significant, and it will increase GDP by about 0.09 per cent, while a one per cent reduction in HUC will lead to a decrease in GDP but not significant; this finding is in line with the study of Fashina et al.

(2018) that stressed the importance of human capital on economic growth.

The NARDL showed that education aid (EDD) is not statistically significant. Likewise, a per cent reduction in health aid (HED) will lead to about 0.004 declines in GDP. An increase in industrial aid (IND) will lead to about 0.003 per cent reduction in GDP, while a percentage reduction in IND will cause a negative effect on GDP but not significant. A percentage surge in infrastructural aid (IFD) will lead to about 0.013 per cent increase in GDP, while a percentage reduction in IFD will cause a positive effect on GDP but not significant. This study has shown that sectoral aid has different implications on economic growth in Nigeria. Increased education, health and industrial aid will not promote long-term economic growth. This finding contradicts the studies by Fasanya and Onakoya (2012), and Odusanya, Logile and Akanni (2011) that reported a positive relationship between aid and economic growth in Nigeria. However, this current study’s implication of infrastructural aid is positive on economic growth. But a reduction in infrastructural is not statistically significant. The effect of education, health and industrial aid on economic growth, in the long run, may be attributed to this, among others, such as the aid may be channelled into achieving consumption rather than productive activity, which crowds out domestic savings and investment or as a result of mismanagement of resources. In addition, Kamguia et al. (2022) reported that aid negatively affects economic growth in less complicated developing countries because the investment in education, health and industrial sectors is still necessary to promote economic growth in Nigeria.

A one per cent increase in trade openness (TRO) will lead to about 0.053 reductions in GDP, while a one per cent reduction in TRO will cause an increase of about 0.052 per cent in GDP. Babalola et al. (2021) reported that the implications of trade openness on economic growth



Source: Author’s Computation

Fig. 12. Impulse Response function for Health Aid. Source: Author’s Computation.

could be positive or negative. For example, a one percentage surge in the exchange rate (EXC) will lead to a 0.17 per cent increase in GDP, while a 1 per cent reduction in EXC will lead to a 0.133 per cent increase in GDP. Likewise, a one per cent increase in institutional quality (INQ) will lead to about 0.016 per cent increase in GDP, while a one per cent reduction in INQ will cause a negative implication on GDP but is not significant; this finding is in line with the study of Dzhumashey and Hailemariam (2021) that stressed that the quality of economic institution in recipient countries significantly improve by foreign aid implication on economic growth. A per cent surge in interest rate (INT) will lead to about 0.001 increase in GDP, while a per cent reduction in INT will lead to about 0.00001 per cent increase in GDP; these findings contradict the study by Ogunjobi et al. (2022).

Short run Estimation

In Table 4, it can be depicted from the result that an upsurge in the capital (CAP) will lead to a 0.21 per cent increase in economic growth (GDP). However, a one per cent reduction in CAP will result in a 0.2 per cent decrease in GDP, aligning with the study of Adebayo and Beton Kalmaz (2020). A percentage increase in labour (LAB) will lead to about 0.45 per cent reduction in GDP. And one per cent reduction in LAB will lead to about 0.87 per cent increase in GDP, contradicts the study by Nchofoung et al. (2021). Also, a one per cent upsurge in human capital (HUC) is statistically significant, and it will increase GDP by about 0.67 per cent, while a one per cent reduction in HUC will lead to about 0.48 decrease in GDP; the finding is aligned with the study of Fashina et al. (2018).

Likewise, the short-run effect shows that a per cent reduction in education aid (EDD) will result to about 0.005 declines in GDP while a surge in EDD is insignificant. Similarly, a percentage surge in health aid (HED) will lead to about 0.002 per cent reduction in GDP. A percentage reduction in HED will cause a negative effect on GDP but not significant. An increase in industrial aid (IND) will lead to about a 1.43 per cent reduction in GDP, while a per cent reduction in IND will cause about 0.24 increase in GDP. A percentage surge in infrastructural aid (IFD) will

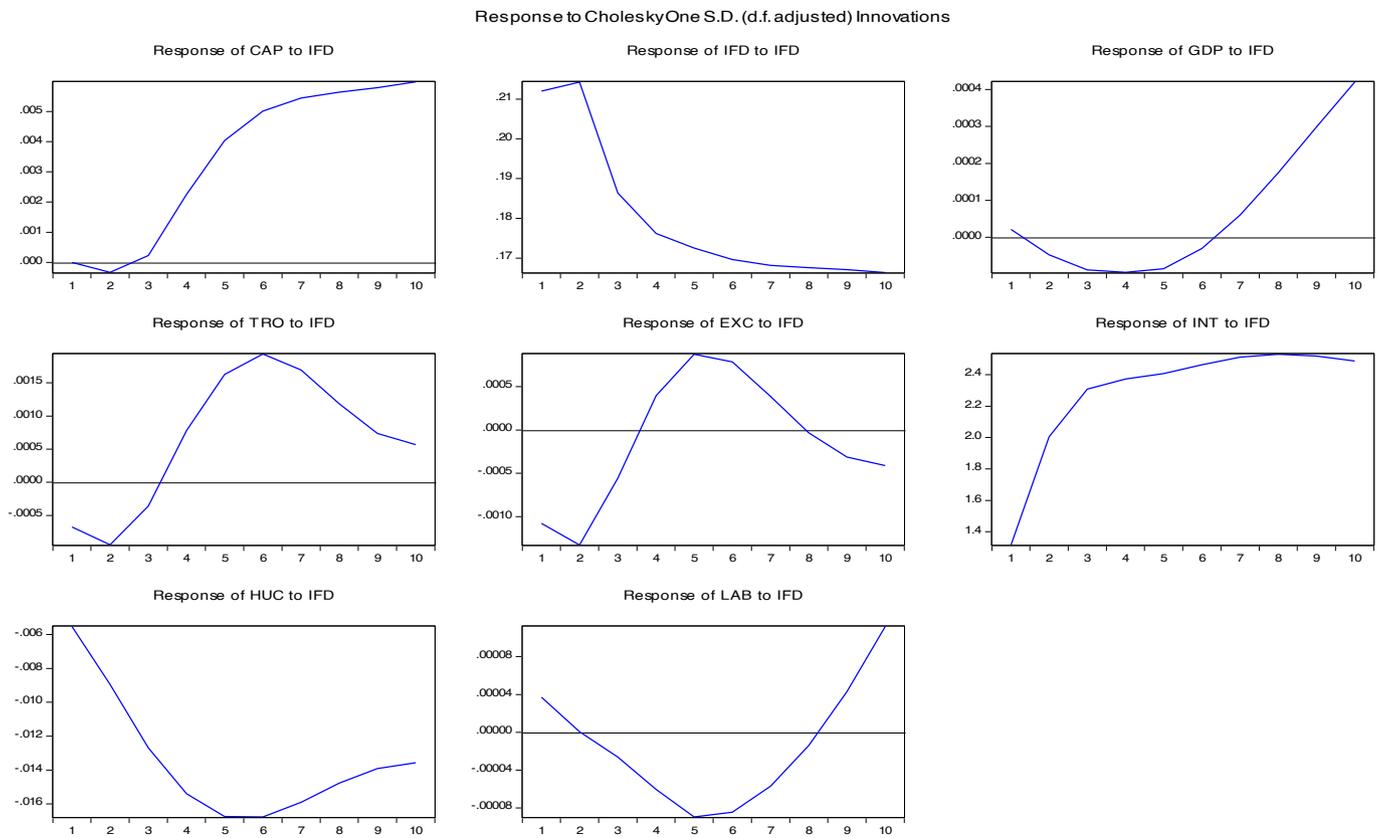
result to about 0.018 per cent increment in GDP. At the same time, a percentage reduction in IFD will positively affect GDP but not significantly. The outcome of the short-run implication of disaggregated aid is similar to the long-run result. The findings contradict other studies in Nigeria. For example, Ogbuabor et al. (2017) reveal that foreign aid has a favourable long-term and short-term influence on the Nigerian economy. Saibu and Obioesio (2017) report that foreign aid promotes growth in Nigeria. The mixed result may be attributed error in measurement. Most aid is spent on consumption rather than productive activity; therefore, estimating the implication of aid in aggregated form on economic growth may be misleading. Nchofoung et al. (2022) stressed the sectoral differences resulting from aid on the economy.

A one per cent increase in trade openness (TRO) will lead to about 0.09 per cent reduction in GDP, while a 1 per cent reduction in TRO will cause an increase of about 0.08 per cent in GDP. Likewise, a 1 per cent increase in the exchange rate (EXC) will lead to about 0.89 per cent increase in GDP, while a 1 per cent reduction in EXC will lead to about 0.88 per cent increase in GDP. Likewise, a one per cent increase in institutional quality (INQ) will lead to about 0.03 per cent in GDP. In comparison, a 1 per cent reduction in INQ will cause a negative implication on GDP but is not significant. Finally, a percentage surge in interest rate (INT) will lead to about 0.021 reductions in GDP, while a percentage reduction in INT will increase by about 0.009 per cent in GDP.

NARDL result for model 1 (Using employment as dependent variable)

The long-run estimation

Table 5 shows that an upsurge in the capital (CAP) will lead to an increment in employment (LAB). However, a one per cent reduction in CAP increased in LAB; both are not statistically significant. A per cent increase in value added (VLA) will lead to a 0.67 per cent increase in LAB; this finding aligns with the study by Chen et al. (2012). And one per cent reduction in VLA will lead to a rise in LAB but not significant. Also, a one per cent upsurge in wages and salaries (WAG) is statistically



Source: Author’s Computation

Fig. 13. Impulse Response function for Infrastructural Aid. Source: Author’s Computation.

significant, and it will increase LAB by about 0.28 per cent, while a one per cent reduction in WAG will lead to a decrease in LAB but not significant; the finding is aligned with the study of [Asaleye et al., \(2021\)](#).

A per cent increase in education aid (EDD) will cause about 0.03 per cent increase in LAB, while a percentage reduction in EDD will cause a decrease in LAB but not significant. A percentage surge in health aid (HED) will cause about 0.05 per cent increase in LAB, while a percentage reduction in HED will lead to about 0.014 reductions in LAB. An increase in industrial aid (IND) will cause an increase in GDP but is not significant, while a percentage reduction in IND will result in about 0.007 reductions in LAB. A percentage surge in infrastructural aid (IFD) will lead to about 0.01 per cent reduction in LAB. In contrast, a percentage reduction in IFD will cause a positive effect on LAB, but not significant. Education and health aid are positively related to employment; this outcome contradicts the findings by [Nchofoung et al. \(2022\)](#), which documented that aid negatively affects employment in 37 African countries. The study by [Nchofoung et al. \(2022\)](#) examined the implication of aid on sectoral sectors. According to the complementary theory, aid can promote output and employment (Migrom & Roberts, 1995; [Nchofoung et al., 2022](#)). However, from the result, a one per cent reduction in EDD will have a negative effect on LAB but is not significant.

One per cent increase in trade openness (TRO) will lead to about 0.101 reductions in LAB. In contrast, a one per cent reduction in TRO will cause an increase of about 0.28 per cent in LAB. 1 percentage surge in the exchange rate (EXC) will lead to about 0.45 per cent decrease in LAB, while a one per cent reduction in EXC will lead to about 0.33 per cent increase in LAB. Likewise, a one per cent increase in institutional quality (INQ) will lead to about 0.08 per cent in LAB, while a 1 per cent reduction in INQ will cause an about 0.07 decrease in LAB. Finally, a percentage surge in interest rate (INT) will lead to about 0.001 drops in

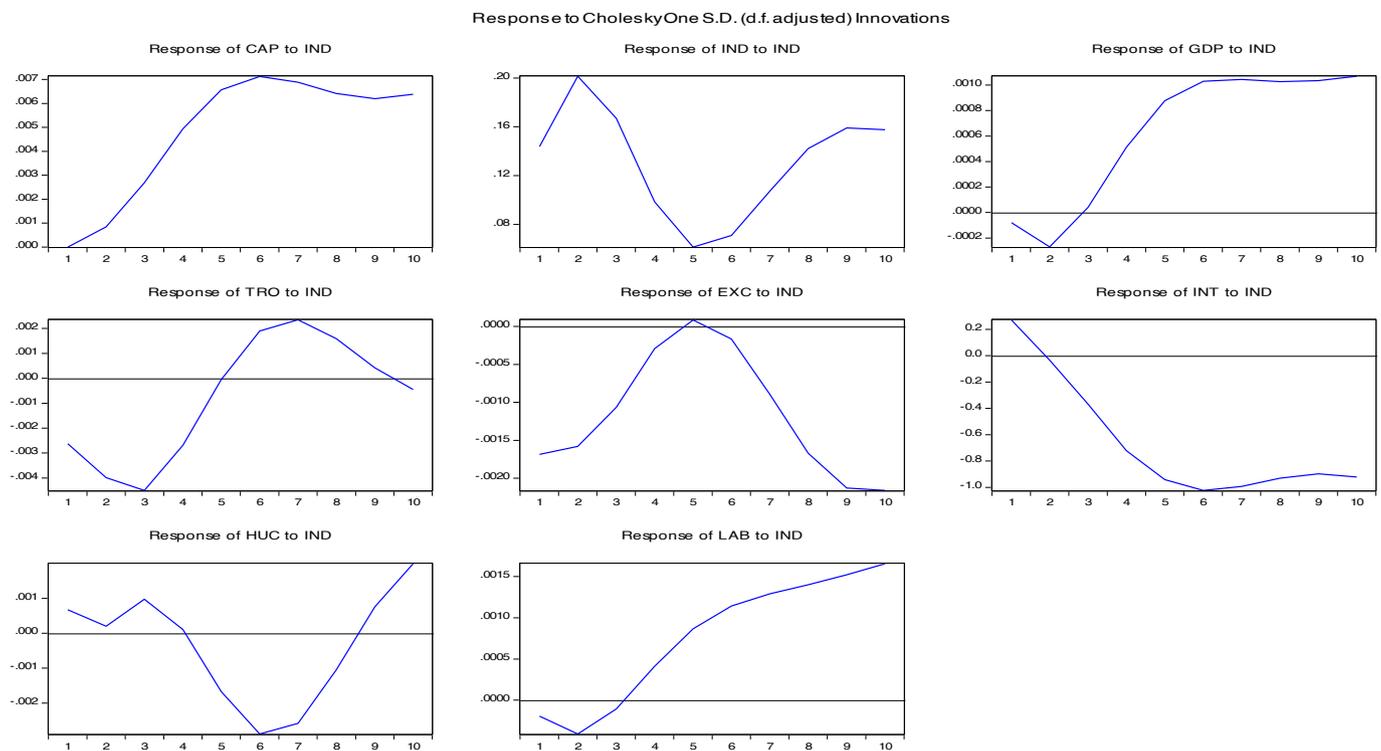
LAB, while a percentage reduction in INT will increase to about 0.00001 per cent in LAB but not significant.

Short run Estimation

It can be depicted from the result that an upsurge in the capital (CAP) will lead to a 0.09 per cent increase in employment (LAB). Also, a one per cent reduction in CAP positively affected LAB but not significantly. On the other hand, a per cent surge in value added (VLA) will lead to about 0.76 per cent increase in LAB. And a per cent reduction in VLA will lead to about 0.68 decreases in LAB. Also, a one per cent increase in wages and salaries (WAG) will increase LAB by about 0.014 per cent, while a 1 per cent reduction in WAG will lead to a 0.004 decrease in WAG.

A per cent increase in education aid (EDD) will cause about 0.002 decreases in LAB. A per cent reduction in EDD will result to about 0.0056 reductions in LAB. Likewise, a per cent surge in health aid (HED) will lead to about 0.006 per cent reduction in LAB. A per cent reduction in HED will cause about 0.009 increase in LAB. An increase in industrial aid (IND) will lead to about 0.1 per cent increase in LAB, while a per cent reduction in IND will cause about 0.004 contractions in LAB. A percentage surge in infrastructural aid (IFD) will result to a 0.025 per cent increment in LAB. At the same time, a percentage reduction in IFD will cause an increase of about 0.00001 per cent in LAB. An increase in education and health aid will negatively affect employment in the short run; this finding contradicts the complementary theory. However, this current study shows that an increase in industrial and infrastructural aid will promote employment; this is in line with the study of [Xu and Zhang \(2022\)](#), who stressed that infrastructural aid used on products and industrial purposes has a positive effect on economic growth and employment.

A 1 per cent increase in trade openness (TRO) will lead to about 0.004 per cent decrease in LAB. In comparison, a 1 per cent reduction in



Source: Author’s Computation

Fig. 14. Impulse Response function for Industrial Aid. Source: Author’s Computation.

TRO will cause an increase of about 0.0001 per cent in LAB. But both are not significant. A 1 per cent surge in the exchange rate (EXC) will lead to about 0.007 per cent increase in LAB but not significant. At the same time, a 1 per cent reduction in EXC will lead to about 0.039 per cent increase in LAB. Likewise, a one per cent increase in institutional quality (INQ) will positively affect LAB. In comparison, a 1 per cent reduction in INQ will also cause a positive impact on LAB, but both are not statistically significant. Finally, a percentage surge in interest rate (INT) will lead to about 0.0001 reductions in LAB, while a percentage reduction in INT will lead to about 0.00001 per cent increase in LAB.

NARDL result for model 2 (Using GDP as dependent variable)

The impact of aggregated aid on employment and economic growth (Model 2) using NARDL is shown in Tables 6 and 7. Model 2 is divided into two, the first is when the study uses economic growth (GDP) as the dependent variable, and the second is when employment is used as the dependent variable. Table 6 presents the non-linear ARDL when GDP is the dependent variable.

The long-run estimation

Table 6 shows that a capital (CAP) upsurge will increase economic growth (GDP). And a reduction in CAP will decrease GDP; however, both are statistically insignificant; the finding contradicts Adebayo and Beton Kalmaz (2020). Likewise, percentage growth in labour (LAB) will lead to an increase in GDP, although it is not statistically significant; this finding contradicts the study by Nchofoung et al. (2021). And one per cent reduction in LAB will lead to about 1,448 decreases in GDP. Also, a one per cent upsurge in human capital (HUC) is not statistically significant, and it will result in to decrease in GDP, while a one per cent reduction in HUC will lead to about 0.424 decreases in GDP; this finding contradicts the study by Babalola et al., (2019), who reported that improvement in the stock of human capital promotes employment and growth in Nigeria.

A per cent surge in aggregated aid (AID) will result to about 0.014 per cent increase in GDP, while a percentage reduction in AID will lead to about 0.036 declines in GDP; this finding is in line with the study of

Boateng et al. (2021). Similarly, the asymmetric effects of foreign aid on economic growth examined in this current study are in line with the literature relating to Nigeria that reported an increase in aid will promote aggregated output, although the previous studies ignored the asymmetric effects (Fasanya & Onakoya, 2012; Odusanya, Logile & Akanni, 2011). But contradicts the study by Kamguia et al. (2022), who reported that aid negatively affects economic growth in less complicated developing countries. Aid to social sectors like health and education boosts the percentage of students enrolled in school, which enhances human capital and increases worker productivity (Fashina et al., 2018).

One per cent increase in trade openness (TRO) will lead to about 0.293 reductions in GDP, while one per cent reduction in TRO will cause an increase of about 0.541 per cent in GDP; this finding contradicts the study by Adebayo and Beton Kalmaz (2020) who document that trade openness promotes growth in the long-run. Likewise, a one per cent surge in the exchange rate (EXC) will lead to an increase in GDP, while a one per cent reduction in EXC will lead to a decrease in GDP; however, both are not statistically significant; the finding contradicts the study of Oziengbe (2017) that show a positive relationship between exchange rate and economic growth in Nigeria. Likewise, a one per cent increase in institutional quality (INQ) will increase GDP but not statistically significant. At the same time, a 1 per cent reduction in INQ will result in about 0.161 declines in GDP. Finally, a percentage surge and decrease in interest rate (INT) will increase GDP, but both are not statistically significant.

Short run Estimation

In Table 4.10, it can be depicted from the result that an upsurge in the capital (CAP) will result in a 0.092 per cent increase in economic growth (GDP). However, a one per cent reduction in CAP resulted in a 0.13 decrease per cent in GDP. On the other hand, a unit upsurge in labour (LAB) will lead to about 0.45 per cent increase in GDP. And a one per cent reduction in LAB will lead to about 0.85 increase in GDP. Also, a one per cent increase in human capital (HUC) will increase GDP by about 0.040 per cent, while 1 per cent reduction in HUC will lead to

about 0.065 decreases in GDP. A per cent increase in aggregated aid (AID) will cause an increase in GDP but is not statistically significant. While a percentage reduction in AID will result to about 0.002 declines in GDP. The findings contradict other studies in Nigeria that reported aid to promote economic growth (Ogbuabor et al., 2017; Saibu & Obioesio, 2017). The mixed result may be attributed to differences in estimation techniques. While Ogbuabor et al. (2017) used ARDL, Saibu & Obioesio (2017) used IV-2SLS. However, both studies investigated aid's asymmetric effects on economic growth.

A 1 per cent increase in trade openness (TRO) will lead to about 0.08 per cent reduction in GDP, while a 1 per cent reduction in TRO will cause an increased GDP but not statistically significant. Likewise, a 1 per cent surge in the exchange rate (EXC) will increase GDP while a 1 per cent reduction in EXC will reduce GDP, but both are not statistically significant. Likewise, a one per cent increase in institutional quality (INQ) will increase GDP but not statistically significant. At the same time, a 1 per cent reduction in INQ will result in about 0.017 declines in GDP. Finally, a percentage surge in interest rate (INT) will increase GDP but is not statistically significant. While a percentage reduction in INT will to about 0.0001 per cent increase in GDP.

NARDL result for model 2 (Using employment as dependent variable)

Table 7 presents the non-linear ARDL when employment is used as the dependent variable.

The long-run estimation

Table 7 shows that an upsurge in the capital (CAP) will increase employment (LAB). And a reduction in CAP will increase LAB; however, both are statistically insignificant. Percentage growth in value added (VLA) will lead to 0.503 per cent increase in LAB; this finding is in line with the study of Chen et al. (2012). And one per cent reduction in VLA will lead to an increase in LAB but not statistically significant. Also, a one per cent increase in wages and salaries (WAG) will lead to about 0.582 per cent increase in LAB, while a 1 per cent reduction in WAG will lead to a decrease in WAG but not significant.

A per cent surge in aggregated aid (AID) will result to about 0.013 per cent reduction in LAB, while a percentage reduction in AID will lead to an increase in LAB but not statistically significant; the finding contradicts the study by Boateng et al. (2021). Although sectoral aid to education and health aid is positively related to employment, aggregated aid is not. The outcome of the aggregated aid on employment is in line with the findings by Nchofoung et al. (2022), which documented that aid negatively affects employment in 37 African countries.

A 1 per cent increase in trade openness (TRO) will lead to a rise in LAB but is not statistically significant. While a one per cent reduction in TRO will cause an increase of about 0.131 per cent in LAB. 1 percentage surge in the exchange rate (EXC) will lead to a decrease of about 0.655 per cent in LAB, while a one per cent reduction in EXC will lead to an increase of about 0.735 per cent in LAB. Likewise, one per cent increase in institutional quality (INQ) will increase about 0.219 per cent in LAB. At the same time, a 1 per cent reduction in INQ will decrease LAB but not statistically significant. A percentage surge in interest rate (INT) will lead to about 0.002 per cent reduction in LAB. At the same time, a decrease in interest rate will increase LAB but not statistically significant.

Short run Estimation

In Table 7, it can be depicted from the result that an upsurge in the capital (CAP) led to a 0.059 per cent increase in employment (LAB). However, a one per cent reduction in CAP will decrease per cent in LAB but not statistically significant. A unit upsurge in value added (VLA) will lead to about 0.49 per cent increase in LAB. And one per cent reduction in VLA will lead to about 0.76 reductions in LAB. Also, a one per cent upsurge in wages and salaries (WAG) will increase LAB by about 0.171 per cent. In contrast, a 1 per cent reduction in WAG will decrease LAB but is not statistically significant. A per cent upsurge in aggregated aid (AID) will cause a decrease of about 0.002 per cent in LAB; this finding contradicts the study by Boateng et al. (2021). At the same time, a per

cent reduction in AID will result to about 0.0002 increase in LAB. An increase in aid will negatively affect employment in the short run; this finding contradicts the complementary theory. However, this aligns with a strand of literature which contends that giving aid to developing economies negatively affected employment by displacing savings, leading to issues with aid dependence (Kamguia et al., 2022; Herzer & Morrissey, 2013; Rajan & Subramanian, 2011).

A 1 per cent increase in trade openness (TRO) will lead to about 0.044 per cent reduction in LAB, while a 1 per cent reduction in TRO will cause an increase of about 0.045 per cent in LAB. 1 per cent surge in the exchange rate (EXC) will reduce in LAB with about 0,189 per cent. At the same time, a 1 per cent reduction in EXC will increase LAB but is not statistically significant. Likewise, a one per cent increase in institutional quality (INQ) will lead to an increase of about 0.03 per cent in LAB. While a 1 per cent reduction in INQ will result in about 0.003 reductions in LAB, it is insignificant. A percentage surge in interest rate (INT) will lead to an increase of about 0.0001 per cent in LAB. At the same time, a percentage reduction in INT will increase in LAB, but not statistically significant.

Vector error correlation model (VECM) result

Table 8 presents the variance decomposition table of aggregated and disaggregated aid on employment and economic growth. The error shock from AID has a minimal effect on economic growth throughout the time horizon, while human capital is the most affected. And capital is the least affected. The error shock from EDD is higher on economic growth than other variables and has minimal impact on human capital throughout the time horizons. In contrast, capital is affected most after economic growth. The error shock from HED is higher on capital than on other variables. With minimal impact on economic growth throughout the time horizon. The error shock from IFD is higher on trade openness than other variables. With minimal impact on human capital throughout the time horizons. The error shock from IND affects the interest rate and human capital variation throughout the time horizons.

In conclusion, evidence from the variance decomposition tables shows that aggregated aid shock affects economic growth more than employment. Also, education aid and infrastructural aid affect economic growth more than employment in Nigeria. At the same time, health aid and industry aid affect employment more than economic growth in Nigeria. While studies on the shock implications of aid on developing economies are still growing, Fashina et al. (2018) reported that aid shock is insignificant to economic growth in the long run, which contradicts the findings of this study.

The impulse response function generated from the VECM is present in Figs. 10 – 14, giving main attention to the choice of variables: economic growth and employment. Evidence from the result shows that a one standard deviation shock to aggregated and education aid causes a significant decrease in economic growth and employment for periods 1 to 10. Also, one standard deviation shock to health aid caused a significant reduction in economic growth from period 1 to 8; afterwards, an increase was observed—likewise, a decrease in employment from period 1 to 4, and after that, an increase in employment. In addition, a one standard deviation shock to infrastructural aid causes a negative effect on economic growth and employment for a while; however, a positive response was observed in periods 6.5 and 8 for economic growth and employment, respectively. In comparison, one standard deviation shock to industrial aid causes a negative effect on economic growth and employment up to period 3 and then increases afterwards.

Diagnostic checks

Tables 4 – 7 show the diagnostic results of NARDL estimations; Durbin-Watson's (DW) statistics for the first model using GDP as a dependent variable is 2.370473, and using employment is 2.427462. Likewise, the DW statistics in the second model, using GDP, is 1.967379

and using employment, it is 1.969987. The DW for the four estimations are closer to 2 and indicates no autocorrelation in the model. The R-squared for each are as follows, 0.990632, 0.999783, 0.965270 and 0.999556 and the adjusted R-squared are 0.988175, 0.999612, 0.958859 and 0.999342. These values indicate more than 95 per cent of variations in the independent variables have been explained in the dependent variable. Hence, the models have a good fit. Furthermore, the F-statistics probability values of the model are less than 0.05; this indicates that the independent variables jointly explain the dependent variable.

In addition, the histogram normality probability values are 0.654320, 0.170510, 0.810518 and 0.80504. Therefore, the null hypothesis that the error terms are not normally distributed is rejected at a 5 per cent significance level. The serial correlation probability values are 0.1533, 0.1328, 0.1116 and 0.5358. Also, the Heteroskedasticity probability values are 0.9961, 0.8078, 0.5100 and 0.4720. From the probability values, the null hypotheses of serial correlation among the error terms and variance of error terms are not constant over time are rejected at a 5 per cent significance level. In addition, Figs. 1 – 4 present the models' stability test. It can be depicted that the cusum line is between the upper and lower boundaries for the observation period; this shows that the model is stable at a 5 per cent significance level.

Likewise, for the VECM, Table 9 presents the VECM lag exclusion result. Based on the outcome of the result, we used two lags to estimate the VECM. The joint null hypothesis is that the lag length should be used in estimating the VECM model. The alternative hypothesis is that another lag length should be used. We rejected the null hypothesis for lag 1, but it cannot be rejected for lag 2. Also, we started with more lags using the approach of general-to-parsimony before we concluded. In addition, the inverse roots of the characteristic AR polynomial of our models satisfy the requirement for dynamic stability of the estimated system of equations. The result is presented in Figs. 5 – 9.

Conclusion

The empirical implications of foreign aid on economic growth and employment have been subjected to intense debate, especially in developing economies. Theoretically, linkages between aid, output, and employment have been established in the literature. The Keynesian theory of employment creates a concept that is the primary driver of output by emphasising demand. As a result, aggregate demand is a key factor in determining the degree of employment in the economy and incorporating Keynes's idea of quantity demanded with the complementarity theory, which holds that job growth is a function of consumption anticipated by output sectors complementing by aid consumption. Hence, foreign aid can be envisaged as an essential source of funds in most Sub-Saharan African (SSA) nations, including Nigeria, where it complements inadequate savings, limited export profits, and weak tax bases.

Foreign aid is presumed to advance developing nations' welfare and economic growth. Nigeria has been an attractive destination for foreign aid. In addition, despite the increased foreign aid to Nigeria, the macroeconomic indicators towards sustainable growth and development have remained low, especially given the high unemployment rate and low level of economic growth. In addition, most studies concerning aid and the economy investigated the impact of aid on the aggregate form. Also, with less emphasis on aid implications on employment. While others used a panel data set. The data panel data set has its advantage due to its flexibility, but most countries have different stages of growth, and economic and non-economic factors affect the growth processes through various channels. Hence, making a generalised conclusion may cause the policy to be inconclusive. Therefore, this study examines the effect of foreign aid on employment and economic growth in Nigeria using disaggregated data on aid. The study covers 2002Q1 to 2021Q4, intending to improve the frontier of knowledge on the subject matter and advocate for the need for effective and efficient utilisation of

sectoral foreign aid to ensure that its impacts are adequately felt on economic growth and employment.

In order to maximise the benefit of aid on the Nigerian economy, the sectoral aid effects must be identified. In this regard, policy formulation should be able to identify that implication of aid can be in three categories. First, aid affects employment and output in a short period of time. Secondly, aid that affects the economy in a long-term period. And third, aid that has no significant effect on the economy. Although the type of aid considered in this study (health, industry, infrastructure and education) can also promote aggregate output and employment. But the Nigerian government should focus on fostering long-term growth via infrastructural aid. Secondly, there is a need to safeguard the aid inflow into the country and channel it to promote pro-growth in human capital formation to ensure long-term employment growth, especially education and health aid. Thirdly, increasing the country's competitiveness, as evidenced by the implication of trade openness on employment and economic growth, is indispensable. Because aid inflow can affect the exchange rate, which can lower growth in production sectors, negatively affecting aggregate employment. Also, strengthening the economic institution will help maximise aid's benefit on aggregate output and employment in Nigeria. Given the low magnitude of institution quality on aggregate production and employment in Nigeria, strengthening the institution may help reduce the mismanagement of funds. Nations with weak institutional quality experience corruption, political instability, and a lack of government accountability; it is believed that aid-recipient countries with greater institutional quality will have a positive marginal effect of sectoral aid on economic growth and employment; this may not only be limited but may affect the security of private property, which will encourage short- and long-term investment.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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