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IMPACT OF HEALTH EXPENDITUREON UNDER FIVE MORTALITY IN NIGERIA: AN ARDL APPROACH

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Abstract

This study examined the relationship between health expenditure and under five mortality contingent on control of corruption in Nigeria spanning the period 2000 - 2020. The study used time series data generated from world bank indicators. The ARDL model was adopted here. The Augmented Dickey Fuller (ADF) unit root test revealed that some of the variables were integrated at order one while the rest are stationary at levels at 5% confidence levels. The result also shows that the variables are cointegratedsincethe computed F-statistic (5.97) falls above the upper bound of the critical values at 1%, 5%, 2.5% and 10% significance level, indicating that there is a long-run association between the explanatory variables GXIM, PHYS,OOPE and CCP and the dependent variable, Under five mortality rate (U5MR) within the period under investigation.However, the result of the ARDL model reveals that the coefficient of the Error Correction Term (ECM (-1)) is negative (-1.19) which implies that there is adjustment of 1.19 percent from short-run to long-run equilibrium among the variables of the study.The ARDL model further showed that, Government expenditure on immunization (GXIM) and physicians density (PHYS) have negative impact on the Under-five mortality rate while Out of pocket expenses (OOPE) and Control of Corruption have positive impact on Under-five mortality rate in Nigeria. The variables are however jointlystatistically significant. The study therefore recommends that the government should effectively fight corruption in the Health Sector by effectively taking proactive steps in ensuring corruptindividuals in the system are rooted out to reduce corrupt practices and improve child mortality rate.

Keywords : Health Expenditure, Under Five Mortality Rate, Control of Corruption,

1. Introduction

The nexus between Health expenditure and child mortality has received serious attention in both developed and developing countries of the world due to its importance in enhancing growth and development of any nation. The general view of government spending on health is that, it can enhance sustainable growth if effectively and efficiently utilized. As such, there have been huge challenges in the process of improving health outcomes and prevalence of large scale healthproblems, such as high child mortality rate and low life expectancy, especially in developing countries which areaconsequence of the scarce health resources andinadequateinfrastructures.Edeme, Emechetaand Omeje (2017) reveal that apart from healthcare budgets whose allocation is low in less developed Countries (LDCs) compared to that of developed countries, the few health infrastructures available are unbalanced between urban and rural areas. In this regard, adequate and efficient health spending remains crucial in improving health outcomes . government expenditure in general plays greater role in influencing macroeconomic variables (Yunana & Dahir, 2016).

Child mortality is a key global indicator of child health (UNICEF, 2016) and one of the most important measures of global health(Black, Levin, Walker, Chou, Liu and Temmerman, 2016) as stated in the Millennium Development Goal (MDG4) and the Sustainable

Development Goal (SDG3) (United Nations, 2016) whose aim is to reduce under-5 mortality to as low as 25 deaths per 1000 live births in all countries by 2030. Substantial progress has been made in this regard since 1990 . The global under-five mortality rate declined by 61 per cent from 93 deaths per 1,000 live births in 1990 to 37 in 2020. In 2020 alone, a high number of roughly 13,800 under-five deaths occurred every day with children facing widespread regional and income disparities in their chances of survival. (Unicef, 2021). The leading causes of which involves infectious diseases, preterm birth complications, birth asphyxia/trauma, pneumonia, congenital anomalies, diarrhea and malaria, all of which can be prevented or treated with access to simple, affordable interventions including immunization, adequate nutrition, safe water and food and quality care by a trained health provider when needed. Liu, Oza , Hogan , Chu , Perin and Zhu (2016). Likewise, malnourished children are at a higher risk of death from these common childhood illnesses. Thus, the need for access to life-saving interventions to ensure steady mortality decline especially in low- and middle-income countries. (UN IGME, 2021)

Although the world as a whole has been accelerating progress in child mortality rate reduction, differences still exist in under-5 mortality across regions and countries. Sub-Saharan Africa(55 per cent) and Asia (27 per cent) remain the regions with the highest under-5 mortality rate in the world, with 1 child in 13 dying before his or her fifth birthday and accounting for more than 80 per cent of the 5.2 million global under-5 deaths in 2019. Its occurrence is highest countries like Nigeria, India, Pakistan, the Democratic Republic of the Congo and Ethiopia, of which Nigeria and India alone account for almost a third of all deaths. (WHO, 2020)

Since independence in 1960, the Nigerian health system has been evolving over the years through various health care reforms such as National Immunization Coverage Scheme (NICS) and Midwives Service Scheme (MSS) to address its public health (child mortality) challenges. However, Bolaji (2018) opined that inability to effectively address these numerous public health challenges has led to persistent and high level of poverty , weakness of the health system, Political instability, corruption, limited institutional capacity and an unstable economy are viewed as the major factors responsible for the poor development of health services in Nigeria. Whereas households and individuals in Nigeria bear the burden of a dysfunctional and inequitable health system in the area of delaying or not seeking health careand having to pay out of pocket for health care services that are not affordable.

Nigeria's health care expenditure has been dwindling over the years with budgetary allocation to the Healthcare sector hardly reaching 5% as against the 15% recommended for all African countries at the 2001 Abuja Declarion by the African Union. There are various health issues seeking for attention in the midst of limited resources and when these resources are available, it is diverted to other purposes. Likewise, the sharp decline in crude oil prices globally, fall in the nations crude oil production quota and the impending COVID-19 pandemic has been a major distraction to economic activities leading to the neglect of healthcare sector.

Corruption has been identified as one of the unresolved problems in Nigeria which has remained a long-term major economic and political challenge that has skewed development critically (Sachs, 2001). It ranges from petty corruption to political / bureaucratic corruption or Systemic corruption which has held back every progress as opined by Mo(2001), Gyimah-brempong, (2002) and Ndikumana, (2006). Likewise, in support of the Transparency International Consistent ratings, (Ribadu, 2003) where Nigeria isidentified as one of the three most corrupt countries in the World whose corruption has become widespread such that it seems to have been legalized, thereby permeating the government and oilfieldsofthe entire nation.

Corruption in the health sector in Nigeria come in many forms . These include absenteeism of its health care workers. This often occurs because they are working another job in the private sector that likely pays a higher salary, so when they are dually scheduled, the public sector suffers and patients who rely on the poorly staffed public facilities face long wait times and health care that is likely not person-centered. Nishtar (2010). Likewise, informal

payments (bribes or kickbacks), which are payments made in kind or in cash by patients or relatives outside official payment channels or purchases meant to be covered by the health care system(Lewis, 2007) made directly to individual providers to either access care, avoid queues, receive more attention or better care, or even express gratitude sometimes termed a "coping strategy" for health care workers to make up for remuneration that does not match their perceived efforts (Kankeu & Ventelou, 2016) and this pattern is appears to be an understandable part of a broken system whereas, this type of malpractice is further enabled due to the use (and even lack of use) of paper records, which makes proper tracking of supplies and payments very difficult Nishtar, 2010

Another form of corruption common in health care is mismanagement of resources and theft of supplies, whether drugs, diagnostic equipment, or even spare parts often perpetrated by hospital administrators, who agree to deals with companies to purchase only their equipment or take money for projects or conditions that are not a need or priority for their community. Pilfering of supplies. Medicines and equipment are siphoned off along the entire supply chain from the stage of procurement delivery to their final destination (Nishtar, 2010) while medicines are sometimes diverted for resale by nurses and other health care professionals, bills or invoices are padded with services that the patient did not use, or records created for "ghost patients" who allegedly received medicine. Theft of spare parts for larger hospital equipment is also commonplace and cannot be overlooked.

Furthermore, the de-prioritization of the sector by the government as it strives to meet other pressing obligations WHO (2016) resulting in placing of more emphasis in less productive sectors is a contrary response to theplight of the growing number of COVID-19 cases that has necessitated an increase in budget share to the health sector instead.A lot of studies have come up with conflicting results with regards health expenditure and its performance on child mortality signifying a gap for further investigations but what has been overlooked in most literatures is the role of corruption in the relationship, which has hampered the flow of resources in reaching the children at the grass roots. Perhaps, the reason for the world bank and United Nations' recommendation to developing countries to pay more attention to the quality of their institutions and governance (Holmberg, Rothstein, &Nasiritousi, 2009).

Given this background, this study seeks to assess the Impact of health expenditure and corruption on improving the mortality rate of children under the age of five in Nigeria over the period 2000-2020. This paper shall therefore contribute to existing analysis within the framework of health care financing and health outcomes in Nigeria. The research hypothesis of the study is formulated in null form as follows: Health expenditure, contingent on corruption has no impact on under five mortality ratein Nigeria. Following this introduction, the remainder of the paper is organized as follows: section II provides the literature review, Section III presents the methodology, Section V contains the analysis and discussion of the results, and the last section concludes and presents policy implications.

2.Literature Review

2.1 Theoretical Theories

2.2.1 The Keynesian Theory of Expenditure

This theory will be adopted in this paper. It was propounded by John Maynard Keynes who advocated government intervention in the management of the macro economy. The prevailing economic theory before Keynes revolution was, the classical or orthodox postulation which states that the market system has the ability to automatically adjust the economy to a point of equilibrium at any stage of the economy, hence there is no basis for government intervention. However, Keynes (2009), in his theory believes that expenditure can contribute positively to economic growth such that an increase in government consumption is likely to lead to an increase in employment, profitability and investment through multiplier effects on aggregate demand. Thus he postulatedthatthe extension of the functions of the state can lead to an increase in public expenditure on administration and regulation of the economy, the rise in public expenditure will bring about more than proportional increase in the national income (income elastic wart) resulting in a relative expansion of the public sector (Ilori and Ajiboye, 2015).

Likewise, the theory opines that government should make huge public spending in the areas that the private sector is deficient and also in activities that need huge capital outlay for the interest of the general public called public good. The model thus supports the idea of public spending to enhance good health outcomes (child mortality inclusive) and economic development of a country.Keynes propositions is applicable tothe Nigerian economy as it supports government healthcare spending and political activities. The theory condemns the classical long-run relationship which cannot be relied on, because in the long run, we all die. Hence, stressed the need for short-run model that will bring the economy to its equilibrium state, and the need for government expenditure also to cure for short-run dynamics. He sees savings as withdrawal from the circular flow, but spending as a boost for production. Thus, advocates for increase in government expenditure to create more purchasing power in the hand of the people, hence, increasing employment.

Finally, the Keynesians proposed that government intervention should not be done directly but indirectly through fiscal policytoolswhich include expenditure and tax byway of tax reduction which eventually leads to havingmore money flowing in the economy and more money available for people to spend on their health due to increased earnings, thereby also addressing the issue of healthcare financing through Out-of-Pocket payment.

2.2Empirical Literature

Logarajan, Nor, Sirag,Said and Ibrahim (2022) examined the relationship between public, private, and out-of-pocket health expenditures and the under-five mortality rate in Malaysia using the autoregressive distributed lag (ARDL) estimation techniqueusing the response surface method for a time-series data of 22 years and found that out-of-pocket health expenditure reduced U5MR in Malaysia, while public and private health expenditures were statistically insignificant.

Similarly, Agbatogun, Opeloyeru (2020) also did a study on the macroeconomic determinants of under-five mortality rate in Nigeria between 1980 and 2017 using the ARDL bounds test estimation techniqueand the human capital development theoryand found that government expenditure is significant while immunization initiatives and health workers exerted an insignificant positive influence on under-five mortality rate.

Russo, Scott, Sivey and Dias (2019) studied the impact of primary care physicians and infant mortality in Brazil from 2005 to 2012. The study used dynamic panel data approach and the result revealed that primay care physician supply contributed to the decline of infant mortality in Brazil. The above works does not capture corruption in their analysis. Interestingly, Corruption was studied in the works of (Ngulube, 2007), (Heckelman& Powell, 2010), (Gyimah-brempong, 2002), (Ndikumana, 2006), and (Mo, 2001)but they all focused on its impact on economic growth insteadwith all the investigations revealing both positive and negative effects of corruption on economic growth, investment, government expenditure, and public health expenditures. For example; proliferation in corruption can lead to an upsurge in investment (Mauro, 1996), in another vent, an increase in corruption reduces the economic growth rate (Mo, 2001), government expenditure is found to be seriously reduced by corruption (Mauro, 1998).

The few studies that investigated corruption and health were (Hussmann, 2011), (Hilaire, 2014)(Carin Nordberg, Vian, 2008)(Sanjeev Gupta, Hamid Davoodi, 2000), but just a few have studied the role of corruption in public health expenditure- health outcome relationship like Hilaire, 2014 in the study titled " Does good governance improve public health expenditure-health outcome nexus? New empirical evidence from Africa". which differs from others because of the expansion of its scope to developing countries.

Considerably, Yaqub, Ojapinwa and Yussuff (2015), investigated the effectiveness of public health expenditure on governance in Nigeria using a two stage least square method and found that public health expenditure has negative effect on infant mortality and under-5 mortalities when the governance indicators are included. Thus concluding that the achievement of the Millennium development goal of reducing under-5 mortality rate in Nigeria may be unachievable if the level of corruption is not reduced significantly. No wonder Andrew (1995) asserts that the process of reform is not concerned only

with defining priorities and policies, but with reforming and restructuring the institutions through which health policies are implemented. Likewise, the study of Odhiambo (2014) also analysed the corruption factor in his work and found that the quality of governance proxied by corruption perception index had an impact on effectiveness of health expenditure in reducing under-five and adult mortality. Thereforeconcluding that Public health expenditure is more effective in reducing under-five mortality in low corruption environments than in highly corrupt environments. In the same vein, the works of Novignon, Olakojo and Nonvignon (2012) whichis also in support ofAnyanwu and Erhijakpor (2007)showed that health care expenditure significantly influences health status through improving life expectancy at birth, reducing death and infant mortality rates. Thereby affirming that health care expenditure remains a crucial component of health status improvement in sub-Saharan African countries.

Similarly, Ahmad and Hasan (2016) identified that there has been less attention given in analysing the relationship between government expenditure, governance and health outcomes particularly in developing countries and did a study on the impact of public health expenditure and governance on health outcomes in Malaysia using an Autoregressive Distributed Lag (ARDL) cointegration framework with data from 1984 to 2009. The result of the bounds testing procedure show that a stable, long-run relationship exists between health outcomes and their determinants, that is, income level, public health expenditure, corruption and government stability, indicating that public health expenditure and corruption affect long-and short run health outcomes in Malaysia. Thus, the need for attention to be given to reduce or eliminate the corruption rate as it has adverse effects on the country.

Furthermore, Rajkumar and Swaroop (2008) used an OLS regression for ninety-one high andlow-income countries using annual data for the years 1990, 1997 and 2003 to examine the socialresults of government expenditure on health impacts. The authors' findings confirm thatcountries with low level of corruption and strong governance have a greater negative impact onpublic health expenditure on child mortality and also pointed outthat public health care spending per se does not assure improvement of social outcomes, but soundgovernance factors such as efficient budget design, implementation and monitoring are critical toattaining a higher quality of health status. However, their estimates might be biased, as potentialendogeneity of health expenditure in the child mortality equation was not controlled.

The above empirical review thus demonstrates that the interaction of public and private health spending and corruption on childhood mortality has mixed or ambiguous results. Variations of which may be due to differences in the econometric methodology, data set, time and sample coverage which includes different countries and regions without ensuring relative homogeneity in health outcomes and economic circumstances.

3. Methodology

3.1 Model Specification

The model for this study is adopted from the work of Edeme, Emecheta, and Omeje (2017) who used ordinary least square technique (OLS) and included governance indicators in their variables.The model of both works was modified to include variables like Life Expectancy (LFEXP) , Infant Mortality Rate (IMR) and Under five mortality rate (U5MR) as the Dependent variable to Measure Health Outcomes, and Health Expenditure (HEXP), Urban Population (URBP), Per Capita Income (PCI), and HIV Prevalence Rate (HIVPR) and Governance indicators (GI) as the independent variables to measure Health Outcomes.

The econometric form of their model is shown below as :

$$HO_t = \beta_0 + \beta_1 HEXP_t + \beta_2 URBP_t + \beta_3 PCI_t + \beta_4 HIVpr_t + \beta_5 GI_t + \mu_t \quad \text{.....(1)}$$

Where:
HO = Health Outcome, HEXP = Health Expenditure ,URBP = Urban Population,
PCI = Per Capita Income, HIVpr = HIV Prevalence rate ,GI = Governance indicators

U_t = Error Term, β_{1-5}= Parameters.

However, in order to achieve the objective of this study, the model is modified to use only one dependent variable; Under Five Mortality Rate (U5MR) while the Health expenditure component will be disaggregated into public and private expenditure , thus, other independent variableswill be added to the model as well as the Control of Corruption (CCP) index. Meanwhile, the HIV Prevalence rate (HIVpr) and Governance indicators (GI) in equation (1) is removed and a new model is shown in equation 2 below:

CM = f (PHE + PrHE + CCP) …….(2)

Where ;CM = Child mortality proxied by U5MR, PHE = Public Health Expenditure which comprises of GXIM = Government expenditure on Immunization, PHYS = Physician's density (Number of doctors per 1,000 lives), PrHE = Private Health Expenditure**,** which comprises of OOPE = Out of pocket expenses , CCP = Refers to Control of Corruption.

The empirical support for some of the variables included in the models are found in the works of Xavier (2005) and Dhrifi (2018)

The model is now expanded as follows:

CM = U5MR

PHE =$\beta_0 + \beta_1 GXIM_t + \beta_2 PHYS_{2t} + \mu_t$ …… (3)

PrHE= $\beta_0 + \beta_1 OOPE_t + +\mu_t$ ……. (4)

Adopting Under Five Mortality Rate (U5MR) as proxy for Health Outcome (Child mortality), equation (3 and 4) above is re-specified in equation 5 below:

$$U5MR=f(\beta_0 + \beta_1 GXIM_t + \beta_2 PHYS_{2t})+(\beta_0 + \beta_1 OOPE_t + \beta_2 PCI_{2t})+\mu_t \quad \ldots\ldots\ldots\ldots(5)$$

Adopting the model as explained by brambor, Clark and Golder (2005), in order to fulfil the objective of the study, there is the need to introduce an interaction term to accurately justify the impact ofHealth expenditures (public and private health expenditure) and child mortality (under five mortality)and how control of corruption affects it.

$$U5MR_t = \beta_0 + (\beta_1 GXIM_t + \beta_2 PHYS_{2t}) + (\beta_3 OOPE_{3t}) + \beta_4 CCP_{4t}) + \cdots \ldots (6)$$

Where :

U5MR = Under Five Mortality Rate, GXIM =Government Expenditure on Immunization

PHYS = Physicians density, OOPE = Out of pocket expenses, CCP = Control of Corruption , β_{1-4}= Parameters of the Model to be estimated, μ_t = Error Term

$\alpha_1,\alpha_2,\alpha_3,\alpha_4, \ldots\ldots\ldots, \alpha_{5\ >0}$are the aprioriexpectations,

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are the slopes of the coefficients.

ARDL Equation

$\Delta U5MR_t = \beta_0 + \sum\beta_1\Delta U5MR_{t-1} + \sum\beta_2\Delta GXIM_{t-1} + \sum\beta_3\Delta PHYS_{t-1} + \sum\beta_4\Delta OOPE_{t-1} + \sum\beta_5\Delta CCP_{t-1} + \gamma_1\Delta U5MR_{t-1} + \gamma_2\Delta GXIM_{t-1} + \gamma_3\Delta PHYS_{t-1} + \gamma_4\Delta OOPE_{t-1} + \gamma_5\Delta CCP_{t-1} + ECM_{t-1} + \mu_t$ ……(7)

3.2. Data Source and Techniques of Estimation

This study examined the impact of health expenditures on under five mortality rate, contingent on corruption in Nigeriausing secondary data that spanned the period 2000-2020, extracted from theWorld Bank database. The data collected wereon Under five mortality rate (U5MR), Government expenditure on Immunization (GXIM), Physicians density (PHYS), Out of pocket expenses (OOPE) and control of corruption (CCP) where U5MR is the dependent variable while GXIM, PHYS, OOPE and CCPare the explanatory variables.

To estimate the data collected, the study employed Augmented Dickey Fuller (ADF) unit root test, Auto Regressive Distributed Lag (ARDL) Bounds test for cointegration and Error Correction Mechanism (ECM). ADF is a test of stationarity that can be used to check for

spurious regression in a model. It is imperative to test for unit root to ensure that the variables are stationary. This is because unrelated time series may exhibit strong trends (sustained upward or downward movements), which can make it look as if they are related. Thus, the ADF test is chosen because it can handle bigger and more complex time series models.

Furthermore, the ARDL bound test for co-integration is a test used to analyze the long-runrelationships and short-run dynamics interaction between dependent and independent variables. The cointegration approach is unique and different from other approachesas it does not require that all the variables be integrated of the same order. It also provides consistent results for small samples (Pesaran& Shin, 1998).It is a dynamic model unlike other models that are static in nature and since healthcare changes over time, the model is therefore ideal as it captures the short run and long run dynamism associated to it. This model is in line with the works of Ahmad and Hassan (2016) on Public health expenditures, Governance and health outcomes in Malaysia using ARDL, findings of which revealed a stable long run relationship between health outcomes and their determinants. The decision rule of ARDL is that if the value of computed F-statistic is greater than the upper bound, there is cointegration and the appropriate model to use is Error Correction Model. In the same vein, if the value of computed F-statistics is lower than the lower bound, hence, short-run ARDL model is appropriate. The ECM also checks for the speed of adjustment of the model from the short run to the long run equilibrium state. The greater the coefficient of the error correction term, the faster the speed of adjustment of the model from the short run to the long run.

4. Data Analysis and Interpretation of Results

4.1 Test of stationarity

Before carrying out any econometric estimation using time series data that are volatile, It is important to verify the stationarity of the data to avoid spurious results. The unit root test was conducted to take care of that and the results are presented in table 1 below:

Table 1: Summary of the ADF Unit Root Test

VARIABLES	ADF STATISTICS VALUE	CRITICAL VALUES @ 5%	P-VALUE @ 5%	ORDEROF INTEGRATION	REMARKS
U5MR	-8.25792	-3.02068	0.000	I (0)	Stationary
GXIM	-3.29452	-3.040391	0.0307	I (1)	Stationary
PHYS	-6.261208	-3.02997	0.0001	I (I)	Stationary
OOPE	-4.345544	-3.04039	0.0037	I (I)	Stationary
CCP	-4.32175	-3.02997	0.0036	I (I)	Stationary

Source: Researcher's Computation , 2022 using Eviews 10.

From table 1, the result of ADF unit root test shows that ADF t-statistics, in absolute terms, are greater than the critical values at 5 percent level of significance. This implies that all the variables are stationary. However, U5MR was stationary at level I(0) while GXIM, PHYS, OOPE and CCP were stationary at first difference that is, integrated of order one l(1). Thus, due to this mixed order of integration, the ARDL Bounds test for cointegration was conducted. Based on the decision rule, the null hypothesis of no cointegration was rejected.

4.2. ARDL Bounds Test for Cointegration

The result of the ARDL bounds test for cointegration is presented in table 2. This is conducted to know whether there is long run relationship or not.

Table 2: Summary of ARDL Bounds Test for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	

F-statistic	5.969628	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	19		Finite Sample: n=35	
		10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
			Finite Sample: n=30	
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84

Source: Researcher's Computation, 2022.

After ascertaining that the variables were stationary, though at different order of integration, i.e. l(0) and l(1), ARDL bounds test for cointegration was conducted. From the result presented in table 2, the F-Statistics of 5.969628 is greater than both the lower bound and upper bound at 5 percent level of significance. This shows that the variables have long run relationship and the null hypothesis of no cointegration is rejected. Then, ARDL-ECM model was conducted.

4.3. ARDL-ECM Model

The result of the ARDL-ECM Model is presented in table 3. This Model helps to check the speed of adjustment of the variables from the short run disequilibrium to the long run equilibrium state.

Table 3: Summary of ARDL-ECM Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056870	0.034354	1.655380	0.1218
D(GXIM(-1))	-6.284263	0.717907	-8.753586	0.0000
D(CCP(-1))	0.426343	0.385169	1.106898	0.2884
D(OOPE(-1))	2.966782	1.653691	1.794037	0.0961
D(PHYS(-1))	-0.055305	0.064785	-0.853671	0.4087
ECM(-1)	-1.192369	0.163989	-7.271027	0.0000
R-squared	0.917038	Mean dependent var		0.084007
Adjusted R-squared	0.885130	S.D. dependent var		0.422760
S.E. of regression	0.143284	Akaike info criterion		-0.795883
Sum squared resid	0.266895	Schwarz criterion		-0.497639
Log likelihood	13.56089	Hannan-Quinncriter.		-0.745408
F-statistic	28.73964	Durbin-Watson stat		1.686150
Prob(F-statistic)	0.000001			

Source: Researcher's Computation , 2022

The summary of the ARDL model is presented in table 3 having established long run relationship among the variables. The result shows that the constant value of 0.056870 indicates that on average, when all the variables, that is, government expenditure on immunization (GXIM), Physicians density (PHYS), Out of pocket expenses (OOPE) , and control of corruption (CCP) . The coefficient of the lagged value of GXIM is -6.284263 and it implies

that 1 percent increase in GXIM will decrease under-five mortality rate (U5MR) by 6.28 percent. The p value of 0.0000 shows that GXIM is statistically significant with U5MR in Nigeria, since the p value is lower than the critical value at 5 percent level of significance. So, the null hypothesis is rejected. This variable conforms to a priori expectation because it is expected to reduce the rate of mortality among under-five children which is in line with the study of Agbatogun and Opeloyeru (2020)whose study revealed thatpublic spending on health has a significant relationship with health outcomes in Nigeria.

The coefficient of the lagged value of CCP which stands at 0.426343 is positive and it indicates that 1 percent increase in CCP will increase U5MR by 0.43 percent. It is however statistically insignificant because the p value of 0.2884 is greater than the critical value at 5 percent level of significance. Thus, the study fails to reject the null hypothesis which states that control of corruption does not have significant impact on Under-five mortality rate (U5MR). The implication of this positive impact is that corruption is still at high level in Nigeria. So U5MR cannot be easily reduced in Nigeria. The reason being that, with corruption, a lot of undue things that will enhance selfish gain will surface, which could lead to high rate of mortality in under five children.This study's finding is in contrary with the study of Odhiambo (2014) who found that control of corruption will reduce under-five mortality rate.

The coefficient of the lagged value of Out of pocket expenses (OOPE) which is 2.966782 shows a positive relationship and it implies that 1 percent increase in OOPE will increase U5MR by 2.97 percent. This outcome supports the findings of Riman and Akpan (2012) who revealed that high incidences of out-of-pocket expenses will increase child mortality rate. This variable is also not statistically significant with under-five mortality rate as the p value of 0.0961 is greater than the critical value at 5 percent level of significance.

The coefficient of the lagged value of Physicians density (PHYS) is -0.055305. It is negative and it indicates that 1 percent increase in the number of doctors per 1,000 lives employed, that is, physician density will reduce the rate of under-five mortality by 0.055 percent. This is expected because when there is increase in number of doctors employed, there is possibility that child mortality will reduce because there would be competent hands to handle cases. The findings conform to the a priori expectation and corroborate the findings of Russo et al (2019). The variable is however statistically insignificant since the p value is greater than 5 percent level of significance.

The coefficient of ECM is -1.192369. The negative sign is expected and also statistically significant at 5 percent level of significance. This implies that any deviations from the long run equilibrium will be corrected within one year at the speed of about 1.19 percent.

The $R^2$is 0.917038 and it suggests that 92 percent variations in the under-five mortality rate are explained by government expenditure on immunization (GXIM), Physicians density (PHYS), Out of pocket expenses (OOPE) and control of corruption (CCP). These variables adequately explain the variations in the under-five mortality rate because the R^2 is quite high. The F-Statistics of 28.73964 shows that all the variables are jointly statistically significant with Under-five mortality rate. This is also evident from the probability of F-statistics (0.000001) which is 0. The Durbin-Watson test which is the test of autocorrelation shows that the model is free from autocorrelation since the value is approximately 2.

4.4. Post Estimation Diagnostic Tests

In order to check the robustness of this study's model, some diagnostic tests were conducted after estimation and the results are presented.

4.4.1. Heteroscedasticity Test

This test is conducted to check whether the mean and variance are the same over time.

Table 4: HeteroscedasticityTest:Breusch-Pagan-Godfrey

F-statistic	0.162029	Prob. F(5,13)	0.9722
Obs*R-squared	1.114600	Prob. Chi-Square(5)	0.9528

Scaled explained SS	0.179939	Prob. Chi-Square(5)	0.9993

Source: Researcher's Computation , 2022.

The result in table 4 is the result of heteroscedasticity test, usingBreusch-Pagan-Godfrey. The F-Statistics and Obs*R-squared values of 0.162029 and 1.114600 with p values of 0.9722 and 0.9528 respectively, indicates that the model is free from heteroscedasticity, meaning that the residuals are homoscedastic, because the F-Statistics and Obs*R-squared with their p values are greater than the critical values at (5 percent level of significance). The null hypothesis is therefore accepted.

4.4.2. Stability Test

In order to determine the stability of the model, cumulative sum of Residual (CUSUM) and CUSUM of Squares tests were conducted on the model. The results of the CUSUM andCUSUM of Squares testsare thus reported in Figures 1 and 2.

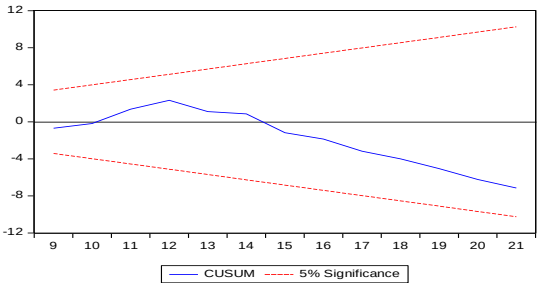

Figure 1: CUSUM Test
Source: Eviews 10.

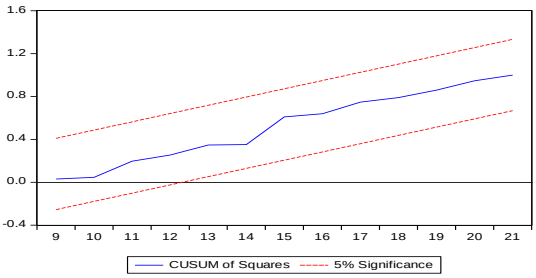

Figure 2: CUSUM of Squares Test
Source:Eviews 10.

The results of the stability tests show that both the CUSUM and CUSUM of Squares tests fall within the 5 percent boundary level since the blue lines fall within the two red blue lines. It therefore suggests that the model is stable.

5. Conclusion and Recommendations

The ARDL Bounds test of co-integration result concludes that there is a long-run association between the explanatory variables (GXIM,PHYS,OOPE and CCP) and the dependent variable (U5MR) within the period under investigation.

The coefficient of the lagged value of GXIM implies that under-five mortality rate (U5MR) is reduced by 6.28 percent and is statistically significant and the null hypothesis is rejected which conforms to a priori expectation because it is expected to reduce the rate of mortality among under-five children. The coefficient of the lagged value of CCP which stands at 0.426343 is positive and indicates that 1 percent increase in CCP will increase U5MR by 0.43 percent. It is however statistically insignificant because the p value of 0.2884 is greater than the critical value at (5 percent level of significance). Thus, the study fails to reject the null hypothesis which states that control of corruption does not have significant impact on Under-five mortality rate (U5MR). Implying that corruption is still at a high level and U5MR cannot be easily reduced in Nigeria, finding of which is in contrary with the study of Odhiambo (2014) who found that control of corruption will reduce under-five mortality rate. The result of Out of pocket expenses (OOPE) shows a positive relationship and it implies that 1 percent increase in OOPE will increase U5MR by 2.97 percent which supports the findings of Riman and Akpan (2012) who revealed that high incidences of out-of-pocket expenses will increase child mortality rate.

The coefficient of the lagged value of Physicians density (PHYS) is negative and indicates that 1 percent increase in the number of doctors per 1,000 livesemployed,will reduce the rate of under-five mortality by 0.055 percent, which is expected because when the number of doctors employed increases, there is possibility that child mortality will reduce as an indication of the presence of competent hands

to handle child mortality cases. Thus, the findings conform to the a priori expectation and corroborate the findings of Russo et al (2019).

It is therefore recommended that Government shouldcheck problem of corruption in the health sector to reduce corrupt practices (bribery and diversion of drugs and supplies) and absenteeism of healthcare professionals as a result of private practice which has led to theneglect of the poor in the society who constitute majority of those that patronize government hospitals,embark on vigorous pursuit of training, retraining, sensitization and recruitment of competent health care professionals to enhance the fight against increasing child mortality rate.

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