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The Impact of Government Expenditure on Rate of Infant and Maternal Mortality in Nigeria

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Abstract: This study examined the impact of federal government expenditure on health, agriculture and transport and communication on the rate of infant and maternal mortality in Nigeria between 1989 -2016. The statistical tools employed in this study includes: the Unit root test, Granger Causality Tests and the least square regression analysis. The findings of the study showed that the rate of infant mortality was found to Granger Cause federal government expenditure on health while maternal mortality rate Granger Cause federal government expenditure on transport and communication. It was found that the models are adequate for estimating the health outcomes (rate of infant and maternal mortality) since the models recorded strong coefficient of determinations. Findings revealed that federal government expenditure on health has negative significant impact on infant and maternal mortality in Nigeria. This result implies that as federal government is increasing its expenditure on health, the rate of infant and maternal mortality will keep decreasing. Also, findings showed that federal government expenditure on agriculture and transport and communication does not impact significantly on the rate of infant and maternal mortality in Nigeria.
Keywords: Communication, Government Expenditure, Health, Infant Mortality, Maternal Mortality, Transportation.

INTRODUCTION

Good state of health is seen as a key element of a policy to promote broad-based economic growth. The burdens of health issues such as infant and maternal mortality are known to slow the economic growth of developing countries. This is why countries like Nigeria devote huge public fund to health care provision with the expectation that this would improve the health of the citizenry so that they can contribute meaningfully to economic growth. In Nigeria, for example, despite the huge government expenditure on health provision, the health status of Nigerians is consistently ranked low. This makes Nigeria's rate of infant and maternal mortality to account among the highest in the world.

Lichtenberg [1] in his study argued that more public health services is expected to enhance level of life expectancy. In achieving this, apart from individual to access services, public spending has a role to play. In their contribution, Aisa and Pueyo [2] explained that an increase in government spending not only leads to longer life and faster economic growth as reinforced by that long life, but implies a larger work force, which can also drive faster growth. Edeme *et al.* [3] stated that empirical studies have revealed that a healthy person not only works efficiently but is also able to devote more time to economic activities that increase productivity. It is estimated that health improvements accounts for one-third increase in GDP growth and its impact on health status improves human capital development [4].

According to Edeme *et al.* [3], in developing countries the improvement in health condition has huge challenge and the prevalence of large scale health problems, such as high infant mortality rate and low life expectancy are as a result of the scarce health resources and infrastructure. Available statistics reveal that apart from healthcare budgets that are far below the developed countries, the few health infrastructures available are unbalanced between urban-rural areas. Also, it was revealed that availability and access to improved healthcare services reduces mortality and financial risk among the population while addressing poverty issues. In this regard, adequate and efficient health spending remains crucial in improving health status.

In the low and middle income countries like Nigeria, direct causes that accounts for 70-80% of maternal mortality in approximate order of magnitude include, hemorrhage, sepsis, hypertensive disorder of pregnancy,

complication of unsafe abortion and prolonged labor. The remaining 20-25% of maternal deaths can be attributed to illness aggravated by pregnancy which may increase the likelihood of the women dying during child delivery [5].

According to studies carried out previously by health researchers, almost half of the child mortality (42%) in the world occurs in Africa and about 25, 000 under- five children that die each day are concentrated in sub-Saharan Africa and South Asia [6]. Under-five mortality rate (U5MR) is generally 29 times higher in developing nations compared to developed countries [6, 7].

In the case of global records, under-five mortality has dropped significantly by almost 45% between 2009 and 2011 but this progress is not the reality for all countries. Despite much progress in advanced countries, but country like Nigeria has failed to make significant progress in checking the rising mortality rate among the under-five. Recently, about half of the world's under-five deaths occur in Nigeria, India, Congo, Pakistan and China [8, 9].

According to WHO[10], health expenditure measures the final consumption of health goods and services plus capital investment in healthcare infrastructure. This implies that, health is a critical component in measuring the living standards of a nation or region. When linked with improvements with other variables such as water, sanitation and nutrition, health is visualized as an input into and outcome of growth process, integrated socio-economic advantage based on health status improvements which depicts a reflection and cause of ongoing development efforts towards human welfare. Edeme *et al.* [3] stated that it has been established form literature that improvements in health of population as a whole definitely have a positive impact by generating social returns to individuals and communities. This explains on one hand that improved human capital is better capable of participating in economic activities, improved productivity at individual level and consequently, better living standards. With the high rate of maternal mortality and new-born mortality in Nigeria and the country's ranking as Africa, it becomes imperative to evaluate the effectiveness of government expenditure in health, agriculture and transport and communication on the rate of infant and maternal mortality [11]. Hence, this study seeks to determine whether government expenditure in health, agriculture and transport and communication has contributed positively on the rate of infant and maternal mortality in Nigeria.

LITERATURE REVIEW

According to Edeme *et al.* [3], studies has revealed that health expenditure as an indicator of the volume of resources flowing into the health sector is expected to have a positive effect on life expectancy and a negative effect on infant mortality rates. This implies that an increase in health expenditure per capita implies a broader access to health care and services which helps to increase life expectancy and decrease infant mortality rates.

Ke *et al.* [12] in their study examined the determinants of health expenditure in developing countries. The findings of their study revealed great variation across countries in health expenditure as a share of GDP, which ranges from less than 5% to 15%. They observed that apart from income, many factors contribute to this variation, ranging from demographic factors to health system characteristics. The result of their findings suggests that health expenditure in general does not grow faster than GDP after taking other factors into consideration. Also, they observed that income elasticity is between 0.75 and 0.95 in the fixed effect model while, it is much smaller in the dynamic model.

Anyanwu and Erhijakpor [13] in their study were able to provided econometric evidence linking African countries' per capita total as well as public health expenditures and per capita income to two health outcomes which comprises of infant mortality and under-five mortality using data from 47 African countries. Health expenditures were found to have significant effect on infant mortality and under-five mortality. Their findings showed that for African countries, total health expenditures (as well as the public component) are certainly important contributor to health outcomes. In addition, infant and under-five mortality were found to be positively related to health outcome for Sub-Saharan Africa. They stated that the reverse is true for North-Africa where ethno-linguistic fractionalization and HIV prevalence positively affect health outcome while higher numbers of physicians and female literacy reduce these health outcomes.

Novignon *et al.* [14] examined the effects of public and private healthcare expenditure on health status in 44 Sub-Saharan Africa countries using panel data from 1995-2010. They fitted fixed and random effects panel data regression models to determine the effects of healthcare expenditure on population health status and to examine the effect by public and private expenditure sources. The result of their analysis showed that healthcare expenditure significantly influences health status through improving life expectancy, reducing death and infant mortality rates. They observed that both public and private healthcare spending revealed strong positive association with health status even though public healthcare spending had relatively higher impact.

RESEARCH METHODOLOGY

Source of Data

Secondary method of data collection was used in this study with data obtained from the National Bureau of Statistics and Central Bank Statistical Bulletin for various years.

METHOD OF DATA ANALYSIS

The Statistical methods employed in this study includes: the Unit root test, Granger Causality Tests and the least square regression analysis.

Model Specification

The study adopts a simple model of health outcomes as follows:

$$Y_t = \beta_0 + \beta_i X_t + \varepsilon_t \quad (1)$$

Where Y_t is health outcomes, at time t and X is a vector of independent variables influencing health outcomes, and β_0 represents the intercept term, while β_i is a vector coefficient of the independent variables. ε_t is the error term which is assumed to be normally distributed with zero mean and constant variance. The broad model is of the form:

$$IMR = f(FGEH, FGEA, FGETC) \quad (2)$$

The linear form of the model is specified as;

$$IMR_t = \beta_0 + \beta_1 \times FGEH_t + \beta_2 \times FGEA_t + \beta_3 \times FGETC_t + \varepsilon_t \quad (3)$$

$$MMR_t = \gamma_0 + \gamma_1 \times FGEH_t + \gamma_2 \times FGEA_t + \gamma_3 \times FGETC_t + \varepsilon_t \quad (4)$$

Where INR =Infant Mortality Rate (per 1000 live birth), MMR= Maternal Mortality Rate (per 100, 000 live birth), FGEH= Federal Government Expenditure on Health, FGEA= Federal Government Expenditure on Agriculture and FGETC= Federal Government Expenditure on Transport and Communication

PRESENTATION OF DATA

Table-1: Summary of Infant mortality rate, maternal mortality rate and government expenditures from 1989-2016

Year	IMR (PER 1000 LIVE BIRTH)	MMR (PER 100,000 LIVE BIRTH)	FGEH (₦'Billion)	FGEA (₦'Billion)	FGETC (₦'Billion)
1989	126.4	1370	0.6	0.2	0.3
1990	126.3	1350	0.5	0.3	0.3
1991	126.1	1320	0.6	0.2	0.2
1992	125.8	1300	0.2	0.5	0.6
1993	125.3	1280	3.9	1.8	2.0
1994	124.7	1270	2.1	1.2	0.4
1995	123.7	1250	3.3	1.5	1.1
1996	122.3	1250	3.0	1.6	2.1
1997	120.4	1240	3.9	2.1	1.6
1998	118.0	1220	4.7	2.9	1.9
1999	115.3	1200	16.6	59.3	11.1
2000	112.5	1170	15.2	6.3	3.0
2001	109.5	1140	24.5	7.1	33.9
2002	106.4	1090	40.6	10	29.4
2003	103.3	1040	33.3	7.5	22.7
2004	100.2	986	34.2	11.3	8.1
2005	97.1	946	55.7	16.3	8.0
2006	93.9	890	62.3	17.9	9.8
2007	90.8	884	81.9	32.5	32.2
2008	87.7	829	98.2	65.4	67.4
2009	84.7	883	90.2	22.4	90.0
2010	81.9	867	99.1	28.2	42.4
2011	79.2	824	231.8	41.2	13.1
2012	76.6	819	197.9	33.3	23.2
2013	74.3	821	180	39.4	18.5
2014	71.5	820	196	36.7	18.3
2015	69.4	814	257.7	41.3	24.4
2016	71.2	576	202.4	36.6	20.7

Source: National Bureau of Statistics and Central Bank Statistical Bulletin for various years

Key: Infant Mortality Rate (IMR), Maternal Mortality Rate, Federal Government Expenditure on Health (FGEH), Federal Government Expenditure on Agriculture (FGEA), and Federal Government Expenditure on Transport and Communication (FGETC)

DATA ANALYSIS AND DISCUSSION

Unit root Test

In order to make sure one is not carrying out a spurious regression, the variables employed were subjected to a stationarity test. For this purpose, the Augmented Dickey-Fuller (ADF) test was used to test the stationarity of the data.

Table-2: Augmented Dickey-Fuller unit root test of the variables

Variables	Level		1st Difference	
	No Trend	With Trend	No Trend	With Trend
LOG(IMR)	-1.40318	-2.6608	-1.7404	-4.69902
LOG(MMR)	-2.428373	-1.783877	-0.6069	-8.0052
LOG(FGEH)	-0.3570	-3.3001	-1.3473	-5.5521
LOG(FGEA)	0.0730	-3.2333	-7.0121	-7.493
LOG(FGETC)	-0.6354	-2.5277	-6.5980	-5.3337
Critical values				
1%	-2.653401	-4.339	-2.6857	-4.498
5%	-1.9539	-3.5875	-1.9590	-3.658

The result of the unit root test on the variables using the Augmented Dickey-Fuller test statistic found that the all series has no unit root and stationary over time at first difference with trend since their test statistic value has a more negative value than the critical values assuming a 95% confidence level. This result implies that the series has no unit root at the first difference I(1) and stationary overtime and can be used to make forecast for future behaviour of the process.

Table-3: Result of Pairwise Granger Causality Tests

Sample: 1989 2016			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
FGEH does not Granger Cause IMR	26	1.24186	0.3092
IMR does not Granger Cause FGEH		7.40366	0.0037
FGETC does not Granger Cause IMR	26	0.53785	0.5918
IMR does not Granger Cause FGETC		2.85882	0.0798
FGEH does not Granger Cause MMR	26	1.49427	0.2473
MMR does not Granger Cause FGEH		2.24524	0.1307
FGETC does not Granger Cause MMR	26	0.31457	0.7335
MMR does not Granger Cause FGETC		6.69280	0.0056

The result showed that IMR was found to Granger Cause FGEH with a p-value of 0.0037 which falls on the rejection region assuming 95% Confidence level and MMR Granger Cause FGETC with a p-value of 0.006 which falls on the rejection region assuming 95% Confidence level.

Analysis on ascertaining the impact of the explanatory variables on Infant Mortality Rate (IMR)

Table-4: Result of Regression model for assessing the impact of FGEH, FGEA and FGETC on IMR

Dependent Variable: LOG(INR)				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
Date: 09/27/17 Time: 12:41				
Sample: 1989 2016				
Included observations: 28				
LOG(IMR)=C(1) + C(2)*LOG(FGEH) + C(3)*LOG(FGEA) + C(4) *LOG(FGETC)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	4.884109	0.030857	158.2829	0.0000
C(2)	-0.125216	0.025871	-4.840041	0.0001
C(3)	0.022393	0.032100	0.697600	0.4921
C(4)	0.024968	0.023906	1.044449	0.3067
R-squared	0.842311	Mean dependent var		4.607489
Adjusted R-squared	0.822600	S.D. dependent var		0.209414
S.E. of regression	0.088203	Akaike info criterion		-1.886791
Sum squared resid	0.186714	Schwarz criterion		-1.696476
Log likelihood	30.41507	Hannan-Quinn criter.		-1.828610
F-statistic	42.73287	Durbin-Watson stat		1.881676
Prob(F-statistic)	0.000000			

The result of the least squares regression model obtained in table 4, found R-square value of 84.2% which implies that the independent variables were able to explain 84.2% of total variation in the rate of IMR in Nigeria over the observed years . It was found that FGEH has negative significant impact on IMR with a coefficient of -0.125 and p-value of 0.0001 which falls on rejection region of the hypothesis. This result implies that as FGEH increases by a unit, IMR is expected to decrease by 0.125 coefficients. Also, it was found that FGEA and FGETC has positive insignificant impact on IMR with coefficient of 0.022 and 0.025 respectively and corresponding p-values of 0.4921 and 0.3067 which falls on the acceptance region of the hypothesis assuming 95% confidence level. The model was found to be serial correlation free with a Durbin-Watson value of 1.88[15].

The obtained model was expressed as-

LOG(IMR)= 4.88 41- 0.1252*LOG(FGEH) + 0.0224*LOG(FGEA) + 0.0250 *LOG(FGETC) (1)

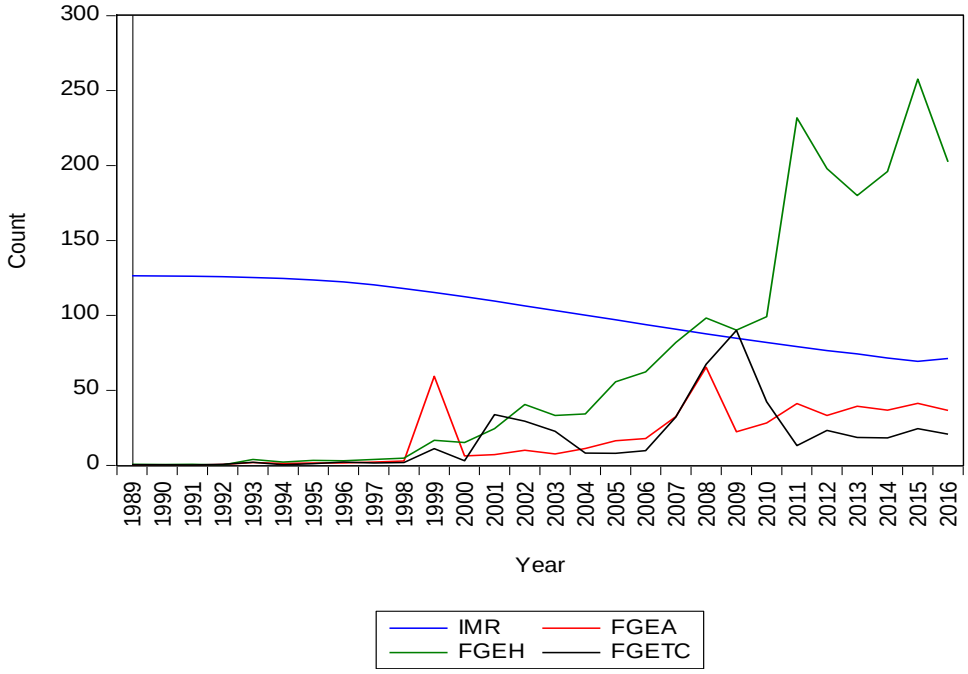

Fig-1: Graph showing IMR, FGEH, FGEA, and FGETC form 1989-2016

The graph shows that FGEH has a steeply increasing trend while IMR has a decreasing trend over the observed years.

Analysis on ascertaining the impact of the explanatory variables on Infant Mortality Rate (MMR)

Table-5: Result of Regression model for assessing the impact of FGEH, FGEA and FGETC on MMR

Dependent Variable: LOG(MMR)				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
Date: 09/27/17 Time: 12:44				
Sample: 1989 2016				
Included observations: 28				
LOG(MMR)=C(1) + C(2)*LOG(FGEH) + C(3)*LOG(FGEA) + C(4) *LOG(FGETC)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	7.214614	0.035773	201.6786	0.0000
C(2)	-0.114404	0.029993	-3.814410	0.0008
C(3)	0.008658	0.037215	0.232640	0.8180
C(4)	0.021138	0.027714	0.762702	0.4531
R-squared	0.807833	Mean dependent var		6.935837
Adjusted R-squared	0.783812	S.D. dependent var		0.219922
S.E. of regression	0.102255	Akaike info criterion		-1.591130
Sum squared resid	0.250946	Schwarz criterion		-1.400815
Log likelihood	26.27582	Hannan-Quinn criter.		-1.532949
F-statistic	33.63040	Durbin-Watson stat		1.915217
Prob(F-statistic)	0.000000			

The result of the least squares regression model obtained in table 5, found R-square value of 80.8% which implies that the independent variables were able to explain 84.2% of total variation in the rate of MMR in Nigeria over the observed years . It was found that FGEH has negative significant impact on MMR with a coefficient of -0.1144 and p-value of 0.0008 which falls on rejection region of the hypothesis. This result implies that as FGEH increases by a unit, MMR is expected to decrease by 0.1144 coefficients. Also, it was found that FGEA and FGETC has positive insignificant impact on MMR with coefficient of 0.0087 and 0.0211 respectively and corresponding p-values of 0.8180

and 0.4531 which falls on the acceptance region of the hypothesis assuming 95% confidence level. The model was found to be serial correlation free with a Durbin-Watson value of 1.92.

The obtained model was expressed as

$$LOG(MMR)= 7.214614 - 0.1144*LOG(FGEH) + 0.0087*LOG(FGEA) + 0.0211*LOG(FGETC) \quad (1)$$

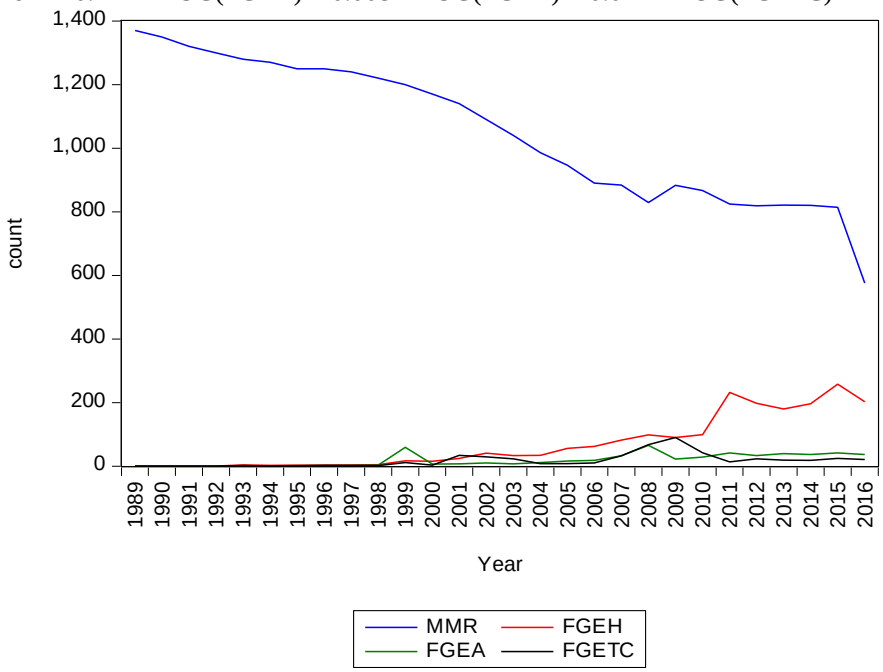

Fig-2: Graph showing MMR, FGEH, FGEA, and FGETC form 1989-2016

The graph shows that FGEH has a steeply increasing trend while MMR has a decreasing trend over the observed years.

DISCUSSION

The findings of the study revealed that all the series has no unit root and stationary over time at first difference with trend. This result implies that the series has no unit root at the first difference I (1) and stationary overtime and can be used to make forecast for future behaviour of the process.

Findings showed that IMR was found to Granger Because FGEH while MMR Granger Cause FGETC.

Also, it was found that the independent variables were able to explain 84.2% of total variation in the rate of IMR in Nigeria over the observed years. Findings revealed that FGEH has negative significant impact on IMR with a coefficient of -0.125 and p-value of 0.0001 which implies that as FGEH increases by a unit, IMR is expected to decrease by 0.125 coefficients. Figure 1 validates this result since it was shown that FGEH has a steeply increasing trend while IMR has a decreasing trend over the observed years.

Similarly, it was found that FGEA and FGETC has positive insignificant impact on IMR with coefficient of 0.022 and 0.025 respectively and corresponding p-values of 0.4921 and 0.3067. The model was found to be serial correlation free with a Durbin-Watson value of 1.88 which is approximate to 2.

In addition, it was found that the independent variables were able to explain 80.8% of total variation in the rate of MMR in Nigeria over the observed years. Findings revealed that FGEH has negative significant impact on IMR with a coefficient of -0.1144 and p-value of 0.0008 which implies that as FGEH increases by a unit, MMR is expected to decrease by 0.1144 coefficients. Figure 2 validates this result since it was shown that FGEH has a steeply increasing trend while MMR has a decreasing trend over the observed years.

Furthermore, findings revealed that FGEA and FGETC have positive insignificant impact on MMR with coefficient of 0.0087 and 0.0211 respectively and corresponding p-values of 0.8180 and 0.4531. The model was found to be serial correlation free with a Durbin-Watson value of 1.92 which is approximate to 2.

CONCLUSION

This study examined the impact of federal government expenditure on health, agriculture and transport and communication on the rate of infant and maternal mortality in Nigeria. The findings of the study showed that the rate of infant mortality was found to Granger Cause federal government expenditure on health while maternal mortality rate Granger Cause federal government expenditure on transport and communication. It was found that the models are adequate for estimating the health outcomes (rate of infant and maternal mortality) since the models recorded strong coefficient of determinations. Findings revealed that federal government expenditure on health has negative significant impact on infant and maternal mortality in Nigeria. This result implies that as federal government is increasing its expenditure on health, the rate of infant and maternal mortality will keep decreasing. Also, findings showed that federal government expenditure on agriculture and transport and communication does not impact significantly on the rate of infant and maternal mortality in Nigeria. Hence, the need for government to improve and boast allocation in the health sector which is in line with recommendation by Edeme *et al.* [3] and as well improve its allocation on agriculture and transport and communication because for pregnant women to get to prompt access to health facilities for delivery and care there is need for efficient transport and communication system. Also, it showed be noted that improper implementation of government funds in these sectors will sabotage the fight to reducing the rate of infant and maternal mortality in Nigeria.

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