

PUBLIC HEALTH EXPENDITURES AND MATERNAL MORTALITY RATE: FURTHER EVIDENCE FROM NIGERIA

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Abstract

This study investigates the nexus between public health expenditure and health outcomes (using maternal mortality as a proxy for the latter) for the period covering 1981-2014 in Nigeria. The study employs Cointegration and error correction modeling procedure with its attendant advantage of minimization spurious regression estimates, while providing long-run estimates at the same time. The results from the analysis reveal that maternal mortality rate declines as both public health expenditure and private health expenditure rise, suggesting that public health expenditure does not crowd out private health financing within the Nigerian context. Poverty rate was however found to contribute significantly to the rising rate of maternal mortality. Finally, health-oriented official development assistance was found to have a negative but insignificant impact on maternal mortality rate in Nigeria. Arising from the foregoing, we recommend, among others, the need for policy makers to adopt a multi-pronged approach which should include, but not limited to, the diversification of the productive base of the economy so as to raise the revenue trajectory of the nation, economic status of women as well as guarantee the provision of good quality facility-based delivery care system and ultimately reverse the rising mortality rate in the country.

Keywords: Health Expenditure; Mortality Rate; Poverty; Nigeria

1.0 INTRODUCTION

One of the crucial indicators of the quality of health care in any country is the state of its maternal health. In most developing countries however, the maternal health status has remained worrisome, when measured by the maternal mortality ratio (MMR). According to the World Health Organization (WHO, 2015), maternal death is the number of women who die from pregnancy-related causes while pregnant. In this context, pregnancy related death is conceived as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death.

In sub-Saharan African countries, this particular health indicator appears to have performed poorly when compared to other developing regions of the world. For instance, between 1990 and 2015, maternal deaths per 100,000 live births declined from 95 to 27 (about 72%) for Eastern Asia, 538 to 176 (67%) for Southern Asia, it merely declined from 987 to 546 (45%) for sub-Saharan African (WHO, 2015).

At the country level, Nigeria is reputed to have the highest maternal mortality rate in the world. In 2015 alone, Nigeria was estimated to account for about 58,000 maternal deaths (about 19 percent) of global maternal mortality deaths of 303,000 (WHO, 2015) a trend that poses severe challenges to the nation's policy makers.

A number of factors have been identified as responsible for the overall poor performance of the health system in Nigeria over the years. These include inadequate health facilities, poor human resources and management and poor health care funding, amongst others (Obansa

&Orimisan, 2013). Among the myriad of factors militating against the performance of the health care system in Nigeria, poor health care financing has come to be identified as a major challenge. This consistently poor state of health care financing has been partly blamed for the high incidence of maternal mortality recorded over the years. In view of the foregoing, this paper attempts to empirically investigate the nexus between public health expenditures and health outcomes in Nigeria with particular focus on maternal mortality ratio (MMR) as a proxy for health outcome for the period of 1981 to 2014.

Accordingly, this work is structured as follows. Following this introductory section, section two provides the literature reviewed. Section three provides the model specification and methodology of the paper. Section four contains a discussion of the empirical results and their implications for policy. Section five concludes the paper with some relevant policy recommendations.

1.2 **The Dynamics of Health Expenditure and Maternal Mortality Ratio**

Health care financing essentially entails strategies for paying for health care expenditure. Broadly speaking, it encompasses the collection of revenues from various sources, pooling of such resources so as to share risk across large population groups, and the utilization of such revenues for the purchase of goods and services from public and private providers for identified needs of the population (Uzochukwu, 2013).

In Nigeria, funding of health care expenditure comes from a number of sources, such as government, private sector, international donor agencies and NGOs. This study however, focuses on government funding. This is partly because public components of total health expenditure are important contributors to improved health outcomes (Anyanwu & Erhijakpor, 2007; Ilori, 2015). It comprises budgetary allocations from government at all level (Federal, States and Local Government).

Table 1 shows that in Nigeria total health expenditure as a percentage of the GDP stood at 2.8% in 1995, but rose to about 3.4% in 1999, 4.3% in 2004, 4.2% in 2009, before stagnating at 3.7% in 2013 and 2014. In all these values fall short of the 15% recommend by the Abuja Declaration of 2010. This trend seems to suggest that, health care system is grossly underfunded, a development that partly underscore the low state of public health in general and the disturbing trend in maternal deaths in particular.

Between 1990 and 2015, MMR was estimated to have declined by about 44% globally though the magnitude of the reduction differed substantially between regions. In Nigeria, although there has been a decline in the MMR for the past two decades (see table 1), the reduction has been slow. For instance, between 1995 and 1999, the MMR declined from 1,250 to 1220 in nominal term, representing about 2.4. Similarly, between 2000-2004, 2005-2009 and 2010-2015, the percentage reductions in MMR were 11.1%, 12.4% and 5.4%, respectively. These figures, when compared to what obtained in East Asia countries within the same time period, reveals what Nigeria has performed poorly in terms of MMR reduction.

2.0 **LITERATURE REVIEW**

An Overview of the Nigeria Health Care Delivery System

The Nigerian public health care system is organized into three tiers, namely, primary, secondary and tertiary. The tertiary health institutions are the teaching and specialists hospitals, while the secondary centres are the state general hospitals. The primary health centres are the local dispensaries and community health centres. However, health facilities are also provided by

religious organization, public corporations, private institutions and private individuals among others.

The Nigerian health care system has witnessed a number of policy and institutional reforms over the years, especially since the enunciation of the National Health Policy (NHP), a strategy to achieve health for all Nigerians in 1988. However, in 2003 a new reforms was initiated within the context of the National Economic Empowerment and Development strategy (NEEDS), Millennium Development Goals (MDGs) and New Economic Partnership for Africa Development (NEPAD). Specifically, as part of the efforts to attain the MDGs, maternal and new-born health, safe water and sanitation, education, especially that of women, family planning, food security and nutrition, and decent housing reforms were carried out, all in a bid to reposition the public sector to be more responsible and responsive to the public needs.

Despite these policy reforms adopted thus far, maternal health outcome has not significantly improved. The reasons for this poor performance ranges partly from the fact that legislative proposals meant to improve maternal outcomes have meet resistance in the nation's National Assembly, lack of effective implementation of policies and, more importantly the relatively low level of government spending on health care, among others (Bankole et al, 2009; Igbinedion, 2010; Nnabuihe, Etemike and Odunze , 2015)

There is an avalanche of empirical studies on the nexus between health care expenditure and health outcomes at both the regional and country levels.

Irrespective of the level, research results of government spending on health and health outcomes is mixed, suggesting that the debate remains inclusive.

On the positive front, studies such as Filmer and Pritchett (1997), Anyanwu and Erhijakpor (2007), Akinkugbe and Mohanoe (2009) and Akanni(2012), Kim and Lane (2013),Eneji, Dickson and Onabe (2013), reported that increased government spending contributed to positive health outcomes. In a related study, and given the importance of controlling for individual household, and state-level covariates, Farahani, Subramanian and Canning (2010) estimated the effect of state level public health spending on mortality across all age groups in India. They found that a ten percentage increase in public spending on health in India decreases the average probability of death by about two percentage, although the effect largely on the young, elderly and women

Kim and Lane (2013) employed the mixed effect model to investigate the impact of public health expenditure on public health outcomes (proxied by infant mortality rate and life expectancy at birth). Their results revealed that higher government spending helps to provide better overall health results for individuals. In another study, Barenberg, Basu and soylu(2015) examined the impact of public health expenditure on infant mortality rate in India. Their finding reveals that a one percent increase in public health expenditure causes infant mortality rate to fall by about 8 infant deaths per 1000 live births.

On the otherhand, some other studies reported that public health expenditure may impact adversely on health outcomes or, at best, of no significant effect. For instance, Rajkumar and Swaroop (2008) examined the impact of government spending on health status using data for1990, 1997 and 2003 for 91 developed and developing countries. Their results revealed, among others, that in countries with weak governance, public health spending may have no effect on under five mortality rate. On their part, Berger and Messer (2002) investigated the effects of public expenditures and other health inputs on health outcomes for 20OECD countries for the period, 1960-19992. Their results revealed among others, that “increases in the share of health expenditures publicly financed are largely associated with higher mortality rates”.

Burnside and Dollar (1998) however, reported a case of no significant relationship between health care expenditure and change in infant mortality rate for low income nations.

The empirical studies examined above have a number of shortcomings. To begin with, some studies (Burnside and Dollar; 1998, Berger and Messer, 2002; Anyanwu and Erhijakpor, 2007; Rajkumar and Swaroop, 2007; Akanni, 2012; Kim and Lane, 2013) have been conducted using cross-sectional data of many developed/developing countries without paying much attention to their differing levels of development and health structures. In addition, such cross country studies tend to mask important variations that may exist in terms of health status as well as health services used in individual countries characterized by diverse socio-economic configurations.

Thus, applying the results from such cross-national studies to policy formulation for individual countries may be misleading. Second at the country level, studies on the nexus between public health expenditures and health outcomes in Nigeria are sparse. Even those at the macro level, for example, Akinkugbe and Mohanoe, (2009) in the case of Lesotho, used life expectancy at birth, infant/under-5 mortality rates as proxies for health status. And, for a country notoriously reputed with the highest rate of maternal mortality (MMR) (WHO, 2015), utilizing MMR as a proxy for health outcomes would better gauge the health status of the Nigerian nation. Third, this study utilizes a longer sample period than any of the previous studies in this area, thus taking into cognizance the far-reaching health reforms that have been carried out over the years. Lastly, the present study employs cointegration and error-correction methodology aimed at providing estimates for both the long term structure and short run dynamics.

3.0 Methodology

3.1 Theoretical Underpinnings

The theoretical framework for this study is predicated on two strands of theories, namely, the Grossman (1972) model of health capital and Wagner (1883). Grossman (1972) model of health capital is basically concerned with how individuals allocate their resources to produce health. This theoretical exposition follows the unconstrained utility maximization theory whereby the individual aims to maximize his utility with a given set of resources. Grossman posits that as the individual aims to maximize his health, he does so by investing in himself to produce the typical health status desired. Essentially, the theory largely explains the relationship between health financing and health outcomes. Thus, the theory simply presents the individual as one whose demand for health inputs is a derived demand, not necessarily for consumption but to produce a typical health outcome. This the individual does by acquiring health inputs such as health care financing which is either public or private, financed, dietary intake, exercise, environment, income, and time, to engage in some production process that yields a typical health outcome.

On the part of government, Wagner(1883), while arguing in favour of government expenditure, posited that there are inherent tendencies for government expenditure on investment to increase both extensively and intensively. Specifically, he designed three focal bases for the increase in state expenditure. One of such focal bases is the need for government to provide welfare services like public health through budgetary spending. Such public spending, according to him, is an endogenous factors which in turn, is determined by the growth in national income.

3.2 Model Specification

Drawing from the reviewed literature and the theoretical underpinnings, comprising Grossman (1972) model of capital health and Wagner (1883) government expenditure on investment, we hypothesize a simple model where maternal mortality rate (MMR) is specified as a function of a number of health inputs, including total government expenditure on health, health-oriented official development assistance, per capita income and poverty rate

$$MMR = \alpha_0 + \alpha_1 TGHE + \alpha_2 ODA + \alpha_3 PCI + \alpha_4 POVRATE + \varepsilon \text{ --- (1)}$$

Where: $\alpha_1, \alpha_2, \alpha_3 < 0$, while $\alpha_4 > 0$

MMR = Maternal Mortality Rate

TGHE = Total government expenditure on health

ODA = Health-oriented official development assistance

PCI* = per capita Income (proxy for private health financing)

POVRATE = Poverty rate

3.3 The Data

The data for this study consists of annual time series spanning 1981-2014. The variables under consideration are total government health expenditure (TGHE), maternal mortality rate (MMR), health-oriented official development assistance (ODA), per capita income (PCI) (a proxy for private health financing), and poverty rate (POVRATE). The data for all the variables are obtained from various sources including; Central Bank of Nigeria (CBN), Statistical Bulletin (2014), World Bank World Development Indicators, and other sundry sources.

4.0 ANALYSIS OF RESULTS AND DISCUSSION OF FINDINGS

Table 1: Descriptive Statistics (Panel A)

	MMR	THE	ODA	PCI	POVRATE
Mean	575.73	1039087	7.37	232457	59.95
Median	519.59	382816.4	2.00	201126.9	60.02
Maximum	800	4233063	80.00	364328.5	70.76
Minimum	350	9636.5	0.00	171136.3	49.15
Std. Dev.	126.61	1352453	15.72	58448.6	6.70
Jarque-Bera	2.57	9.19	311.57	5.77	2.03
Prob	0.27	0.01	0.00	0.05	0.36
Observ	32	32	32	32	32

Correlation Matrix (Panel B)

	MMR	THE	ODA	PCI	POVRATE
MMR	1.0000				
THE	-0.0394	1.0000			
ODA	0.391	0.3624	1.0000		
PCI	-0.0822	0.9118	0.4461	1.0000	
POVRATE	0.315	0.8685	0.4266	0.6772	1.0000

Source: Author's Computation

Note:*

Ideally, we should utilize private household expenditures on health to capture private health financing, but no such time series was available. Since average income in a country and remittances are vital sources of household income, particularly for developing countries like Nigeria, we employ per capita income as a proxy for private health financing as commonly used in extant literature (see Khan,1999; Zaidi, 2001)

Table 1 (Panel A) presents the description of the variables. From the table, the Jarque-Bera statistic rejects the null hypothesis of normal distribution for total government expenditure on health, official development assistance, and per capita income. On the other hand, the null hypothesis of normal distribution is accepted for maternal mortality rate and poverty rate.

From the correlation matrix (Panel B), maternal mortality rate (MMR) shows a positive correlation with ODA (39 percent) and poverty rate (31 percent), and a negative correlation with total government expenditure on health 3 percent and per capita income (8 percent). Similarly, PCI shows a high positive correlation with TGHE and to a less extent, with POVRATE.

4.1 Testing for Stationarity

Granger and Newbold (1977) averred that, in literature, most time series variables are non-stationary and utilizing such non-stationary variables in the model might provide spurious results and, by implication, misleading policy prescriptions. Thus, the time series behavior of each of the series was investigated using the Augmented Dicky-Fuller (ADF) and Phillips-Perron (PP) tests. The results are as presented in Table 2

Table 2: ADF AND PP Unit Root Tests

Variable	ADF			Phillips-Person		
	Level	1 st DIFFERENCES	Remark	Level	1 st DIFFERENCES	Remark
MMR	0.9106	-4.2675*	I(1)	-0.4166	-4.3357**	I(1)
THE	0.3706	-6.5558**	I(1)	-0.0709	-6.5255**	I(1)
ODA	-3.9175	-3.9175*	I(0)	-3.1324	-11.8755**	I(0)
PCI	-1.2430	-5.2587**	I(1)	-1.2074	-5.3239**	I(1)
POVRATE	1.2257	-5.3018**	I(1)	-3.3386	-12.4875**	I(1)

NOTE: *(**) denote significance at 5% and 1% respectively

Source: Author's computation

The results in table 2 shows that, with the exception of ODA variable that was stationary at level (using both test statistics), all other variables became stationary after first differencing. In addition, while TGHE, PCI and POVRATE are significant at 1 percent level of significance, MMR and ODA were only significant at 5 percent level of significance.

4.2 Testing for Co-Integration

Essentially, cointegration tests are designed to test for the existence of long-term equilibrium between the variables in the model, as this is vital for the purpose of policy making. This study utilizes the methodology developed by Johansen (1988) and Johansen and Juselius (1990). Expectedly, this method should produce asymptotically optimal estimates since it incorporates a parametric correction for serial correlation, and it does not depend upon the method of normalization chosen.

Following the approach by Johansen and Juselius (1990), two likelihood test statistics, the Max-Eigen and Trace tests were utilized to derive the number of cointegrating vectors. The cointegrating tests were performed allowing for the absence of linear trends.

Table 3 shows the results for the Johansen cointegrating test. The test statistics indicate that the hypothesis of no cointegration among the variables can be rejected. The results show that there are six (6) and five (5) cointegrating equations (with respects to the trace and max-Eigen statistics respectively) existing among the variables of interest.

Table 3: Johansen Cointegration Test results

Null Hypothesis	Trace Statistics	Critical value at 5 percent	Null Hypothesis	Max-Eigen Statistics	Critical value at 5 percent
$\alpha = 0$	230.62	95.75	$\alpha = 0$	91.75	40.07
$\alpha \leq 1$	138.86	69.81	$\alpha \leq 1$	61.49	33.87
$\alpha \leq 2$	77.37	47.85	$\alpha \leq 2$	38.28	27.58
$\alpha \leq 3$	39.08	29.79	$\alpha \leq 3$	18.49	21.13
$\alpha \leq 4$	20.59	15.49	$\alpha \leq 4$	15.27	14.26

Note: α represents number cointegrating vectors

Sources: Author's Computation

LONG-RUN MODEL

Next, we present the results for the long run relationship:

$$\text{MMR} = 14595.54 - 06517\text{TGHE} - 0.5121\text{ODA} - 409.7906\text{PCI} + 0.2358\text{POVRATE} \quad (2)$$

(-6.1955)*
(0.4158)
(6.7053)*
(2.3465)**

Note: ** (*) denotes significant at 5% and 1% levels respectively

From the foregoing long run results, total government expenditure on health variable (TGHE) is a major determinant of maternal mortality rate. The coefficient of TGHE is both negatively signed and statistically significant at the one percent level. Thus, increase in the level of government expenditure on health by one percent leads to a long run decrease in the maternal mortality rate by about 0.65 percent. These results are consistent with those obtained by Akinkugbe and Mohanoe (2009), Farahani et.al(2010), and Pickbourn and Ndikumana (2016). The implication of this is that any government policy that encourages greater allocation of funds into the health sector will inevitably bring about a commensurate reduction in maternal mortality rate.

The result for the poverty rate variable suggests that the level of poverty has a statistically significant positive impact on maternal mortality rate. Thus, a one percent increase in poverty rate is associated with a 0.24 percentage point increase in maternal mortality rate. This finding is

in consonance with results from studies by Demery and Walton (1998); Sede and Ohemeng, (2015).

The implication of this is that government should adopt a comprehensive policy framework for reducing the rising and alarming level of poverty estimated at 33.1% (World Bank, 2011) if the crusade to reduce the maternal mortality rate to an acceptable level in Africa’s biggest economy is to be realized.

The result for per capita income (a proxy for private health financing) suggests a significant complementarity between public and private health financing in the Nigerian context. More specifically, an improvement in private health financing by one percent is associated with 409.75 percentage point reduction in maternal mortality rate. Thus, within the Nigerian context, policies directed at improving the per capita income have the potential of producing a significant net decrease in the nation’s maternal mortality rate. This finding is in line with some other cross-country results of Demery and Walton (1998), Umoru and Yaqub (2013) and Kim and Lane (2013)

However, the official development assistance (ODA) variable, though positive, but failed to achieve statistical significance in the maternal mortality rate function. From the result, there is no empirical evidence in support of the proposition that the inflow of ODA for the period under consideration has contributed in any significant way to reducing the rising cases of maternal mortality. The implication of this is that, health-oriented official development assistance, unless complemented by other external/domestic resources, may not impact significantly on reducing the prevailing maternal mortality rate in the country.

4.3 The Error Correction Model

Following Engel and Granger (1987), if cointegration exists between non-stationary variables, then an error-correction representation of the kind specified by equation (3) exists for these variables. Basically, the error correction terms (ect) in equation (3) enables us to gauge the speed of adjustment of equilibrium once the equation is shocked. Below is the dynamic error correction formulation.

$$\Delta MMR_t = \varphi_0 + \varphi_{1i} \sum_{i=0}^1 \Delta MMR_{t-1} + \varphi_{2i} \sum_{i=0}^1 \Delta TGHE_{t-1} + \varphi_{3i} \sum_{i=0}^1 \Delta ODP_{t-1} + \varphi_{4i} \sum_{i=0}^1 \Delta POVRATE_{t-1} + \varphi_{5i} ect_{t-1} \text{-----} (3)$$

Where

ect is the error correction term, and “Δ” represents the difference of a series. $\varphi_0, \dots \dots \varphi_7$ are parameters of the model to be estimated. The “i” represents the number of lags included for the first difference of both the dependent and independent variables while t represents the time period. Since all the variables, in the equation are stationary, estimating the equation by Ordinary Least Squares (OLS) gives consistent estimates (Enders, 1995). Accordingly we utilize the OLS method, and the model tested for stability.

Table 4: Estimated Short-Run Regression Result for Maternal Mortality Rate (MMR)

Dependent Variable: MMR

Sample (adjusted): 1983-2014

Included Observations: 30 after adjustments

Variables	Coefficients	Std. Error	t-Statistics	Prob.
C	342.9559	314.6829	1.0901	0.2880
DTGHE	-8.7305*	4.3706	-1.9988	0.0587
DTGHE(-1)	-0.001*	5.3015	-3.0865	0.0056
DODA	0.5445	0.5187	1.0498	0.3057
DPCI	0.0013**	0.0006	2.1577	0.0427
DPOVRATE	-436.2454	430.8983	-1.0124	0.3229
ECM(-1)	-0.6502*	0.2166	-3.2881	0.0017
R-squared	0.6116	Akaike Info. Criterion	10.9314	
Adjusted R-squared	0.4637	Schwarz Criterion	10.9314	
F-Statistics	4.1344	Hannan-Quinn Criterion	10.6455	
Durbin Watson stat.	2.2745			

Note:**(*) Significant at 5% and 1% respectively

Source: Author's Computation using E-views 7.0

Table 4 contains the estimated short-run regression result for maternal mortality rate (MMR). The parameters along with their standard errors, t-values and the corresponding critical values are also reported in the table. The parameter of per capita income (PCI) is significant at 5 per cent level, while that of total government expenditure on health (TGHE) is significant at 1 per cent level. In addition, the coefficient of the error correction term (ECM) is appropriately signed and is statistically significant at 1 per cent level, with the speed of convergence to equilibrium of about 65 per cent. This result indicates that about 65 percent of the short-run disequilibrium in MMR is corrected each period (year). This high rate of convergence is of much practical use in policy analysis and in decision making (Pesaran, 1997).

4.4 Stability Test, Variance Decomposition and Impulse Response Function

Following the procedure provided by Brown, Durbin and Evans (1975), this study investigated the short run stability of the parameters in the maternal mortality rate model using the plots of cumulative sum of the residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq). The results of the two tests are provided in figures 1(A) and 1(B) respectively. Essentially, the existence of parameters instability is established if the CUSUM and CUSUMsq go outside the bands represented by the two critical (dotted) lines. From the graphs, only CUSUM stays within the 5 percent critical line, implying parameter stability throughout the sample period of the study. For CUSUMsq, parameter instability established between 2005 and 2007. Thus, the finding is relatively robust for policy analysis and formulation.

Figure 1(A)

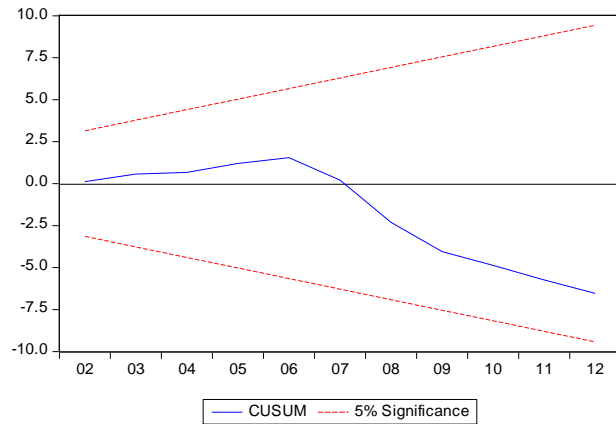


Figure 1(B)

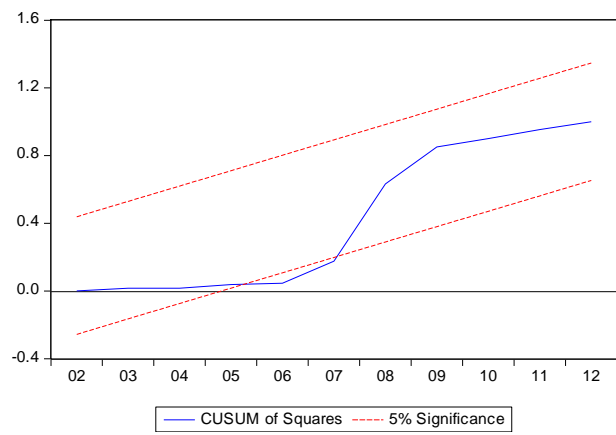


Figure 1: Stability test using CUSUM and CUSUMsq of residuals.

An examination of the short run dynamic properties of maternal mortality rate is further supplemented by computing the forecast error variance decomposition (FEVD) and the impulse response function (IRF). Basically, variance decomposition provides the proportion of the movement in the dependent variables that are due to their own shocks, versus shocks to the other variables. Most empirical studies have shown that, the highest percentage error variance decomposition of macroeconomic variables often originates from their own past shocks, but are expected to decline over the forecast periods. The FEVD result is presented in table 5.

Table 5: Variance Decomposition of MMR

Period	Variance Decomposition of MMR:					
	S.E.	MMR	THE	ODA	PCI	POVRATE
1	28.46675	100.0000	0.000000	0.000000	0.000000	0.000000
2	38.37067	79.13019	9.142020	10.40352	1.176492	0.147774
3	53.76116	87.51107	4.662756	6.892858	0.601718	0.331602
4	66.93370	84.45706	3.220556	10.61226	1.380145	0.334683
5	77.35715	80.15260	2.429888	8.372196	8.597880	0.447435
6	86.66871	70.14480	3.812295	11.26798	13.18502	1.589911
7	93.19494	65.48122	6.050525	11.61239	12.67702	4.178815
8	96.54648	62.25528	7.550139	11.73695	11.87850	6.579133
9	98.66963	59.65402	7.500385	12.81369	11.38191	8.649993
10	100.6769	57.74562	7.281117	14.18006	10.93282	9.860383

Source: Author's Computation

From the table 5, it can be seen that MMR is fully explained by its own variation, accounting for 100 percent in the first year and other variables share in explaining the remaining variation in zero percent. Shocks to official development assistance (ODA) accounted for about 14.2% in the tenth year, while innovations in per capita income (PCI), poverty rate (POVRATE) and total government expenditures on health (TGHE) explained 10.9%, 9.9% and 7.3% of its own forecast error variance is explained by itself in the tenth year. Thus, the result provides evidence that shocks induced by other relevant policy variables can explain a relatively modest proportion of changes in MMR overtime in Nigeria.

Table 6 provides estimates from the impulse response function of maternal mortality rate as against its own shocks and the shocks of total government expenditures on health, health-oriented official development assistance, per capita income and poverty rate over a ten year horizon. The time horizon will enable the capturing of both the short-term, medium-term and long-term responses. The result shows that maternal mortality has a positive relationship with its past values in the first nine years, while its relationship turned negative in the tenth year. Conversely, its own response to the shocks of per capita income and poverty rate (with the exertion of the tenth year in the latter case), there was positive relationship only in the first year and then negative relationship in the other years. However, in its response to the total shocks of government expenditures on health and health-oriented official development assistance, it

alternated between negative in the first few years and positive in the other years, with the exception of TGHE in the tenth year.

Table 6: Impulse Response of MMR

Period	Response of MMR:				
	MMR	THE	ODA	PCI	POVRATE
1	28.46675	0.000000	0.000000	0.000000	0.000000
2	18.83307	-11.60167	12.37626	-4.161921	-0.70398
3	36.93589	-0.408896	-6.786001	-0.263914	-2.90175
4	35.41862	-3.085273	-16.61988	-6.666402	-0.90428
5	31.82226	1.059621	5.055780	-21.27618	-4.21202
6	21.73633	11.87231	18.58460	-21.81467	-10.1208
7	20.45328	15.46437	12.73500	-10.51896	-15.789
8	10.75711	13.35137	9.244281	-2.486839	-16.1237
9	2.186237	5.142897	12.38851	-0.941944	-15.2493
10	-6.728501	-2.790699	13.77557	-0.159767	-12.5406

Source: Author's Computation

5. CONCLUSION

This study has investigated the nexus between public health expenditure and health outcomes, using maternal mortality rates (MMR) as a proxy for the latter in Nigeria for the period 1981-2014. The estimated results from the long run model suggest that government expenditure on health and per capita income have statistically significant negative impact on maternal mortality rate. The critical role of poverty level in aggravating maternal mortality rate was clearly confirmed in the study, as increase in poverty was positively associated with the rise in maternal mortality rates. However, health-oriented official development assistance appears not to have any meaningful impact on maternal mortality rate.

Arising from the foregoing findings, we make the following policy recommendations. First, there is the need for the government at all levels to step up their resource allocations to the health sector in general and for maternal health care in particular in order to stem the rising tide of maternal mortality rate. In order to achieve this, there is the need for the government to sustain the diversification of the nation's resources base with a view to enhancing the revenue base of the nation. Such measures should include a reform to agriculture, adoption of a sustainable energy policy which provides for stable electricity as well as the promotion of small and medium scale enterprises which targets the women folks, among others.

Second, considering the fact that poverty makes it difficult for women (especially rural women) to afford medical bills, antenatal and post-natal services, transportation bills and good nutrition (especially for pregnant women), there is the urgent need to empower the women. This can be achieved by the government guaranteeing soft loans through micro finance institutions to those women in trade and in agricultural activities. Such efforts should be complemented by ensuring equitable distribution of the new found wealth which accrues from oil (that is, the sovereign wealth fund (SWF)).

Third, per capita income (a proxy for private health financing) has been shown to complement rather than substitute public health financing in the country. In this regard, government should put in place appropriate policy measures aimed at promoting the real income

growth of the nation and reducing the rising unemployment level. In the latter case, the current youth empowerment programme of the government should be strengthened and sustained. Also, in view of the complementary nature of the public-private expenditures on health, the government should put in place appropriate policy framework aimed at establishing effective public-private partnerships with a view to developing the health sector and improving on the level of maternal health. In general, the task of improving women's health and reducing maternal mortality in Nigeria, as in many other developing economics, requires the adoption of a multi-faceted approach. Such multi-pronged approach should include not only improving the revenue base of the nation and, by extension, the economic status of women, but also providing good quality facility-based delivery care system manned by qualified medical workers. In the interim however, and considering the dwindling revenue trajectory of the nation, there is the urgent need to address the issue of poverty-constrained access to the patchy services available in our health institutions with a view to curbing the rising tide of maternal mortality in the country.

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