PUBLIC HEALTH EXPENDITURE AND UNDER-FIVE MALARIA MORTALITY IN NIGERIA FROM 1990 TO 2017

BY

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DEPARTMENT OF ECONOMICS,
AHMADU BELLO UNIVERSITY,
ZARIA

FEBRUARY, 2020

Declaration

I solemnly declare that this research work entitled "PUBLIC HEALTH EXPENDITURE AND UNDER-FIVE MALARIA MORTALITY IN NIGERIA: 1990 – 2017" submitted for the award of Doctor of philosophy (PhD) Degree in Economics of the Ahmadu Bell University, Zaria is the result of my research work and has not previously been presented to any university for award of a degree. All references in the workhave been duly acknowledged. All errors and omissions in this work are solely mine.

Isah Paiko Imam

…………………… …………………… …………………

Name Signature Date

Certification

I certified that this research work entitled "PUBLIC HEALTH EXPENDITURE AND UNDER-FIVE MALARIA MORTALITY IN NIGERIA: 1990 – 2017" carried outby IsahPaiko Imam has been carefully read and approved as meeting the requirement of Department of Economics, ABU Business School, Ahmadu Bell University, Zaria for the awardof PhD in Economics.

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Isah Paiko Imam

February, 2020.

DEDICATION

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Abstract

Nigerian government over the years has committed huge financial resources in health sector in fighting malaria. However, in spite of the huge expenditure, reduction in under-five malaria mortality is far from the recommended 25 per 1000 live birth by Sustainable Development Goals. The study therefore, set out to investigate the link between public health expenditure and under-five malaria mortality in Nigeria between the periods 1990 to 2017. Specifically, the study tries to find out determinants of under-five malaria mortality; impact of public health expenditure on under-five malaria mortality; response of under-five malaria mortality to shocks in public health expenditure and determinants of public health expenditure in Nigeria. To achieve these objectives, the study employed modified VAR and Error correction model to determine the nature of the relationship public health expenditure and under-five malaria mortality. The results from the study revealed the following; impact of public health expenditure in reducing under-five malaria mortality is weak, female labor force participation and household's behavior were found to influence under-five malaria mortality and malaria cases and environmental pollution were found to increase public health spending. The study concludes that apart from government spending there are other factors that influence decrease in under-five malaria mortality. The study therefore, recommends that since government is a major player in the health sector, more funds should be allocated to health especially capital expenditure with strict compliance to fiscal rule to avoid mismanagement and diversion of funds; ensuring gender sensitive in employment and female empowerment; encouraging positive behavior of household's behavior towards health seeking behavior and enforcing environmental sanitation to reduce breeds of mosquito, malaria incidence and under-five malaria mortality.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Allocation of scarce resources to various competing ends is one of the fundamental issues in economics and among different economies hence, the quantities of resources that should be devoted to health care have generated a lot of attentions from researchers and policy makers. This comes as a result of debate on whether or not public spending on health care produces better health outcomes.

Health is one of the significant factors that determine the quality of human capital which is a necessary factor for economic growth. Thus, the level of government expenditure on health determines the ultimate level of human capital development which eventually leads to better, more skilful, efficient and productive investment in other sector of the economy (Muhammad and Khan, 2007). Based on this notion, developing countries have attempted to enhance the human capital through public health expenditure as well as government spending on education and other social services. Al- Yousif (2000) and Lawson (2009) noted that education, health care, training and investment in social services enhances and improves the human capacity which has a spillover effect on economic growth.

Therefore, the public health expenditure is expected to have a positive impact on child health outcomes through a reduction in both infant and under-five mortality. Because, statististcs shows that globally under-five mortality is rated the highest among all death (adult and childern) and the major cause of this death is attributed to malaria WHO (2012) and about 3.2 billion people almost half of the world's population is at risk of malaria. Sub-

Saharan Africa carries a disproportionately high share of the global malaria burden. For example, in 2015, the region was home to 89% of malaria cases and 91% of malaria deaths (WHO, 2016). According to WHO (2015) there were 214 million cases of malaria and 438,000 deaths from the disease in 2015 in SSA countries.

In Nigeria, under-five mortality rates is 128 deaths per 1,000 live births, respectively (WDI, 2016). The mortality levels shows that 1 in every 15 Nigerian children dies before reaching age 1. One in every 8 does not survive to his or her fifth birthday. USAID (2014) also reported that under-five mortality in Nigeria is still on the increase especially between 2007 and 2011. This was further confirmed by a report from WHO (2014) on Nigeria and Pakistan as having the worst record globally in under-five mortality traceable to malaria.

WHO (2016) reports that in Nigeria malaria accounts for 60% of out-patient visits and 30% of hospitalizations among children under five years of age. With a population of about 200,963,000 (UN,2018) million people, at least 50% of the population in Nigeria suffers from at least one episode of malaria each year and more reported cases of deaths due to malaria than any other country in the world (WHO, 2016). This malaria scourge has caused serious economic damage to the country as evidenced in a study by Bello (2005) who found that between 1975 and 2001, average of 5.86% of the GDP was lost to malaria death annually.

Nigeria malaria under-five mortality rates differ by zones. The under-five mortality rate ranges from 185 deaths per 1,000 live births in North West Zone to 90 per 1,000 live births in South West Zone. The North east accounts for the highest infant and under-five mortality(NDHS, 2013)

Apart from loss of life from malaria, its prevalence has been recognized as an ailment that impose sizable economic burden on most households. Researches such as Jimoh (2005) and Obinna (2016) have shown that malaria causes households in Africa to lose up to 25% of income to the disease. Leading health economist (Badalcci, Musgrave, Rhum, Gupta, Filmer and Pritchet) economists estimate that malaria causes an "economic growth penalty" of up to 1.3% per year in malaria endemic African countries. Malaria discourages investments and tourism, affects land use patterns and crop selection resulting in sub-optimal agricultural production, reduces labor productivity, and impairs learning (WHO 2008). Furthermore, malaria can strain national economies, impacting some nations' gross domestic product by as much as an estimated 5–6% (world economic forum GHI 2006).

Informed by this under-five malaria death, promotion and investing in child health has gained attention in international agenda. For instance, the fourth (4th) Millennium Development Goals (MDGs) now Sustainable Development Goals (SDGs) is to reduce child mortality. Specifically, target five (5) and six (6) of the goal are to reduce by two thirds, between 1990 and 2015, the under-five mortality rate and malaria incidence (UN, 2000). However, as at 2015, the majority of African countries, including Nigeria, did not achieve this target (UNAIDS 2015).

Even though data shows that there has been a decrease in under-five mortality rates during the period 2000-2011 (WHO, 2012). This may not be unconnected with increases in public health spending in some SSA countries as a result of Abuja Declaration of 2001 that sought to increase public health spending in SSA. Also at the same time, there has been increased donor funding of health programmes from US$ 1.4 billion in 2002 to US$ 8.7 billion in 2010 (Wexler, Valentine, and Kates, 2013). These interventions have reduced death from malaria (WorldHealth Organization, 2011b). The child mortality decrease has not been the case with Nigeria where infant and (91 per 1000 live births) is still among the highest in the world while the mortality rate for children under age five is 192 deaths per one thousand (WHO, 2016).

This undercore the relevance of government spending on health and other intervention policies. Available data shows that Government health expenditure over the years has witnessed marginal increase. For example between 2011 to 2012 health expenditure increase from 31.23% to 31.32% it declined to 23.83% by 2013 and by 2015 it increase marginally to 25.33%. On the other hand, there has been a marginal decrease too in under-five mortality. However, the decrease in the under-five mortality fell short of international standard of 25 per 1000 live birth (SDGs, 2016).Hence, an empirical study is needed to examine public health expenditures and under-five malaria mortality. Even though there are many researches in this regard however, the findings produced by these researchers are varied and in some cases contradictory. The available studies so far document a range of effects – from no impacts, to limited impacts, and to impacts on some specific interventions only. For example studies supporting the positive impact of public spending on child health outcomes includes Houweling, Kunst .A. Looman, C and Mackenbach, J.P (2005), John and Andrew (2007) Yushum (2014), Daniel and Subramanian (2014), Sanjay (2015), Sarah and Zahra (2016) Sede (2017). On the other hand, studies with opposite views includes Baldacci, et al. (2003), Bokhari et.al (2006) Ricci and Zachariad (2006), kamiya (2010) , Yaqub, J.O., Ojapinwa, T.V. and Yussuff, R.O. (2012), Hu and Mendoza (2013), Roperto jr and Tiany (2014).

Previous studies conducted have theoretical underpinning which form the basis of the studies. For example, Grossman theory popularly known as health demand theory (1972) enphasised on health outcome of a society which according to him is mainly determined by the investments made in healthcare to produce health stock. These investments are the inputs into the health production. Other theories like the endogenous growth theory, Wagner's law of public health expenditure, wiseman and peakcock expenditure theory, Keynes theory and theories on human capital all emphasize on the the relevance of government as an institution in influencing some economic and social activities for growth in all sectors of the economy.

In Nigeria, public health expenditures is the key inputs into the production of health and it has the capacity to influence health outcomes especially among the children of less than five years of age. Previous studies had demonstrated how public health spending has impacted on under-five mortality in Nigeria however; these studies were not diseases specific. On the otherhand, studies which anaylised impact of public health expenditure on malaria reduction were not age specific. The difference between this study and previous studies is that, this study examines public helth expenditure and malaria specific mortality in children of less than five years of age.Therefore this study fill gap by looking at public health spending and under-five malaria mortality. The study is different from previous studies in the sense it is age and diseases specific (under-five malaria mortality). This allows for more targeted and specific policy on reduction of under-five malaria mortality from current state of 108 deaths to 25 deaths per 1000 live birth as recommended by SDGs.

1.2 Statement of the Research Problem

Public health expenditure has been recognized as a key policy instrument expected to reduce under-five mortality especially in a country like Nigeria where majority of people are living below poverty line. Data shows that Government health expenditure over the years has not been encouraging and failed to meet up with the recommendation of Abuja declaration of 2001 of allocating 15% of total budget to health sector. Statistic revealed an insignificant percentage allocation made to health sector in Nigeria over the years. For example in 1990 only 1.01% of the total budget was allocated to health and by 1994 the percentage increased marginally to 1.8 however, by 1995 the allocation to health witnessed a sharp increase to 5.2% of the total budget allocation and by 1998 it nose dived to 0.66%. The year 1999 witnessed and unprecedented increase allocation to health sector getting 7.32% of the total budget. The increase was not sustained in 2000 as the percentage allocation to health dwindled again to 5.15% and 3.85% in 2000 and 2001 respectively. The downward trend continue up to 2010 were only 3.58% was allocated to health from the total budget. However, the percentage allocation increased to 5.58% in 2011. By 2012 it increased marginally to 5.95% and decreased to 5.66%, 5.63%, 5.78%, and 4.13% in 2013. 2014, 2015 and 2016 respectively. In 2017 it appreciated to 5.17% again and declined to 4.00% in 2018 (FMoH, 2018).

Therefore, it is expected that public health expenditure will significantly reduce malaria and under-five mortality as enshrined in SDGs goal (formerly MDGs goal). However, available data (WDI, 2017) shows that reduction in under-five mortality in Nigeria fall short of WHO recommendation of reducing under-five mortality to as low as 25 per 1000 live birth. For example, in 1990 under-five mortality per 1000 live birth was 212.5 it declined to 207.8, 186.8, 158.1 in 1995, 2000 aand 2005 respectively. By 2010 and 2015 it further declined to 130.3 and 108 accordingly (WDI, 2016). However, the figure 108 is far from the recommended 25 per 1000 live by SDGs. Already, about 117 countries have met the SDGs target and 26 countries are expected to meet the target by 2030. Tanzania and Rwanda are predicted to meet up with the target of 25 deaths (under-five mortality) per 1000 live birth (WHO, 2016).

The major cause of this under-five mortality has been traced to malaria. WHO (2010) reports that in Nigeria around 700,000 children died before their fifth birth day and 60% of these death were due to followings; malaria (41%) Pneumonia (17%) Prematurity (12%) and diarrhea (7%), hence malaria is a major killer of children under the age of five. WHO (2014) reports that Nigeria and Pakistan have the worst record globally in infant and under-five mortality traceable to malaria. World malaria report (2015) also shows that Nigeria share of estimated malaria case in 2015 was 55% in West Africa above Ghana, Niger and Burkina Faso with only 6%, 5% and 6% share respectively. Furthermore, Study has found that about 80 percent of the global malaria burden is in Africa and 29% of this burden is burned by Nigeria (World Malaria Report 2014). Statistics shows that in Nigeria, malaria is responsible for approximately 60% of outpatient visits and 30% of admissions in hospital compared to any other diseases. The disease (malaria) overburdens the already-weakened health system and exerts a severe social and economic burden on the nation, retarding the gross domestic product (GDP) by 40% annually and costing approximately 480 billion naira in out-ofpocket treatments, prevention costs, and loss of man hours (FMoH and National Malaria Elimination Programme [NMEP] 2014).

Therefore, from the problem statements the following research questions emerge;

i. What are the determinants of under-five malaria mortality in Nigeria?
ii. What is the impact of public health expenditures on under-five malaria mortality in Nigeria?
iii. How does shock from public health expenditure affects under-five malaria mortality in Nigeria?
iv. What determines changes in public health expenditure trend in Nigeria?

1.3 Research Objectives

The main objective of the study is to examine the relationship between public health spending and under-five malaria mortality in Nigeria from 1990 to 2017. Specifically, the study aim to achieve the following objectives.

i. To examine the determinants of under-five malaria mortality in Nigeria.
ii. To examine the impact of public health expenditure on under-five malaria mortality in Nigeria.
iii. To investigate how shocks from public health expenditure affects under-five malaria mortality in Nigeria.
iv. To identify the determinants of public health expenditure trend in Nigeria.

1.4 Justification of the Study.

Substantial literature exist on public health expenditure and under-five mortality. Available literatures tried to examine how increase or decrease in public health expenditure affects under-five mortality rate. Such studies includes Anyanwu and Erhijakpor (2007), John and Andrew (2007), Novignon (2012), Joseph (2013), Daniel and Subramanian (2014), Sanjay

(2015) and Aeron (2016). However, in all the literature reviewed on government health expenditure and under-five mortality, none of the literature was diseases specific but take on general cause of under-five mortality. Secondly, literature reviewed on government expenditure and malaria mortality, none of the study was age specific but on general malaria mortality across all ages. Hence, this study fills the gap by being specific on age (under-five) and diseases (malaria). Therefore, unlike previous studies, this study focuses on government health expenditure and under-five malaria specific mortality.

The variable household's behavior is very crucial in determining under-five malaria mortality but was ignored in by other scholars. Hence, this study fills the gap by introducing the variable in the study.

Methodologically, majority of the study reviewed employed OLS estimation techniques for example, Yakub et.al (2013), Daniel and Subramanian (2014), Yushum (2014) Micheal and Ramu (2015), Innocent and O'Hare (2015), Nwano et.al (2015), Latitagauri (2016), Khan and Shatie (2016), and Craig and Hristos (2016). However, this strand of studies that uses OLS is faulty because of the stochastic nature of underline data which could be non-stationary. This category of data will evidently fail the OLS estimation because of their lack of non-stationary at levels which require at either 1^{st} or 2^{nd} differencing. Similarly, others studies who adopted logit regression like Kayode and Joseph (2012), Olalekan and Nurudeen (2013), Sunday and Clifford (2014), Bello and Joseph (2014) and Aeron (2016) are restricted to binary response which is not in line with properties of the data. In similar vein others who employed Vecto error correction model (VECM) for example Faisal and Ulrich (2011), Maughele and Ismaila (2013), Okeke (2014), Sede (2015) and Ilori (2015) are suspected to have violated the requirement of the 1st order of integration in the series in line with Sims (1981)

Therefore, this study employed the modified VAR estimation techniques in the spirit of Toda and Yamamota (1995) and Bello and Sanusi (2018) will provide more suitable estimation techniques that can accommodate mix order of integration for a non-stationary series or data.

1.5 Scope of the Study.

The study will cover the period between 1990 to 2017. The period was chosen because budgetary allocation to health in 1990 began to rise from lowest of 1.01% to 5.1% and remained within the average of 5% between 1990 to 2017. Also within the period of 1998 Roll Back Malaria programme was lunched. In addition, under-five mortality within the period 1990 began to decline but still far above the international recommended standard. Within the period 1990 to 2000 MDGs now SDGs came in to beig with goals of reducing child mortality and eradication of malaria. The period also marked the beginning of more deliberate and intensive effort by federal government of Nigeria to fight malaria and consequent introduction of malaria programmes like National malaria control program (NMCP) lauched since 1993, Presidential malaria initiatives (PMI) launched in 2005. The study will only cover specific disease (malaria) and children of less than five years of age. Lastly, there is available data on the variables which covered the period under study.

1.7 Structure of the Study

The study is structured into five chapters. Chapter one presents the background to the study, the problem statement, research questions, objectives and hypothesis of the study. The chapter also includes justification for the study. Chapter two is divided in to section A and

B. Section A presents the conceptual issues relating to the study, theoretical and empirical review of the literature on the subject matter of the study while section B looked at the overview of public health expenditure in Nigeria and malaria programmes in Nigeria. Chapter three discusses the methodology of the work which comprises of conceptual and theoretical framework, model specification and estimation techniques to be employed. Chapter four presents the results, interpretation and analysis. Chapter five summarizes the major findings emerging from the study, conclusition, policy recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter is divided in to two sections (A&B). Section A presents conceptual reviews, reviews of theories relevant to the study for the study to have a sound theoretical backing.To identify the gap in the literature, related empirical work conducted by other people were reviewed. The study looked at cross country studies, country case study using time series and panel data. Some of the literature took similar position while some have a divergent view. Conclusion was drawn from the literature reviewed and research gap identified. The section B presents overview of Nigeria's health system, trend in public health expenditure and malaria programmes in Nigeria.

2.1 Conceptual Review

2.1.1 Public Health Expenditure

Health financing refers to the collection of funds from various sources (e.g; government, households, businesses, and donors) pooling them to share financial risk across larger population groups and using them to pay for services from public and private health care providers (WHO, 2010). The major sources of finance for the health sector in Nigeria are the three tiers of government (Federal State and Local Government), public general revenue accumulated through various forms of taxation, the health insurance institutions (private and public), the private sector (firm and households), donors and private health organizations.

Furthermore, WHO (2010) consider Public health expenditure to consist of recurrent and capital spending from government (federal, states and local government) budgets, external borrowings, and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds WHO (2010).

OECD (2001) refers Public expenditure as expenditure on health care incurred by public funds. Public funds are state, regional and local Government bodies and social security schemes. Public capital formation on health includes publicly-financed investment in health facilities plus capital transfers to the private sector for hospital construction and equipment

Health expenditure as an indicator of the volume of resources flowing into health is expected to reduce under-five mortality rates. Thus an increase in health expenditure per capita implies a broader access to health care and services which helps to decrease mortality rate. Given the redistributive influence of public intervention, a positive correlation between public health financing and health outcomes is expected.

This study therefore, conceptualizes public health expenditure to mean government health expenditure (federal) budgets, grants from NGOs. The public health expenditure consist of salaries and allowances (recurrent expenditure) and construction of new health facilities, procurements of health equipments, ITNs and purchase of anti-malaria drugs (capital expenditure). The health expenditure is expected to impact positively on children of less than five years of age in terms of reduction in malaria dealth.

Therefore, there exists a room for government intervention in health care on the basis of provision of quality health care where the market is ineffective and also from welfare point of view. Many studies have shown the positive effect of state or government health expenditure on the economy and health sector in particular. State intervention in health was proved to increase positive health outcome in terms of under-five mortality reduction, prevention and control of communicable diseases and increased life expectancy.

2.1.2 Under-five Malaria Mortality.

Child mortality refers to number of child death under the age of 5 per 1000 live birth. However, the child mortality could be simplified in to more specific terms such as prenatal mortality (death before birth), perinatal mortality (death within one week of birth), neonatal mortality (death within first 28 days of birth), and infant mortality (death within 12 months of birth). Under-five mortality is children that died before reaching their fifth birth day. The cause of the death may be due to illness such as malaria, cholera, pneumonia, respiratory track diseases, measles etc. this study conceptualizes under-five malaria mortality to mean children that died before reaching the age of five as a result of malaria only. Hence under-five malaria mortality means specific malaria mortality of children less than five years of age.

2.2 Theoretical Literature Review

Wagner (1883), Keynes (1932) Wiseman and Peacock (1974), Musgrave (1999), have contributed to development in the field of public finance. They have all tried to justify the relevant of public expenditure in the economy which serve as basis for theory in research in the areas of public or government expenditure. However, this study is on public health expenditure, hence will review human capital theories which are much more relevant to research in health economics. Though, there are limited theories that address the needs for research in health economics, people like Grossman (1972), cropper (1974) and Maurine (1982) have come to share, atleast in broad outlines, a conception of the research agenda that arouse from adoption of the human capital idea. Therefore, this study, rely heavily on human capital theories as the basis for theoretical underpinning of this rearch work which is well rooted in health economics.

2.2.1 The Human Capital Theories

Analysis of the health sector is considered 'notorious' simply because it lack theoretical basis (McGuire 1993). Most studies and modeling in health economics is adhoc utilizing empirical approach to find coefficient of interest with minimum reliance on theory while some utilize public expenditure theories (Wagner, Wiseman and Peacock, Musgrave etc) which are inappropriate for studies in health economics. Secondly, scholars like Schultz (1960), Becker (1964), and Mincer (1958) have also contributed to the development of human capital theories however, their work on human capital was not directly related to health but to education and on the job training as a necessary condition to enhance workers performance to earn more income and increase his efficiency in production, hence, their theories are not related to this study. Nevertheless, Grossman (1972), cropper (1974) and Maurine (1982) have attempted to provide theoretical models for health studies in health economics. The Grossman model is called 'health demand theory' which has since it emergence dominate theoretical justification in health economics studies. Though, the theory which was originally micro in nature has been modified by some scholars to capture macro studies in health economics. The theory is built on intuitive notion that health has many inputs. The theory look at health as an important commodity implying that demand for health supersede demand for healthcare and this automatically makes demand for health care as a derived demand. The model argues that health is both a consumption and investment goods which implies that individual are both consumers and producers of health.

The model treats individual health as a durable and endogenously determined stock which evolves over time. Hence,

$H_{t+1} - H_t = I_t - \partial_t Ht$

Where H_{t-1} is the health capital

$T + 1$, I_t = gross investment, *t*, and ∂_t is the rate of depreciation that is assumed constant within a given time interval *t*, and exegenously dependent only on an individual's age.

Formally, the Grossman model is based on the maximization of an intertenporal utility over individual's life time. The utility is a function of healthy days *h*, and a consumption of a composite commodity other than health Z

$U = U(h_o, \ldots\ldots\ldots, h_n, Z_o, \ldots\ldots Z_n)$

Where *n* is the lenth of life in the model and endogenously determined as shown above. Similarly, gross investment in health, the total consumption of the composite commodity *z*, also obeys the household production function.

$Z_t = I(X_t, T_t, E_t,),$

Where X_t = market googs input,

T_t= time spent in producing Z

E_t= efficiency parameter defined in terms of education.

The full wealth constraints is defined in the Grossman model as

$$\sum_{t=0}^{n}\left[P_t M_t + Q_t X_t + W_t\left(TL_t + TH_t + T_t\right)\right]\frac{1}{(1+r)^r} = A_0 + \sum_{t=0}^{n} W_t \Omega \frac{1}{(1+r)^t} \ldots\ldots\ldots\ldots\ldots 2.1$$

Where P_t= price of medical care,

M_t, Q_t = price of market goods

X_t, W_t = wage rate

TL_t = sick time

TH_t *and* T_l = time spent on producing health and market goods respectively; r is the opportunity cost of capital, A_0 is the discounted value of capital income, and **Ω** is the total amount of time available. Grossman believes that an individual can use his time to add to his earnings apart from his initial wealth. Therefore, healthy days can be used to earn more income

Grossman (1972) using the household production framework to develop his model of the demand for health, viewed health as drived demand and a durable capital stock, and hence implied that the end product is not health as such but the services which health could help to produce like productivity. According to Grossman's formulation, each person derives utility from the services that health capital yields and from the consumption of other goods and services. The stock of health capital depreciates in the long run and the consumer can produce gross investments in it according to a household production function using medical care and their own time as inputs. He emphasized that the optimal level of health capital for any individual is determined by the point at which the marginal cost of investment in health capital is equal to the marginal utility of healthy days. However, it is assumed that the effectiveness of the production process purely depends on individuals' stocks of other forms of human capital, like education.

In Grossman's model, the lengths of time for inter temporal optimization or maximization is determined endogenously by defining a minimum level of health ("death stock") below which death follows. The yield from the individual's stock of health capital is defined as the total number of healthy days in each year, which generates utility directly, since being healthy yields utility ("consumption" motives), and indirectly, since being healthy yields income which in turn can be used to purchase goods or to produce commodities which influence utility ("investment" motives). In the Grossman model, demand for heath is derived demand therefore, household production models in general, the demand for the medical care, and other market goods, are all indirectly derived.

The Grossman model though very convicing did not take in to consideration some factors that could influence health such as household's health behaviours and environmental factos which are very important especially in SSA contries and specifically Nigeria in determining one's health stock. Also, the issue of seeing health as a derived demand is mostly applied to specific age group who are within the productive age. Children and old people's demand for health may not be seen as derived demand but demand for health for comfort.

This model considers health as a capital good that is inherited and depreciates or deteriorates over time. The theory explains that investment in health is a process in which medical care is combined with other relevant factors to produce new health, which in part, offsets the process of deterioration in health stock. Failure to produce the new health, the health stock tends towards zero, and finally results to illness and death.

According to Grossman (1972), health are demanded for two reasons; (i) as a consume commodity- this directly enters their preference function or sick days as a source of disutility. Secondly, as an investment commodity-it determines the total amount of time available for market and non-market activities. In other words, an increase in the stock of health reduces, the amount of time lost from these activities, and the monetary value of this reduction is an index of the return to an investment in health.

One of the novel feature of the model is that individual's choose their length of life. Gross health investment are produced by households production function that relate an output of health to such choice variables or health inputs as medical care utilization, diet, exercise, cigarette smoking, and alcohol consumption.

Despite the contribution of the Grossman model in the development of health economics, studies have emerged either supporting or disapproving the Grossman theory. Among studies supporting the theory includes Leu and Doppma (1986) and Leu &Gern (1992) confirm a decrease of health capital with age. Similarly, Strauss et.al (1993) found that health based on activity limitation decreases with age and higher education leads to improved health. Using Swedish data, Ulf G-Gerdman (1999) showed that demand for health increases with income, education, and decrease with age, overweight, urbanization, and well being. Sickles and Yazbeck (1998) showed that healthcare and leisure consumption tend to improve health. The Grossman model was also employed by Nixon and Ulman (2006), and Thorton and Rice (2008), where they analyze health status through the production function, where health is seen as an output of a healthcare system, which is produced through inputs to that system. In this case, health expenditures proxy by medical care comprise health inputs, whose outputs from the health system are the resultant health outcomes measured through life expectancy and under-five mortality. The study found medical expenses to have positive impact on child's health

On the other hand, numbers of studies have disapproved Grossman theory based on empirical studies. For example, findings of Wagstaff (1986) and Leu and Gerlin revealed negative relationship between health and demand for medical services however, they found a positive correlation between education and demand for health services. In similar vein, Duan et.al (1984), Phelps (1974) and Zwelfel (1985) rejected empirically the prediction that demand for health services increases with age. Tituas Galama (2009) in their paper " Grossman missing link health threshold" disapproved Grossman prediction that health and medical care are positively related.

Other observations includes Zweifel and Breyer (1997) who pointed out that the theory neglects the likelihood of stochastic shocks, such as accidents, major illnesses and disabilities which may result in large and permanent decreases in the level of health capital which may sometime leads to overestimation of an individual's control of his own health in the long run. Therefore these shocks may be a limitation to individual's choice of the means for any further health improvements.

To overcome the shocks which limits individual‘s choice to further health improvement. Cropper (1977) introduced some modifications to Grossman's model, which are particularly interesting from the point of view of health promotion. Cropper (1977) based her developments on the pure consumption version of Grossman's formulation by assuming that investment in health is driven by the desire to avoid disutility related to illness as such, rather than monetary losses due to sick time. Cropper (1977) distinguishes between illness and death as, respectively, temporary and permanent interruptions to the individual's utility stream. Cropper (1977) allows for uncertainty in the relationship between the stock of health capital and the service flow from the stock by assuming that the critical level of stock below which illness occurs is a random variable. In other words, even at a high level of health capital an individual cannot be sure that illness is avoided. Cropper designs the model specifically to analyse minor illnesses and assumes that short-lasting conditions do not affect the level of health stock. Cropper (1977) assumes that individual's use of medical care is related to a random event of falling ill and that preventive health services alone can be treated as genuine investment in health.

Cropper's work differs from that of Grossman in the sence that he sees ramdom nature of illness and death. Cropper (1977) sees investment in health not to receive money (derived demand) from work but totally to avoid disutility associated with being sick or ill because a state illness cause discomfort for an individual. This disutility could also include death which causes permanent interruption of the utility stream. Secondly, relationship between health capital and illness is treated here as random rather than as deterministic. Whether one is well or ill depends, after all, on random events-changes in climate, exposure to viruses and germs-as well as upon the size of one's health stock. According to cropper, individual can increase his stock of health by investing in health but cannot guarantee that sickness cannot occur. She identified two types of medcal expenditure, first to prevent illness and second to cure when sickness occurred.

Maurine (1982) also contributed to the debate by adopting a more general concept of health outcome, by looking at productive benefits produced by the stock of health as increased capacity to perform economic activities and allowing the value of that improvement to depend on the individual’s circumstances. Maurine (1982) in her model, healthy time, as a proxy for the benefits produced by health capital, does not have any inherent theoretical significance, and hence can be replaced or ignored if necessary.

Investments in health as explained by Grossman (1972), copper (1977) and Maurine (1982) are all human capital investment which is derived from expenditures in health and education. This investment can be done by either individual or by government, the overall objective is to attained good health because health is capital goods which give individuals strength to engage in labour market and hence contribute to more production of goods and services in the society. Good health increases the chances of individual to work for longer hours and thus increase in labor supply with corresponding income. In terms of education, health may be positively related to the level of educational attainment. Thus, healthy children are expected to exhibit less school absence and school drop-out. Healthy individuals are also inclined to have more savings than individuals in poor health as a result of more participation in labour. More Savings will ultimately increase many investment opportunities and hence have future influences on income and wealth.

Conclusively, the public expenditure theories from various authors emphasized on the need for public investment to achieve economic progress. For example Keynes argued that public intervention through expenditure is necessary to achieve economic growth. Other people like Wagener, Peacock and Wiseman though differ in their approaches all emphasize on the relevance of government expenditure in the economy to achieve economic progress. Human capital theories, Grossman (1972), Copper (1977) and maurine (1982) as reviewed in this work are of production function approach (input-output) where investment in health and education by both private and government for example medical input, infrastructures are seen as input in the production function. This work therefore, will derive from human capital theories where individual and government investment in health is taken as input in the production function and the output (health outcomes) represented by under-five mortality. The government health expenditure is an input in the health production process (investment in malaria control, financing of health care delivery), the output represents the service delivery indicators (SDI) eg doctors, nurses, equipments and household's behavior. The health outcomes in the production funtions are the child mortality, maternal mortality and life expectancy.

2.3 Empirical Literature Review.

The study reviewed empirical work on public health expenditure and under-five mortality. To make the review robust, we reviewed studies on cross country and specific country case studies. This will enable us understanding the dynamics ans trends in public health expenditure across the globe and how this has effect Childs health outcome. The study also reviewed public health expenditure and malaria mortality. Other studies reviewed include determinants of under-five mortality and as well determinants of public health expenditure. The review will guide us to understand the impact of public health spending on children of less than five years of age and to explore gap existing in the current literature.

2.3.1 Public Health Expenditure and Under-Five Mortality

A Vast literature exists on the impact of Public helth expenditure and under-five mortality. Some of these study have reported either positive or negative or no impact at all. However, majority of the studies have revealed positive impact of public health expenditure on child's health outcome. Ealier studies employing ordinary least square (OLS) have shown that investment in health by government have produce positive results and have reduced the number of children dying before reaching the age of five. Such studies includes Arnand and Ravallion (1993), Canning (2009), John Philippe (2006), Abbas and Heimenz (2011), Muthaka (2013), Olarinde and Bello (2014) and Dominic and Anthony (2015).

Early literature such as Filmer and Pritchett (1999) applied OLS and 2SLS to examine the impact of public health spending on under-five mortality using cross-section of 98 countries. The OLS estimates showed that an increase in public health expenditure by 1% led to a fall in under-five mortality by 0.14% at 10% significance level indicating a weak link. This finding is in consistent with Gupta, et al. (1999) who also employ OLS and 2SLS to investigate the effects of total health spending and public spending on primary health care (public expenditure on clinics and practitioners or on preventive health) on under-five mortality rates in 50 developing countries and transition economies. They found that an increase in primary health care expenditure by 1% reduced under-five mortality rates by 0.97% and 0.95% respectively. Two weaknesses can be identified in these studies. First, non-uniform definition of public health expenditure across countries. Secondly, due to inconsistencies in data the sample size used was far below the initial 50 observations (30 in OLS and 29 in 2SLS) this leaves very few degree of freedom which may affect robustness of the estimates realized in the studies.

In a related study, Gupta, et al. (2001) examined the separate effects of public and private health spending on under-five mortality rates among the poor and non-poor households in 70 countries. The OLS estimates showed that an increase in public health expenditure per capita by 1% reduced under-five mortality rates between 0.3% to 0.32% in the poor households. But private health expenditure had insignificant effect. For the non-poor households, the results revealed that an increase of 1% in public and private health expenditure per capita contributes to a decline in under-five mortality rates by 0.23% and the range of 0.28% to 0.43% respectively. The findings of this study corroborate the findings of filmer and prichett (1999). However, this study unlike Filmer and prichett consider the impact of private health expenditure which is central in determining under-five mortality in SSA countries

Upholding the view of Gupta et.el (2001) Hanmer, Lensink and Howard (2003) used data for 115 countries using five years period from 1992-1997. It is estimated that income per capita and health expenditure is consistent and robust in explaining variations in under-five mortality rate. It is recognized in the study that growth in income is necessary to sustain health expenditures.

Baldacci, et al. (2003) estimated the relationship between 3-year (1996-1998) averages in public health expenditure and both infant and under-five mortality rates for 94 developing and transition economies. To account for potential endogeneity of health expenditure and heteroscedasticity in the cross-sectional data, Weighted Two stage Least Squares (WTSLS) was used. The cross-section results indicated that an increase in public health expenditure by 1% resulted in decline of under-five mortality rate by about 0.22%. For the infant mortality rate, a rise in public health expenditure by 1% reduced it by 0.13% to 0.22% across three estimation methods (OLS, 2SLS and WTSLS). The finding of this study is in line with the previous works. However, the weakness of the study is that the periods of three years are too short for any significant and robust result compared to prvious studies which used more than thirty years observations.

Houweling et.al (2005) examined the effects of public health expenditure on under-five mortality rates in a sample of 43 countries in Africa, Asia and Latin America with emphasis on differential impact among the rich and poor. OLS estimates indicated that a 10% increase in public health expenditure per capita would decrease under-five mortality rates by about 1.1% (rich) to 2.4% (poor). Reporting similar finding, Issa and Quattara (2005) investigated the effect of public and private health expenditure on under-five mortality ratess: Does the level of development matters? The study considers some selected developing and developed countries over the period 1980-2000. Variables of interests in the study include RPCGDP, per capita income, female secondary school enrollment rate, CO_2emmissions. Employing OLS and panel data estimation techniques, the results suggest a strong negative relationship between health expenditures and U5MRs. However, public expenditure exert more influence on U5MRs in developing countries, while, private health expenditure at developed countries than public spending. The relationship between U5MRs and per capita income was negative and statistically significant. However, the difference between the studies is that Issa and Quattara examined the difference between developed and developing countries Houweling, et al (2005) study was on SSA countries but we can conclude that public health expenditure has a grater role to play in developing countries than developed countries given the level of economic growth in the SSA countries.

Gottret and Schieber (2006) employed several methods (OLS, Heteroscedastic OLS, 2SLS and generalized method of moment Heteroscedastic 2SLS) to investigate the relationship between government health expenditure and under-five mortality rates in 2000 for 113 countries. The OLS estimates indicated that increase in government health expenditure by 1% reduces under-five mortality by 0.17%. This result is lower than those which controlled for endogeneity (2SLS and GMM-H2SLS) which ranges from 0.34% to 0.4% in reducing under-five mortality. This findind was authenticated in similar study by Nixon and Ulman (2006) who used a production function and defined two models on health expenditure and health outcomes, with life expectancy and infant mortality as proxies for health outcome. They run econometric analysis on a fixed effects model conducted on a panel data of 15 European Union countries over the period 1980-1995. The general finding from their study was that increases in healthcare expenditure led to significant improvements in infant mortality, but marginally to life expectancy. For the model of life expectancy, they found that health expenditure and number of physicians has a positive and significant relationship with health outcome. In terms of gender, the two variables were significant determinants of female life expectancy. When they further estimated the infant mortality model, they found that health expenditure and number of physicians were the only significant determinants in the reduction of infant mortality for the different EU countries.

Anyanwu and Erhijakpor (2007) investigated health expenditure and under-five mortality rates in Africa. The study used a panel of 47 African countries for the period 1999-2004. The authors applied three estimation methods, robust Ordinary Least Squares (ROLS), and robust Two-stage Least Squares (R2SLS) to account for endogeneity and fixed-effect estimator to account for unobserved heterogeneity. The study revealed that an increase of 10% in per capita total health expenditure would decrease under-fivemortality rates by the range of 1.7% to 6.3%. Additionally, an increase in public per capital health expenditure by 10% would reduce under-five mortality rates by the range of 1.8 % to 2.5% using the three estimation methods. In a related study, using a sample of 127 developed and developing countries, Bokhari, et al. (2007) studied the link between per capita public health expenditure and under-five mortality rates. Unlike Houweling et.al (2005), the paper controlled for endogeneity of health expenditure and real per capita GDP by using instrumental variable generalized method of moments-Heteroscedastic OLS estimator (GMM-HOLS) and Heteroscedastic Two-stage Least Squares (GMM-H2SLS). The estimated elasticities imply that a 1% increase in per capita public health expenditure reduced under-five mortality by 0.34% and 0.52% for developed and developing countries respectively. Though the study used GMM models the type of data used does not account for dynamics.

Still on positive impact of public health expenditure and under-five mortality, John and Andrew (2007) investigated Health expenditure and health outcomes in Africa precisely 47 African countries from 1985-2005. The variables of interest in the study includes per capita health expenditure, public health expenditure, total health expenditure, female literacy rate, urban population, GDP per capita and number of physicians (per 1,000 population). The study employed OLS and 2SLS and the result obtained from the estimation revealed that health expenditure have a statistically significant effect on infant mortality and under-five mortality. The result implied that the total health expenditure is certainly important to health outcomes in 47 African countries examined however; the study was not specific on which of the health outcome (infant mortality, under-five mortality of life expectancy) is mostly in |fluence by health expenditure. Combining the three health outcome can be misleading in making conclusions.

Examining the link between components of health expenditure and under-five mortality in Asia-Pacific countries Freire and Kajiura (2011) employed fixed effects model in their estimation using panel data for the period 1990-2009. The authors found that a 1% rise in public health expenditure reduced under-five mortality rates by 0.06%. A 1% increase in private health expenditure reduced under-five mortality rates by 0.10%. From the results, public health spending exerts more influence on under-five mortality than private health spending. However, the study does not account for potential endogeneity of public and private health expenditure in the estimated under-five mortality equation. The finding from this study is confirmed by Katherine (2011) who conducted a similar study not on SSA but UN member countries. Katherine examined the Health system determinants of infant, child and maternal mortality rate: A cross sectional study of UN member countries. Under-five mortality rate, infant mortality rate and maternal mortality made up the dependent variables while explanatory variable consist of human health resources, health service coverage, public health financing, medical product, vaccines and technology, leadership and governance, health demographic variables. Using mixed linear regression model, the empirical result indicates that all the explanatory variables are significant related to under-five mortality and were found to be significantly risk factor to under-five mortality.

Similarly, Novignon et.al (2012), studied the effects of public and private health care spending on infant mortality rates in a panel of 44 Sub-Saharan Africa countries for the period 1995-2010 using fixed effect model. The results obtained indicated that a 1% increase in total health expenditure reduced infant mortality by about 3 per 1000 live births. The results further show that increasing public and private health expenditure by 1% reduced mortality rates by 4.2 and 2.5 per 1000 live births respectively. A drawback of these results is that potential endogeneity of the health expenditure variables in both infant and an under-five mortality equation was not taken into account.

The findings of Novignon is line with Tae and Shannon (2013) who carried out a study on government health expenditure and public health outcomes: A comparative study among 17 countries and implication for US Health care reform. The study empirically analyzes the relationship between public health expenditure and national health outcome among developed country between 1973-2000. The dependent variables were Infant mortality and child morality. While the independent variables includes Public Health expenditure (% of total health expenditure, Real GDP per capita,Gini coefficient, Unemployment rate ,Rate of ageing population. Their findings revealed a statistically significant association between government health expenditure and public health outcome. Particularly it showed a negative relationship between government health expenditure and under-five mortality rate and a positive relationship between government health expenditure and life expectancy at birth. This result suggest that higher government spending on medical goods and services and can be shown to provide better overall health result for individuals. The findings corroborate the findings of John and Andrew (2007) and Bokhari et.el (2007). The major difference in the study is that the author uses developed countries while others used developing countries as case studies.

Validating the above findings, Joseph (2013) employed fixed effect model to examine the effect of government health expenditure on under-five mortality in a cross country study SSA from 1990-2012. The study consider the following variables; economic development, democratization and government health spending. The result revealed that on average a 1% increase in domestic government health expenditure leads to a 0.34% decrease in under-five mortality Moreover, this effect is heterogeneous. Countries with larger GDP per capita or more civil liberties, political right and democratic have significant larger health spending elasticities.

Erick (2013) investigates the effect of health expenditure on health outcome in SSA. Objective was to investigate relationship between health expenditure, health outcome, economic growth in SSA. Method employed was Generalized lest squares estimator using fixed and random effect model. The results shows that health expenditure has two fold effect, first by improving health outcomes, through reduction in mortality and contributing to economic growth as an investment in health capital which improve health outcome. Variables used includes, Health outcome (mortality) independent while the independent includes Per capita expenditure, vector of health system variable, socio-economic variables, (per capita income, clean water education, population and age structure. Though, the study not outcome specific but corroborates the results from study conducted by Savas and Okan (2013) where they examined public spending on health care and health outcome: Cross country comparison. They used cross country regressions to estimate the strength of association between child and infant mortality rate and public health expenditure. Variables used in the study includes under 5 mortality, infant mortality independent), GDP per capita, Government health expenditure % of GDP, total health expenditure, law and order ,expected year of schooling ,Population ,Dummy for sub-Sahara, Dummy for OECD, Dummy for high income Non OECD, Dummy for high income Non OECD, Total health expenditure % GDP. Their finding revels a statistically significant and robust result. They found government health spending as share of GDP negatively associated with lower level of under-five mortality. However, they failed to estimate what proportion of the income or assets was going to health. Their study was also macro based. The finding was upheld by Farag et.al. (2013), where they examined a link between health expenditure, infant and child mortality, and the role of governance in low and middle income countries. The study employed fixed effect method of estimation to a panel of 133 countries for the years 1995- 2006. The estimates revealed that a 1% increase in total health expenditure decreased under-five mortality by the range of 0.15% to 0.38%. On the other hand, it lowered infant mortality by the range of 0.13% to 0.33%. Rising government health expenditure reduced under-five mortality by a percentage ranging from 0.1 to 0.19 while private health expenditure reduced it from the range of 0.07% to 0.08%. Additionally, a rise in government health expenditure by 1% led to a decline in infant mortality ranging from 0.08% to 0.17%, while increasing private health expenditure by 1% reducedinfant mortality by the range of 0.05% to 0.07% respectively. The estimation results indicated that improving the level of government effectiveness reduced child mortality. The full effect of government health expenditure with respect to improved government effectiveness (evaluated at the mean) led to a reduction of under-five mortality ranging from 0.07% to 0.12%.

However, the fixed effect estimator does not take into account potential endogeneity of health expenditure in both infant and under-five mortality equations.

Joseph (2013) employed fixed effect model to examine the effect of government health expenditure on under-five mortality in a cross country study SSA from 1990-2012. The study consider the following variables; economic development, democratization and government health spending. The result revealed that on average a 1% increase in domestic government health expenditure leads to a 0.34% decrease in under-five mortality. Moreover, this effect is heterogeneous. Countries with larger GDP per capita or more civil liberties, political right and democratic have significant larger health spending elasticities. In a similar study, Adeleke and Sijoula (2016) also examined SSA countries. The study centered on public health expenditure efficiency and infant survival rates in three selected SSA countries from 1998-2012. The study focused on government recurrent expenditure, government capital expenditure, RGDP per capita, public health expenditure per capita. Employing stochastic frontier analysis (SFA) model, the following findings were revealed. The result shows that capital health expenditure efficiency in the three countries had improved significantly over the years while the recurrent health expenditure efficiency had not witnessed any significant improvement. The result also shows that changes in infant survival rate were due to improvement in the capital health expenditure efficiency while the recurrent health expenditure efficiency had no statistically significant effect on changes in infant survival rate.

Similarly, Daniel and Subramanian (2014) employed OLS to investigate the association between coverage of maternal and child health interventions and under-five mortality in SSA countries. The period for the study covered from 1990-2012. The explanatory variables of the study include, government expenditure, PCGDP, maternal education, mother's age. Household's wealth, area of residence and birth order. The findings from the study revealed that, government intervention was associated with reduction in under-five mortality rate. However, the study did not consider private health expenditure in reducing children mortality under the age of five. Secondly, the period covered by the study is too short to obtain a robust result. Consistent with this findings is Scholastic (2014) who investigated under-five mortality rate in SSA countries from 2000-2011. The study examined health care spending and health outcome in SSA countries. Among the variables examined are public health expenditure, private health expenditure, total health expenditure, RGDP per capita, HIV prevalence rate, total fertility rate, measles immunization, ethnic fragmentation, female literacy rate, female labour participation rate , corruption perception index. The study employed GMM, linear dynamic model and the result obtained from the study suggested that total health expenditure reduces under-five mortality in SSA. The result also shows that when public health expenditure is stronger in reducing under-five mortality it crowds out the relative effect of private health expenditure. Hence, increasing public spending is essential in achieving lower under-five mortality rate.

Odhiambo (2014) estimated health care spending and health outcomes in SSA: evidence from dynamic panel using GMM-IV. The study was conducted over the period spanning from 2000-2011. He consider Under-five mortality as dependent variable and regressed it against public health expenditure, private health expenditure, per capita income, total fertility rates, ethic fragmentation, female literacy rate, female labour participation, HIV prevalence. The results indicated that health expenditure significantly reduces under-five mortality and adult mortality as well in SSA countries. Hence, public health expenditure has significant negative effect on under-five mortality and positive effect on adult mortality.

In a similar study Sanjay (2015) corroborate the findings of Odhiambo 2014, though while Odhiambo examined SSA countries, Sanjay examined European Union countries from 1995-2010. The major objective of the study was to investigate changes in government spending on health care and population mortality in the European Union. The study sought to know the how infant, U5M and neonatal mortaliry respond to GDP per capita, rate of inflation, unemployment, government debt as percentage of GDP, urbanization, access to number of calories per day, number of hospital beds, number of physician, out of pocket health expenditure, private health spending as a percentage of GDP. The study employed Multivariate regression analysis. The empirical result revealed that a 1% decrease in government health care spending was associated with significant increase in all mortality metrics. And 1% decrease in health care spending measured as a proportion of GDP and in purchasing power parity was both associated with significant increased in all mortality metrics ($p<0.05$). Further, the results show that five years after the 1% decrease in health care spending, significantly increases all mortality metrics. The two confirmed the relevance of public health spending on child health outcome. However, the five years period use in the study of European countriesis to short to obtain a robust result.

In a related study, Enayatollah (2015) investigated the comparison of the effect of public and private health expenditures on the Health status: a panel data analysis in the Eastern Mediterranean countries from 1995-2013. Variable of interest of the study includes; public health expenditure, private health expenditure, GDP, female labour force participation, fertility rate, population under the age of 15, proportion of population in urban area and years of schooling. They employed OLS and found that the public health expenditure had a strong negative relationship with infant mortality rate. However, a positive relationship was found between the private health expenditure and infant mortality rate. The relationship for public health expenditure was significant, but for private health was not. Supporting finding above, Micheal and Ramu (2015) investigated health care spending and health outcomes in sub-saharan African countries, particularly, Ghana from 1990-2012. Infant mortality was used as dependent variable while independent variables used in the study comprise of RGDP, public health expenditure, literacy level, and female labour force participation. Ordinary least square method of estimation was employed. The result revealed that public health care expenditure is associated with improvement in health status through reduction in infant mortality. The shortcoming of these studies is that they did not consider service number of physicians, nurses and household's health behaviours which are relevant in determining infant mortality.

Investigating Quality of governance, public health spending and health status in Sub-Saharan Africa using panel data from 1996-2001, Innocent and Bernadette (2015) employed 2SLS and revealed that public health spending on health has statistically significant impact in improving health outcomes. The elasticity with respect to under-five mortality is between -0.09 and -0.11. The variables of interest regressed against under-five mortality in the study includes; public health spending, quality of governance, female literacy, rule of law, sanitation, of accountability, control of corruption.

The negative relationship between government health expenditure and under-five mortality as observed in the above study was corroborated by Aeron et.al (2016) who investigated factors associated with declining under-five mortality rates in 46 African countries from

2000-2013. Variable of interest in the study includes public health financing and good governance, ICT, child survival intervention, maternal health, access to health care clinical and health condition of the mother. Employing linear regression, the study found that under-five mortality is negatively related to all the explanatory variables. This is supported by Craig and Hristos (2016)in a study of OECDA countries where they examined the impact of health care spending on health outcomes. The model consists of only the following explanatory variable public health spending which was regressed against infant mortality rate and under-five mortality rate. The estimation was carried out using Meta Regression Analysis (MRA). The empirical result revealed that spending elasticity for the mortality rate is particularly sensitive to data aggregation, to the specification of the health production function and the nature of the health care spending. The finding from this study confirms negative relationship between public health spending and U5M. unlike other studies who mostly employ OLS, 2SLS, this study employed mete regression analysis in estimating the relationship between under-five mortality and public health spending.

On the other hand, some studies have found weak or no relationship between public health expenditure and under-five mortality. For example, using a fixed effects model with data from seven Pacific Islands, Gani (2008) looked at the effects of per capita public health expenditure on infant and under-five mortality for selected periods between 1990 and 2002. The fixed effects estimation was corrected for auto-regression of order one. The study revealed an insignificant relationship between per capita public health expenditure and under-five mortality in the Islands. On the other hand, increasing per capita public health expenditure reduced infant mortality by 0.66%. However, the study did not control for potential endogeneity of health expenditure. The size of the sample used for the study was small (n=28) such that with 12 explanatory variables few degree of freedoms for hypothesis testing are left which may produce spurious result.

There seems to be a consensus in all cross-country studies on negative relationship between public health expenditure and underfive mortality. In all the literature reviewed, there is agreement that public health expenditure impact positively on under-five mortality except for one study by Gani (2008) were he fond insignificant relationship between public health spending and under-five mortality. Methodologically, almost all the studies employed OLS, 2SLS and fixed effect model in their estimation techniques. However, the weekness of these cross-coutry studies is that each of the country have their own peculiar characteristic that defined their economy therefore, combining them may not produce results that is consistent with the realities of individual country. Secondly, in cross sectional studies temporal dynamics are not accounted for because of their one period nature. Thirdly, important variable such as household's is omitted in all the cross country studies especially, studies on SSA countries.were traditions, customs and religion dogmatism still play amd important role in their economic and social life. Again couple with bad governance, corruption and diversion of public funds most government health expenditures do not get to the people. Lastly and more importantly, all the studies were not diseases specific and there are different causes of U5M across country. This serve as a major flaw in the cross country studies. Hence, the need to conduct a study using a specific major disease responsible for U5M for a better policy direction across SSA country.

2.3.2 Public Health Spending and Under-Five Mortality (Specific Country Study)

Most country case study employed time series data to establish the link and relationship between public health expenditure and under-five mortality. Time series studies provide a trend and temporal perspective and can be used to project future patterns of behavior of both health expenditures and under-five mortality.

Again, majority of these studies revealed the relevance of public spending in reduction of child's mortality in most countries.In a study of the relationship between public health expenditure and child mortality in Sri Lanka Anand and Ravallion (1993) observed the impact of public health expenditure per capita and infant mortality rate. Employing data for the period 1952 to 1981. OLS estimates confirmed that raising public health expenditure per capita by 1% decreased infant mortality by about 0.33%. However, this study neither controlled for potential endogeneity of public health expenditure in the infant mortality equation nor looked at the time series properties of the data used. Thus the estimated relationship is likely to be spurious. However, in related study, Subramanian and Canning (2009) used data from a National Family Health Survey carried out in India. It contained information on individual characteristics and mortality. The explanatory variables for their study were at three levels: individual, household and state. The variables of interest used by the study in the individual's category were age and sex. For household, asset index quintile, religious affiliation, residence (urban, rural), and access to safe water and sanitation (divided into piped, well, other sources and whether private or public). State data included government spending on medical expenses and public health. Out-of-pocket expenses were also included as a state level explanatory variable used multilevel probit to estimate the effects of health spending at state level, on the probability of death at the individual level.

They argued that the multilevel probit model is advantageous because it simultaneously considers the household and individual-level predictors, while allowing for non-independence of observations within groups. Their study found that an increase in public health spending decreases the probability of death, especially for the young (infant and under-five) and the elderly. In addition, other factors like household poverty status, location of residence (rural/urban) and access to toilets facilities affect child mortality.

John and Philippe (2006) examined the relationship between health care expenditure and health outcome in Philippines. The Objective of the study was to examine life expectancy and infant mortality as the output of the healthcare system and various life-style, environment and occupational factor as input. Method used was fixed effect model (Panel data) 1980-1995. Variables used include Infant mortality as dependent variables. Health expenditure, lifestyle, environmental factor, occupational factor, number of physician, nutrition and pollution as independent variables. Results Shows that increase in healthcare expenditure are significantly associated with large improvement in infant mortality but only marginally in relation to life expectancy. However, the study did not consider the private health expenditure which is relevant in determining health outcomes.

In a related study by Faisal Abbas (2010) on Public health sector expenditure, health status and their role in development of Pakistan. He empirically estimates the role of different macroeconomic and policy relevant factors affecting public health spending and health status in Pakistan using time series data from 1972 to 2008, employing Johansen cointegration methodology. He estimated long run income elasticity of health expenditures in Pakistan and found that income elasticity of public health expenditures in Pakistan was less than unity while the short run elasticity was negative. Also using cointegration and

Granger bi-variate causality analysis for health status of the population he estimated that per capita health expenditures are negatively related with infant mortality rate and positively related with female life expectancy. The study ignore private and out of pocket expenditures in determining infant mortality and other non-public health expenditures which exert influence on child mortality. Similarly, Huabouni and Abednnadher (2010) examine the determinants of health expenditures in Tunisia during the period 1961-2008, using the Autoregressive Distributed Lag (ARDL) approach. The results of the bounds test show that there is a stable long-run relationship between per capita health expenditure, GDP, population ageing, medical density and environmental quality. In fact, on the one hand there are the short-run and long-run results which reveal that health care is a necessity, not a luxury good. On the other hand, results of the causality test show that there is a bi-directional causal flow from health expenditures to health outcomes, both in the short and in the long run.

The finding above was corroborated by Abbas and Heimenz (2011) were they empirically examined the determinants of public health expenditure in Pakistan for the period which span between 1972 and 2006. Using co-integration and error correction methodology, the study reveals that health care in Pakistani is a necessity commodity. Urbanization and unemployment have negative effect on health care expenditure which implies that it is costly to provide health care to resident of remote rural area of Pakistan. However, they found government expenditure having significant impact on child mortality. The study failed to connect that the positive effect of immunization together with the household played their role by agreeing the uptake of immunization which reduced the infant mortality.

Again, Bassey et.al (2011) examine health care expenditure in Nigeria; does the level of government spending really matter for the period which spanned between 1980 to 2003, employing cobb-douglas production and ordinary least squares method of analysis. They found that life expectancy and literacy rate were negatively correlated with health care expenditure both in the short and long run, income elasticity of health care expenditure was below unity both in the short and long run. Which show that health care spending is income inelastic and concluded that health is a necessary goods in Nigeria. They recommended that in order to improve the health status of Nigerians, government needs to increase funding of health sector and reduce the inequality in the budgeting distribution of health expenditure. The result concurred with findings of Abbas and Heimenz (2011) and George et.al (2013) However, both studies failed to recognized the relevance of other factors that contributes to health outcome

such as the service delivery indicators (household's behavior, hospital equipment and facilities)

In a related study, Kristine et.al (2012) investigated prioritizing child health intervention in Ethiopia: modeling impact on child mortality, life expectancy and inequality in age at death. The study was carried out looking at the period spanning between 2011- 2015. Infant mortality and life expectancy were regressed against health intervention (public health expenditure). Using life save tool the result indicates that health intervention reduces child mortality and increases life expectancy in Ethiopia. Consistent with this findings, Farahan and Canning (2012) investigated Effects of state-level public spending on health on the mortality probability in India for a period spanning between 1998-1999. They employed probit and logit model to test for child mortality and public health spending, private health spending, per capita income and access to toilet. The result from the study suggests a negative relationship between health expenditure and child mortality. The study could not test for joint impact of public and private health expenditure on child mortality. Secondly, the period studied is too short to capture impact of public health spending on child's mortality rate.

Paul (2012) examined USA for a period between (1995-2003) on the impact of local health expenditures on health status. He uses fixed effects regression to establish relationship between health expenditure and the followings variables smoking and obesity prevalence, infectious diseases morbidity, infant mortality, death due to cardiovascular diseases and cancer and overall premature death. The empirical results from the study shows that an increase in health expenditure was associated with a statistically decline in state level infectious diseases and mortality. The major weakness of the study is that it did not separate neo-natal, infant and under-five mortality and treat them separately but simply look at the children which could have a different result if treated differently. Correspondingly, Lawrence and Ismaila (2013) in a study used an error correction mechanism to estimate the total government health expenditure and health status in Nigeria. The major findings of the study are that, there exists a positive but insignificant relationship between gross domestic product per capita and total government health expenditure in Nigeria. Also, health expenditure share in gross domestic product (proxy for government developmental policy on health sector) has negative and significant impact on health status in Nigeria.

Similarly, George et.al (2013), empirically investigated Public Expenditure and Health Status in Ghana, Using time series data from 2001- 2010 they found that despite the relationship between health status and many other possible determinants, the most important factors relevant to health status in Ghana are health insurance policy, and the availability of physicians. It would imply that, better health status seem to be associated with higher health spending and more physicians. However, study failed to consider the role of out-of-pocket expenditure in determining health status mainly through per capita income. In related study, Muthaka (2013) also examined health expenditures and child mortality: evidence from Kenya. The study employed linear probability model (LPM) and control function approach (CFA) to estimate public health expenditure, private health expenditure, mother's highest level of education and head of household level of education as against under five mortality in Kenya. The estimated result shows that, public and private health expenditures have no effect on death of neonatal, but significantly influence the mortality of infant and children below the age of five.

Olarinde and Bello (2014) examined public health Expenditure and health sector performance in Nigeria: Implication for sustainable economic development. The considered the period between 1990-2012. Variables of interest in the study are government health expenditure, private health care expenditure, literacy rate, Gross domestic product per capita (a proxy for poverty level) and urban population. Dependent variable which is the health outcome comprise of IMR and U5MR. The study employed Autoregressive distributed lag (ARDL) and Vector error correction mechanism (VECM). The empirical result from the ARDL bound testing approach provide strong evidence of the existence of a long run and short run stable relationship among the variables included in both model. The findings show a significant negative relationship between per capita health expenditure in Nigeria and health outcomes (U5MR and IMR).

On the other hand, there are studies that confirmed that there is no sstatistical relationship between public health spending and under-five mortality for example in a study of phillipines by Roperto Jr and Tiany (2014) on public health expenditures, income and health outcome in phillipines supported the findings of Kaushalend Kumar et.al (2013). The study eployed vecto autoregressive VAR analysis and Granger causality test. Per capita healthexpenditure was regressed against the following explanatory variables; GDP percapita, infant mortality, under-five mortality and life expectancy. The result from the study is categorized in to two. First, the result revealed that health expenditure per capita increases growth rate and GDP with decrease in IMR, U5MR and increased life expectancy. Secondly, VAR results revealed that the past values of public health expenditure has no effect on U5M but affects infant mortality rate. Similarly, Bokhari et.al (2006) investigated Government health expenditures and health outcomes in developing countries. Per capita government health expenditure was used as a dependent variable. The explanatory variables include U5MR, maternal mortality rate, per capita GDP, education expenditures, sanitation, roads and per capita donor funding. Estimation technique employed was GMM and 2SLS. The finding revealed no statistical significant relationship between government health expenditure and health outcomes.

2.3.3 Public Health Spending and Mortality Related to Malaria

Few studies exist on the relationship between public health expenditure and malaria mortality in Nigeria. Some of the studies report negative relationship between public health expenditure and some report insignificant or no relationship. Among studies who revealed negative relationship between public health expenditure and malaria mortality using OLS techniq are Bello (2005), Yoko and Rifat (2010), Thomas P. (2013), Sede (2015) and

Mosonmula and Udodo (2016) .Bello (2005) in a study reducing the impact of malaria in Nigeria: A public expenditure conundrum. He focused on malaria specific mortality in Nigeria. Variables included in the model are public health spending, per capita income, non-public health expenditure and political instability. An OLS estimation technique was employed to test the model. The result from the study revealed negative relationship between death from malaria and public health expenditure. The study concludes that to reduce death from malaria, government should increase its health expenditure. However, the study did not focused on a particular group of population like under-five children or adult thereby making it difficult for policy recommendation

Corroborating the above finding Yoko and Rifat (2010) studied the Effect of Investment in Malaria Control on Child Mortality in Sub-Saharan Africa between 2002–2008. The objective of the study was to examine the impact of international financing of malaria control on under-five mortality in sub-Saharan Africa. Variables used in the study include under-five mortality, ITN/IRS coverage, service delivery, investment and child health. The method applied was combined multiple data sources, using panel data regression analysis to study the relationship among investment, service delivery/intervention coverage, and impact on child health by observing changes in 34 sub-Saharan African countries over 2002–2008. They used Lives Saved Tool to estimate the number of lives saved from coverage increase of insecticide-treated nets (ITNs) indoor residual spraying (IRS). Findings revealed that the Impact of ITN/IRS coverage on under-five mortality was significant among major child health interventions such as immunization showing that 10% increase in households with ITN/IRS would reduce 1.5 [95%CI: 0.3–2.8] child deaths per 1000 live births. The major departure of this study from Bello (2005) is the use of international financing without the use of data on government health financing which may not account for full effect of its impact on under-five mortality.

Other studies linking interventions to mortality is that of Thomas (2012) who carried out a study on estimates of child deaths prevented from malaria prevention scale-up in Africa 2001-2010. Objective was to to quantify the likely impact that malaria prevention intervention scale-up has had on malaria mortality over the past decade (2001-2010) across 43 malaria endemic countries in sub-Saharan African. Variables used in the study includes; child deaths prevented as dependent variable while the independent variables were the number of child deaths by cause projected to occur in each year (including population growth parameters over time); the protective effect (PE) on cause-specific mortality (PE = 1-relative risk 100) for each intervention being scaled-up; and increases in population coverage of each intervention. Method used was The Lives Saved Tool (LiST) model. Findings revealed that malaria prevention intervention scale-up over the past decade has prevented 842,800 (uncertainty: 562,800-1,364,645) child deaths due to malaria across 43 malaria endemic countries in Africa, compared to a baseline of the year 2000. Over the entire decade, this represents an 8.2% decrease in the number of malaria-caused child deaths that would have occurred over this period had malaria prevention coverage remained unchanged since 2000. The result though robust and in consistent with Yoko and Rifat (2010) did not considered the joint impact of both private and public health expenditure in reducing infant and under-five mortality.

The above finding was corroborated by Sandra et al (2013) where they examined Child mortality patterns in rural Tanzania: an observational study on the impact of malaria control interventions by government. The period considered was from January 1997 to December

2009. The objective of the study was to estimate the contribution of these interventions to observed decreases in child mortality. Employing a time series analysis of child mortality rates and explored the contribution of rainfall and household food security. Using Poisson regression with linear and segmented effects to explore the impact of malaria control interventions on mortality. The variables employed were child mortality, ITNs ownership, food security, nutrition, environmental and socioeconomic factors. Results shows that child mortality rates decreased by 42.5% from 14.6 c/1000py in 1997 to 8.4 c/1000py in 2009. Analyses revealed the complexity of child mortality patterns and a strong association with rainfall and food security. All malaria control interventions by government were associated with decreases in child mortality, accounting for the effect of rainfall and food security.

Nwanosike (2014) looking at Nigeria also conducted study on Nexus between health spending and malaria reduction. Using public health expenditure as a dependent variable and other control variables includes, malaria cases as variable of interest. Employing cointegration, the study concludes that public health spending significantly reduce malaria cases in Nigeria. similarly, Nwanosike (2015) examined malaria prevalence and health outcome in Nigeria for a period spanning from 1990-2014. Using OLS, they considered the impact of government health expenditure, per capita income, literacy rate, malaria cases on under-five mortality. The study revealed that government expenditure impact positively on under-five mortality. Hence, the study suggest that if greater resources are available for malaria control, a high health outcome through successful malaria reduction will be recorded before the end of 2015 in Nigeria.

Similarly, Nwanosike et.al (2015) corroborates the findings by Nwanosike (2014) where they conducted a study on progressive health spending and health outcome in Nigeria: the case of malaria for the period of 1970-2013. Variables of interest in the study include malaria spending proxy by public health spending, education spending, literacy rate and per capita income. The study employs OLS and cointegration to find out the effects of these variables on under-five mortality. Finding from the studies revealed that health expenditure and educational expenditure are major means government spends on malaria incidence in terms of providing essential infrastructural services and that malaria mortality decrease as more resources are spent by government.

In a related study, Sede (2015) looked at Government Health Expenditure and Malaria in Nigeria for the period spanning from 1990 to 2013. Variables of interest in the study include government recurrent expenditures on health sector, per capita income and malaria cases reported while the dependent variable is Malaria death. Using cointegration and error correction mechanism result indicated that Government health expenditure is significant in reducing malaria deaths in Nigeria. The coefficient of malaria case (prevalence) is found to be highly significant in explaining malaria deaths in Nigeria, while that of per capita income is not significant. Similarly, Mosunmola and Udodo (2016) investigated public health expenditure on malaria morbidity and mortality in Nigeria from 1990 to 2014 using correlation and regression analysis. They regressed government health expenditure against malaria index, non-health expenditure and health GDP. The result revealed that the relationship between government spending and malaria case and mortality were positive. Suggesting that increase in government spending does decrease malaria mortality.

The findings above were contested in a study by Olalekan and Nuradeen (2013) where they conducted a study on impact of health spending on malaria reduction in Asa local government area of Kwara state of Nigeria. The study employed logit regression, and using

Public health spending as a dependent variable and number of nurses, physicians, out of pocket expenditure as independent variable. The result revealed that public health spending does not reduce malaria in the study area.

2.3.4 Determinants of Public Health Expenditure

Public health expenditure is key to economic growth and development of any country. Globally, public health expenditure has bee given recognition. This has spurs a lot research to invstigate causes or factors determining the size of public health expenditure. Studies have revealed that factors such as environmental quality, population density, real gross domestic product, number of hospitals, malaria cases reported determines public helath expenditure for example, Abedmadher (2010), George at.el (2013), Folaham and Awe (2014) and Ilori (2015).

Employing ARDL model, Taudihir (2008), in a study on determinant of public health expenditure: some evidence from Indian states between the periods 1971 to 1991. Employing the following explanatory variables such as RGDPC, literacy rate, physician density, population over 60 years of age and population of people per primary health care. The result revealed that RGDPC, literacy rate determines public health expenditure while population over 60 years of age, population of doctors per primary health care was not statistically significant in determining public health expenditure. Employing the same method (ARDL) Huabouni and Abednnadher (2010) examine the determinants of health expenditures in Tunisia during the period 1961-2008, using the Autoregressive Distributed Lag (ARDL) approach. The results of the bounds test show that there is a stable long-run relationship between per capita health expenditure, GDP, population ageing, medical density and environmental quality. In fact, on the one hand there are the short-run and long-run results which reveal that health care is a necessity, not a luxury good. On the other hand, results of the causality test show that there is a bi-directional causal flow from health expenditures to health outcomes, both in the short and in the long run.

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Folahan and Awe (2014) in a study an Assessment of Health Expenditure Determinants in Nigeria for a period spanning from 1976-2010 consider the following variables Health expenditure, Number of physicians, number of nurses, number of hospitals, reported cases of Malaria, HIV AIDS, tuberculosis, population and the GDP. Employing cointegration and error correction mechanism the result showed that number of physicians, number of nurses, and number of hospitals have a long run positive relationship with health expenditure in Nigeria. Their effects are also significant showing that they are important determinants of health expenditure in Nigeria. However, cases of various diseases such as Malaria, HIV AIDS, and tuberculosis did not have a significant long run relationship with health expenditure.

Investigating the determinant of health expenditure in Nigeria between 1990 to 2008. Employing regression analysis. Kehinde and Abayomi (2010) consider government health expenditure as the independent variable while GDPC, population rate and literacy rate as independent variables, the study confirmed that GDPC is more important in determining public health expenditure.

Similarly employing OLS, ARDL model and Engle-Granger in modeling determinant of health expenditure in Malaysia between 1990 -2014 Khan, Razali and Shatie (2016) observed that when real percapita health expenditure is dependent on GDP, life expectanchy at birth, population age at 65 and population growth. Only income and population growth were identified as the significant factors contributing to variation in public health spending.

Again, Omitogon and Olawunmi (2014) examined determinant of public health expenditure in Nigeria for period between 1990-2012 employing regression analyses. They regressed RGDP, population, government development policy, unemployment, consumer price index and political instability against public health spending. Result from the revealed that RGDP (income) and government policy development significantly contributes to factors explaining variation or change in public health expenditure. While, unemployment, and political instability exhibits negative relationship with public health expenditure.

Using independent variables such as time trend, income, number of physician and public health spending as independent variable with regression analysis to investigate the determinant of public health expenditures between Canada and Spain for the period spanning through 1981-2013 (Canada) and 2002-2013 (Spain) Liviodi and David (2018) found that time trend, income and number of physician are driver of public health expenditure between the two countries. However, the study found that number of physician does not drive public health expenditure in Spain.

Faisal and Ulrich (2011) examined determinant of public health expenditure in Pakistan for the period spanning 1972-2006. They employed cointegration and error correction model (ECM). In their model public health spending is the dependent variable while income, urbanization and unemployment are the explanatory variables. Finding from the study shows that unemployment and urbanization and income explained the variation in public health expenditure in Pakistan.

Similarly, cointegration and ECM was employed to investigate determinants of public health care expenditure in Nigeria between the period of 1986-2010 by Maughele and Ismaila (2013) . the variables of interest in the study includes children below the age of 14, development policy, GDPC, unemployment, physician density and consumer price index and public health expenditure is the dependent variable. The study found that children under the age of 14 and development policy are significant in determining government health expenditure while physician density, unemployment and political instability were found insignificant in explaining the variation in government health expenditure. This result concurred with the findings of Omitogun and Olawunmi (2014). However, the method of analysis employed by them differs.

In a similar study Ilori (2015) employed ECM to examine the determinants of public health expenditure in Nigeria between 1981-2014. The study considered the following as independent variables; population, tuberculosis, sickle cell, anemia, HIV/AIDS and income. Results revealed only population, unemployment and tuberculosis as major determinant of public health expenditure in Nigeria while HIV/AIDS, income sickle cell and anemia were insignificant in determining variation in public health expenditure.

In a cross country studies, Alihussain and Enayatollah (2015) examined determinant of health expenditure in ECOWAS countries using panel co-integration test. The study examined how GDPC, population below 15 years of age and above 65 years of age, number of doctors and urbanization influence the variation in health expenditure. Findings from the study revealed the existence of long run relationship between all the variables and public health expenditure except children below 14 years of age and people aged above 65. This result contradicts Maughele and Ismaila (2013) who found that children below 15 years of age explain variation in government health expenditure.

2.3.5 Determinants of Under-five Mortality

A substantial body of empirical evidence exists on the determinants of child health and mortality in developing countries. Majority of the study concurred that government health expenditure, female literacy, female labour force participation as determinants of under-five mortality. examples of such studies includes, Gbesemete and Jonsson (1993), Yushum (2014), Ramesh and Sam (2007), Adepoju et.al (2010), Oleche (2011) and Riatu and Junaid (2017). In examining the some determinants of under-five mortality, Gbesemete and Jonsson (1993) using data of 28 low and middle income African countries analyzed social, economic, demographic, environmental and political factors. The finding from the study revealed that female literacy, health spending and urbanization are negatively related to infant mortality rate (IMR). Urbanization variable implies that a more urban country has less chances of infant mortality (IMR). The study did not include lack of access to health facilities in the rural areas as one of the factors determining under-five mortality. In a similar cross country studies, using panel data with fixed effect (FE) and random effect (RE) models for 25 OECD countries, Ramesh and Sam (2007) look at the economic, institutional, and social determinants of health outcomes. Parameter estimates of health employment variables are strongly significant for life expectancy and IMR with FE and RE. This indicates that increasing spending on health, employment and personnel will definitely increase access to health care and help in improving life expectancy and reducing mortality. The study revealed that most important factor affecting IMR includes physician supply, followed by immunization. The study failed to consider income level and female literacy as factors affecting under-five mortality in OECD countries.

Mturi and Curtis (1995) analyzed the socio-economic determinants of IMR and Child mortality using 1991/92 demographic and Health survey (DHS) data from Tanzania using hazard model. Factors considered in the model include both demographic and biological factors such as mother's education, father's education, immunization. Findings revealed that all the variables considered are insignificant in explaining infant and child mortality rate in Tanzania. In a related study, Imam and Koch (2004) conducted a study on the determinant of infant, child and maternal mortality in SSA countries for a period spanning from 1999-2003. They employed OLS to estimate GDP per capita, adult HIV/AIDS infection rate, health care, immunization rate against DPT, female labour force participation, the female literacy rate and prevalence of war on infant, child and maternal mortality. The result from the study shows a significant and negative relationship between infant, child and maternal mortality and all the explanatory variables except female labour force participation is not correlated to infant mortality. The weakness of these studies is that it did not consider government health and private health expenditure as determinant of infant, child and maternal mortality.

In a related study, Uddin et.al (2009) innvestigated determinanats of child mortality in Bangladesh. The study employed logistic regression. Results showed that father's education, occupation of father, occupation of mother, standard of living index, breastfeeding status and birth order were significant determinants of child mortality in Bangladesh. Similarly, in a related study at same year and on same country, Mondal *et al.* (2009) using the logistic regression model, investigated factors influencing infant and child mortality in Rajshahi District of Bangladesh. Both finding revealed that the most significant predictors of neonatal, post-neonatal and child mortality levels are immunization, ever breastfeeding, mother's age at birth and birth interval. The two studies employ similar method and have similar findings. However, the two studies failed to mentioned environmental quality and household's health behavior in influencing child mortality.

Kamla-Raj (2009) studied Factors Influencing Infant and Child Mortality: A Case Study of Rajshahi District, Bangladesh. The objective of the study is to observe the influencing factors on infant and child mortality of suburban and rural areas of Rajshahi District, Bangladesh. A multivariate technique is employed to investigate the effects of those variables both socioeconomic and demographic on infant and child mort ality. The study results reveal that several socioeconomic, demographic and health related variables affects infant and child mortality. The variables used in the study include; immunization, ever breastfeeding, mother's age at birth, birth interval, toilet facilities, parent occupation and treatment places. Though the study have similar findings with Uddin et al. (2009) and Mondal (2009), the differences lies in methodology while the two study employed logistic regression Kamla-Raj employed multivariate regression, secondly, Kamla-Raj uses both suburban and rural area in his study.

In a similar vein, Chowdhury *et al.* (2010) examined the effects of demographic characteristics on neonatal, post neonatal, infant and child mortality also using the logistic regression model. They identified the important predictors of neonatal mortality as breast feeding practice, of post neonatal period as duration of marriage; order of birth and birth interval and of infant and child mortality as age at marriage, duration of marriage, birth interval, birth order and breast feeding practice. The study is not age specific and diseases specific in identifying the causes of mortality among children aged 1-5

Adepoju A.O et al (2010) in a study examined the determinants of child mortality in rural Nigeria employing the 2008 Nigeria Demographic and Health Survey (NDHS) data. Data were analyzed using Descriptive Statistics and the Logit regression model. The result of analysis showed that while the average age of the respondents at first birth is 19 years, more than half of them had no formal education and about three-fifths had less than 24 months birth interval. Secondary and higher education of mother, age of mother at first birth, place of delivery, type of birth, child ever breastfed, sex of child, were among the significant factors influencing child mortality in rural Nigeria. They conclude that maternal education, access to adequate health care (especially for pregnant women and children under five years) and increased awareness of benefits of breastfeeding were identified as the key factors to reducing child mortality in rural Nigeria. In a related study Abinbola, Adepoju, Akanmi and Falusi (2012) examined determinants of child mortality in Nigeria between 1990 to 2010. Employing logic regression model where they regressed child mortality against maternal education, access to health care and breast feeding, the findings from the study shows that maternal education and access to health care facility were fund to be more significant in determining child mortality. both studies recognizes education of both parents as a key factor in reducing child mortality

Oleche (2011) estimated the effect of out of pocket health expenditure on mortality level in Kenya. The study used the household expenditure and utilization survey data of 2007.The study estimated a linear probability equation and a probit model of child health. The major findings of the study were that a percentage increase in out of pocket expenditure in health is associated with a decrease in mortality level by 0.16 percent. Also, a full subsidy on user charges per visit or on the health inputs used to produce health services decreases mortality level by 0.51 percent. The result though robust did not recognized the impact of public health expenditure which very important in reducing under five-mortality in African or developing countries. The study employed small sample (30 observations) such that with several explanatory variables few degrees of freedom are available for statistical inferences. The study does not also look at the time series properties of the data. Thus the likelihood of estimation results becoming spurious cannot be avoided. Unobserved heterogeneity in time series studies are not generally control for.

Kayode et al (2012) carried out a study on risk factors and a predictive model for under five mortality in Nigeria. The objective was to develop a predictive model and identify maternal, child, family and other risk factors associated with under five mortality in Nigeria. Using the following variables, under five mortality, maternal education, maternal occupation, marital status and maternal age. Employing Multivariable logistic regression method, result shows that Maternal, child, family and other factors were important risk factor of under five mortality in Nigeria. Similarly, Iyywomi and Donald Ikenna (2013) empirically investigate infant and child mortality in Nigeria using impact analysis. The objective is to ascertain the influencing factor on infant and child mortality in Nigeria. Variables used were Education attainment of the mother, place of delivery, women status in respecting decision in the house (Final say a mother health care, final say in making large h/h purchase final say on visits to family or relative, final say on deciding what to do with money husband earns). And the Dependent Variable were Infant and child mortality. The Simple regression estimation technique was employed. Findings revealed positive linear association between infant and child mortality and each of the variables serving as indicator for women status. However place of delivery play a crucial role in infant mortality while higher educational level has a positive impact on infant and child mortality. The variables used in this study differs from previous studies. Very interesting variable was who is having a final say on how the husband spends his money. This implies that women who control their husband may influence child mortality.

Bello and Joseph (2014) empirically investigated some important determinant of infant and child mortality in Oyo. Infant and child mortality as the independent variables while the regressors includes poverty, malaria, postnatal care, Health scheme and breast feeding; HIV . employing Linear regression using binary logic, finding revealed that out of the major determinant of infant and child mortality are poverty, malaria, postnatal care, health scheme and breast feeding are the major determinant of infant and child mortality. A finding from this study is different from previous studies in the sense that the study was diseases specific (malaria) but not age specific.

Sunday and Clifford (2014) under take a study on under-five mortality in Nigeria: effects of neighborhood context with the objective of examining the effects of neighborhood context on under-five mortality in Nigeria. Employing multilevel Cox regression analysis. Result indicates that established region of residence, place of residence, ethnic diversity, neighborhood, and infrastructure and community context as important determinant of under 5 mortality in Nigeria. Finding further showed that being born or raised in poor neighborhood, rural communities and North Eastern region was associated with elevated hazard of death before age of five. This study clearly revealed that children raised at poor home are more likely to die before reaching the age of five

The study recommends Policies to achieve under 5 mortality reduction in Nigeria which must evolved community level interventions aimed at improving child survival in the deprived neighborhoods. Variable used are Child mortality which was regressed against Maternal age, child sex, birth order, birth interval, child size at birth, parental care, contraceptive use, place of delivery and maternal education. Other variable which influence child survival includes, family structure, children ever born and wealth index. Community Level Variables are region of residence ethnic diversity, distance to health facility, community maternal level of education community infrastructure, community prenatal care, community poverty and community hospital delivery.

Quinhas (2014) also investigated effect of health system strengthening on under-five and infant and neonatal mortality in Mozambique for a period of eleven years (2000-2010). Explanatory variable included in the model includes health work force density, maternal and child health nurse density, higher population by health facility and public financing per head. The study employed binomial mixed model. Result shows that under-five mortality have significant negative relationship with all the explanatory variables. The weakness of the study is that it did not consider socio-economic factors in determining child mortality and it did not specify the type of diseases mostly responsible for under-five mortality. in a related study, Anja (2015) studied health insurance and child mortality in rural Burkina Faso from 2000-2010. Using Cox regression, he estimated under-five mortality rates with the following explanatory variables; socio-economic status, father's education distance to the health facility, year of birth and insurance status of the mother at the time of birth. Finding from the study revealed that under-five mortality is negatively related to all the explanatory variables. Therefore, health insurance is significantly related to under-five mortality in rural Burkina Faso.

In a study conducted by Riayati and Junaid (2016) between 1984-2009, examined public health expenditure, governance and health outcome in Malaysia. The study employed autoregressive distributed lag (ARDL) cointergration to test for the relationship between under-five mortality and infant mortality and public health expenditure, income level, corruption and government stability. The results based on the bounds testing procedure shows that a stable long run relationship exist between health outcome and there determinants namely, income level, public health expenditure, corruption and government stability. The result also shows that public health expenditure and corruption affect long and short run health outcomes in Malaysia. This study includes variables not fond in previous studies for example corruption and stability of government. These variables are very relevant in explaining child mortality especially in developing country where corruption and political instabilities are still major issues.

In conclusion, in all the literature reviewed, majority employed logistic regression in estimation except for Riatu and Junaid (2016) who employed ARDL. However, finding from the studies reviewed revealed that father and mother education, income, access to health care facility and quality of governance are very important variable in determining under-five mortality. However, most studies except for Riati and Junaid omitted government expenditure in explaining under-five mortality especially in developing countries were majority are living below poverty line.Secondly, all work reviewed ignored two important variable in determining child mortality which female labor force participation and household's health behavior especially in this part of the world were culture and religion influence most of our action

2.3.6 Limitations of the Previous Studies and Gap

From the literature reviewed, findings from cross country studies shows that government health expenditure has significant impact on under-five mortality. Furthermore, literature reviewed (specific country studies) on impact of government health expenditure on malaria mortality shows the significant of government health expenditure on reduction of malaria morbidity and mortality. However, literature reviewed on government health expenditure and U5M were not diseases specific. On the other hand, studies on government health expenditure and malaria mortality were not age specific. Hence, Therefore, this study contributes to the debate by exploring the effect of variation in public health spending in Nigeria on under-five malaria specific mortality. The work is different from other studies in the sense it focus on malaria specific mortality and not general cause of under-five mortality. Because child mortality disaggregated by cause of death allows more precise conclusions as to the cause and effect of the determinants of under-five mortality. A situation where overall child mortality aggregates all causes thus, partially confounds our understanding of why mortality is high amoung the children of less than five years of age in the country.

Secondly, studies on determinant of under-fove mortality were rubost though the studies omitted an important variable like household's behaviour which is central to determinants of under-five malaria mortality in Nigeria. This variable is very important in discussing under-five mortality especiall in a country like Nigeria were culture and religion determines our behavior. Hence, this study will contribute to the debate by including household's behavior as determinants of U5M in Nigeria.

From the literature on determinanats of public health expenditure, malaria cases were not considered as a determinanant of public health spending. Hence, this study considers this variable important in determining the puclic health spending in Nigeria.

On methodology, majority of the study were found to apply OLS, estimation techniques for instance Yakub et.al (2013), Daniel and Subramanian (2014), Yushum (2014) Micheal and Ramu (2015), Innocent and O'Hare (2015), Nwano et.al (2015), Latitagauri (2016), Khan and Shatie (2016), and Craig and Hristos (2016). However, this strand of studies that uses OLS is likely to be faulty because of the stochastic nature of underlining data which could be non-stationary. This category of data will evidently fail the OLS estimation because of their lack of non-stationary at levels which require at either 1st or 2nd differencing. Imposition of OLS technique will render the result spurious and will violate the basic assumptions of non-correlation between the residuals and the regressors. Similarly, others studies who adopted logit regression like Kayode and Joseph (2012), Olalekan and Nurudeen (2013), Sunday and Clifford (2014), Bello and Joseph (2014) and Aeron (2016) are restricted to binary response which is not in line with properties of the data. In similar vein others who employed Vector error correction model (VECM) for example Faisal and Ulrich (2011), Maughele and Ismaila (2013), Okeke (2014), Sede (2015) and Ilori (2015) are suspected to have violated the requirement of the 1st order of integration in the series in line with Sims (1981)

Thus, the modified VAR estimation techniques in the spirit of Toda and Yamamota (1995) and Bello and Sanusi (2018) could provide more suitable estimation techniques that can accommodate mix order of integration for a non-stationary series or data.

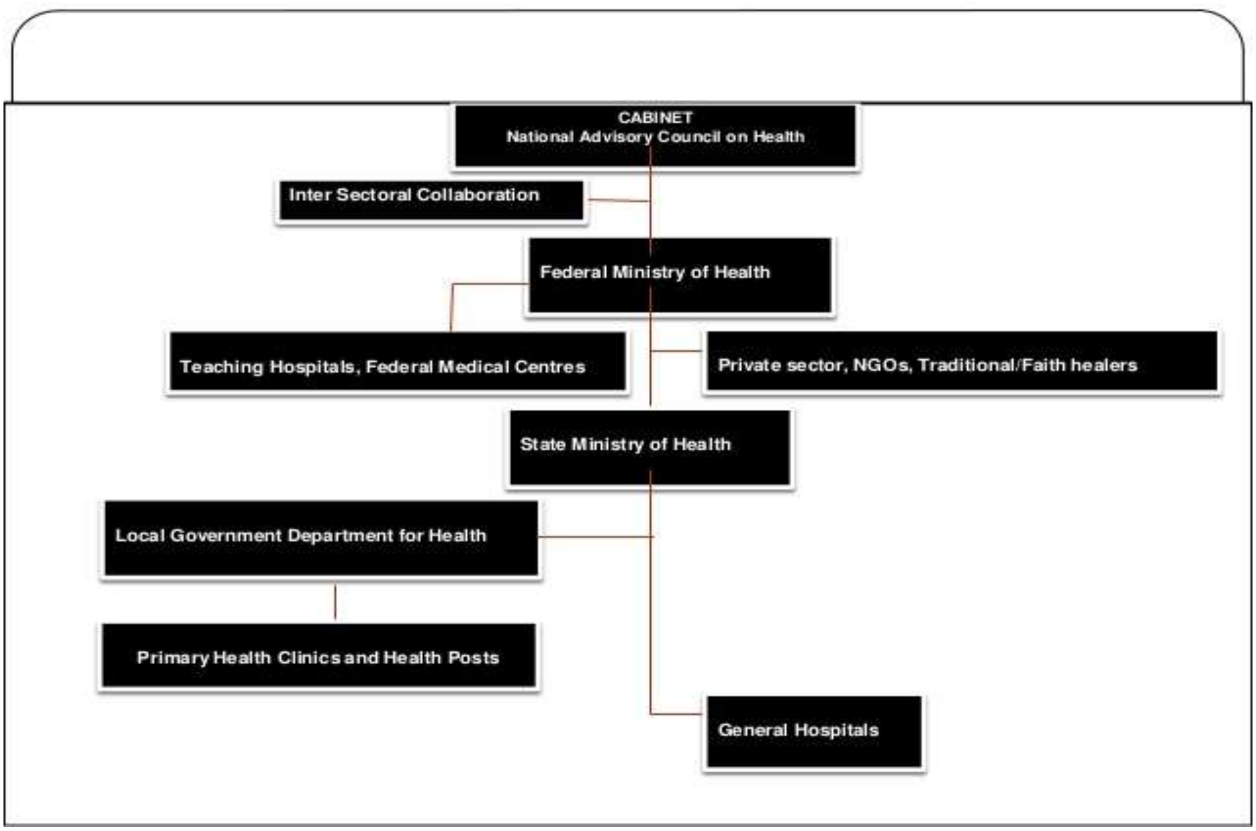
SECTION B

2.4 Structure of Nigeria's Health System

The nigeria's health system is structured in to Federal, State and Local government with each tier having it own responsibilities for providing health services and programmes in Nigeria. The Federal Government is largely responsible for providing policy guidance, planning and technical assistance, coordinating state-level implementation of the National Health Policy and establishing health management information systems. In addition, the Federal government is responsible for disease surveillance, drug regulation, vaccine management and training health professionals. The Federal Government is also responsible for the management of teaching, psychiatric and orthopaedic hospitals and also runs some medical centres (FMoH, 2010)

The responsibility for management of health facilities and programmes is shared by the State Ministries of Health, State Hospital Management Boards, and the Local Government Areas (LGAs). The states operate the secondary health facilities (general hospitals) and in some cases tertiary hospitals, as well as some primary health care facilities. The training of nurses, midwives, health technicians and the provision of technical assistance to local government health programs and facilities are also the responsibility of the state authorities. The 774 local governments oversee the operations of primary health care facilities within their geographic areas. This includes the provision of basic health services, community health hygiene and sanitation.

Figure 2.1 Organogram of Nigeria's Health System



Source: FMoH

2.5 An Overview of Public Health Expenditure: Health Budget Allocation in Nigeria

Public health expenditure in Nigeria consists of federal, state and local government. The federal government is concerned with expenditure at tertiary level such specialist hospitals, taching hospitals, federal medical centres. State is concerned with the secondary laevel of health expenditures such as general hospitals, state specialist hospitals. The local government take care of health at primary level such as primary health care centers (FMoH, 2010)

2.5.1 Trends in Health Allocation

Over the years between 2010 - 2017, health budget at federal level has oscillated within the range of 3.58% (lowest) in 2010 to 5.58% (highest) in 2011. In between these years, 2011 was 5.8% and it increased marginally to 5.66% in 2012. By 2013 it has dwindled to 5.66% and furher declined to 5.63% in 2014. By 2015 it appreciated marginally to 5.78 and by 2016 it dropped to 4.13%. The percentage allocation to health increased to 5.17 in 2016 and fell again to 4.00 in 2018.

From analysis above, it can be concluded that allocation to health sector at the federal level, relative to budget size continue to decline, falling from a high of 5.58 in 2011 to 4% in 2018 . This trend is inconsistent with Abuja declaration of 2001 which states that 15% of government total allocation should go to health sector. Conversely, the highest percentage allocated to health in Nigerian history was 5.17% in 2017 less than half of Abuja declaration 2001 standard. Furthermore, the national Health Act signed in to law in 2014 stipulate that 1% of consolidated revenue fund be used to finance the act was just implemented in 2018 using only three states (Abia, Niger and Osun) as a pilot study (FMoH, 2018).The following data shows percentage increase and decrease in health budget allaocatio at the federal level.

Table 2.1: Trends in health expenditure in Nigeria (%)

2010	2011	2012	2013	2014	2015	2016	2017	2018
3.58	5.58	5.95	5.66	5.63	5.78	4.13	5.17	4.00

Source: FMoH 2018

When translate in to naira we have the following expenditure in billion as allocated to health

Table2.2: Trends in health expenditure in Nigeria (Nbillions)

2010	2011	2012	2013	2014	2015	2016	2017
164	235.9	282.2	282.5	264.5	259.8	250.1	377.4

Source: FMoH 2018

Table 2.3 Recurrent and Capital Budgetary Allocation to Health in Billions (N)

Year	Capital	Recurrent
2006	38.04	-
2007	51.17	-
2008	49.37	-
2009	50.08	103.8
2010	49.99	111.9
2011	33.53	203.3
2012	57.01	217.8
2013	60.08	215.00
2014	49.52	214.94
2015	22.68	237.08
2016	28.65	221.41
2017	55.61	252.84
2018	71.11	265.00

Source: BudgIT, 2018

From table 2.3 we can observe that recurrent expenditure on has been increasing over the years while that of capital expenditure has been fluctuating. For example 2013 the capital stood at 60.08% growth rate only to nosedive 49.52% in 2014 and further decline to 22.68% and 28.65% in 2015 and 2016 respectively and picked up again to 55.61% to highest of 71.11% in 2017 and 2018 accordingly

2.5.2 Funding Sources of Health Expenditure in Nigeria

The recommended benth mark for out-of-pockect expenditure is 20% while in Nigeria it account for 75%. Government contribution to health spending per individual is N1, 671 instead of N35, 931. Hence government only pays only 4.7% on individual. This clearly explains why the mortality amoung children of less than five years of age are high in Nigeria.

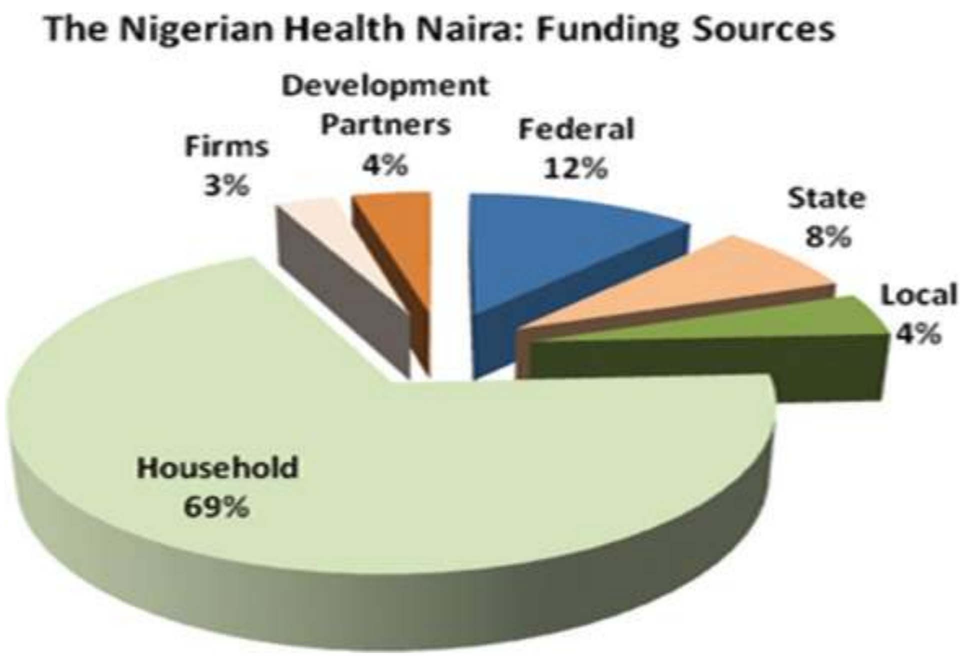


Figure 2.2 : Funding sources in Nigeria. Source: NHA 2003–2005

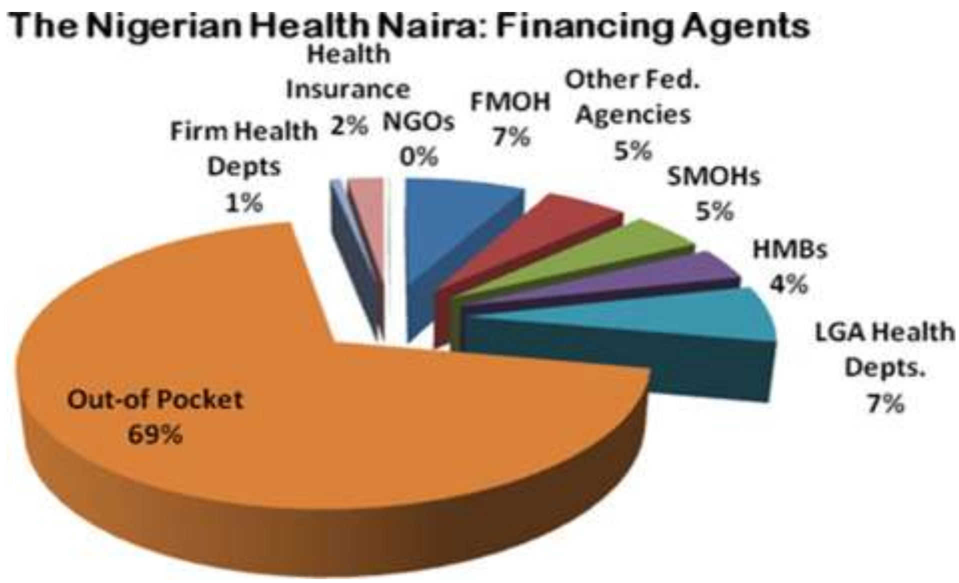


Figure 2.3: Financing agents in Nigeria. Source: NHA 2003–2005

2.6 An Overview of Malaria Programmes in Nigeria

2.6.1 Malaria situation in Nigeria

Malaria is endemic in Nigeria, and remains a major public health problem with year-round transmission. The disease even though it is preventable, treatable, and curable remains an important cause of morbidity and mortality in the country especially amoung children of less than five years of age, and puts 97% of the population at risk NMEP(2010). Along with two other countries, India and Democratic Republic of Congo, Nigeria accounted for over 40% of the estimated total of malaria cases and deaths globally in 2010 (WHO, 2012) in addition, Nigeria accounts for about 29 percent of this burden (MIS, 2015). Moreover, in combination with the Democratic Republic of Congo, Nigeria contributes up to 40 percent of the global burden (World Malaria Report 2014). There are 70-110 million clinical cases of the disease in the country per year. It accounts for about 60% of all outpatient attendances and 30% of all hospital admissions with an annual death of children under 5 years estimated to be around 300,000 caused by malaria (WHO, 2014).

Malaria also exerts a huge social and economic burden on families, communities, and the country at large, causing an annual financial loss of about N146 billion in the country more than any other diseases which is attributable to treatment and prevention costs as well as lost working hours (NMEP, 2013). Malaria places a considerable burden on an already-weakened health system. It makes up about 50% of the total disease burden and total health expenditures in Nigeria, making it a significant public health concern in the country (FMoH, 2013).

2.6.2 National Malaria Policy

The National Malaria Policy, launched in February 2015, expresses the desire and commitment of the government of Nigeria at all levels to ensure the elimination of malaria. The policy was conceived within the context of a malaria-free Nigeria and addresses core issues related to malaria prevention, diagnosis, and treatment; communication and social mobilisation; and regulations regarding antimalarial commodities. Its aim is to provide equitable, comprehensive, cost-effective, efficient, and quality malaria elimination services while ensuring transparency, accountability, client satisfaction, and community ownership and partnership.

2.7 Institutional Framework for Malaria Control Program in Nigeria

Given the malaria prevalence in Nigeria the federal government have introduced some programs to eradicate malaria. A review of some the programmes includes: National

Primary Health Care, Roll Back Malaria Initiatives, Millennium Development Goals, and National Malaria Programme.

2.7.1 National Primary Health Care:

The National Primary Health Care Development Agency (NPHCDA) is a parastatal of Nigeria's Federal Ministry of Health whose mandate is to develop national primary health care (PHC) policy and support states and LGAs to implement them. It was established to Achieve Health for All Nigerians, by the year 2000.The goals of the agency include: controlling preventable diseases, improving access to basic health services, improving quality of care, strengthening of institutions, developing a high- performing and empowered health workforce, strengthening partnerships and engaging communities.

The system was developed and strengthened and this helped to improve some of the health status indicators. Among other things, distribution of Insecticide Treated Nets (ITNs) and availability of Artemisin Therapy (ACTs) to the rural communities had been carried out, as well as routine immunization coverage which had led to reduction in infant and child mortality rates. Unfortunately, this routine immunization was not sustained. There has been a downward trend in health development since 1993 (Federal Ministry of Health (FMoH, 2004). This could be traced to high prevalence of poverty in the rural areas. Hence, there is a need to improve the health of Nigerians not only to break the vicious circle of ill-health, poverty and low level of development but to convert it to the virtuous circle of improved health status, increased well-being and sustainable development (FMoH, 2004).

Apart from this, most of the rural areas do not have access to good health care systems. Usually there are no accessible roads to the health centers, which are often times poorly equipped and have inadequate drugs for malaria treatment. This has led to abandoning of such facilities in some communities and hence self-medications are often carried out at home and at times visiting of traditional healers. Since the majority of rural dwellers lack basic education required to reading and sticking to instructions stipulated, irrational use of antimalarial drugs are often encouraged.

2.7.2 Millennium Development Goals

At the international level, in September 2000 the United Nations Millennium Summit endorsed the Millennium Development Goals (MDGs) in what was called the "Millennium Declaration". The main objective of the Millennium summit was to set quantifiable and times bound global development goals to end human suffering from hungers, destitution and disease mainly in developing countries. Malaria features prominently in the Millennium Development Goals, in which malaria control and prevention capture about six goals (i.e goals 1,2,4,5,6 and 8) out of the eight goals of the MDGs. Therefore, any effort geared at achieving the six goals, will go a long way in preventing and eradicating malaria in rural areas.The major limitation to the achievement of these goals as mentioned under RBM is limited resources to reach out to more than 133 million people residing in the 774 LGAs (about 10,000 wards) of Nigeria, especially in the rural areas.

2.7.3 National Malaria Programme (NMP)

The NMP developed malaria control plan builds on the National Malaria Strategic Plan (NMSP) for Malaria Control in partnership with the RBM Partners, States' Ministries of

Health and other Stakeholders to enable national scale-up of key preventive and curative interventions. This malaria strategic plan addresses national health and development priorities, including the Roll Back Malaria (RBM) Goals and the Millennium Development Goals (MDGs). The plan aims at reducing malaria mortality and morbidity to improve health status, lower health care costs as well as have other socio –economic impact. Malaria control has been incorporated into the existing health care delivery system which is aimed at providing malaria treatment and prevention services as close to the client as possible, both in the rural and urban areas.The National Malaria Control Program (NMCP) has delivered about 17 million ITNs during 2005-2007 (6.6 million Long Lasting Insecticidal Nets), and about 4.5 million single dose packages of ACT in 2006 and 9 million in 2007 to both rural and urban areas. Despite these efforts of NMCP, the available resources are not sufficient to reach national targets for prevention and cure. This has reduced the effectiveness of the programme.

2.7.4 Roll Back Malaria

Roll back malaria Initiative: Established on the 9th of December, 1998 by several international organizations. The Roll Back Malaria (RBM) Initiative was meant to provide a coordinated approach to fighting malaria. (RBM:2010). Four central features stood RBM initiative from previous attempts; first, RBM places more emphasis on control rather than eradication. Second, unlike the previous attempts that were mainly targeted to the Americas, Asia, Europe and Eat Africa RBM embraces all countries of the world but the major focus was on sub-Saharan Africa. Third, it follows a horizontal approached and encourages the strengthening of local capacities and health system so that malaria can be dealt with through prevention adapted to local needs. And fourth, RBM Initiative is a global partnership between development agencies, banks, the private sector, NGOs, foundations and a network of researchers. (Utzinger: 2001)

Over the years this partnership have conversed support and incorporated partners from both malaria-endemic and non-endemic areas- multilateral' development organizations, the private sector, NGOs, foundations, and research and academia- all in a common global effort to end malaria. The passion to end malaria infection led to an ambitious declaration by African Heads of state during a summit in Abuja, Nigeria, in the year 2000. The ambitious declaration commonly known as 'the Abuja Declaration' majorly emphasized on the items of the RBM initiative of 1998 and made historic commitments to reduce drastically the burden of malaria. As a result of the declaration the periods 2001- 2010 was tagged "The Period to Roll Back Malaria" by the United Nations Assembly.

Both prevention and treatment strategies were considered as means toward achieving the goals of the RBM initiatives. The elements of the prevention strategy included the use of ITNs (Insecticides Treated Nets), IRS (Indoor Residual Spraying) and intermittent preventive treatment during pregnancy and for young children (prophylaxis). For treatment there was prompt case detection effective management. In 2008 the malaria community adopted the RBM's Global Malaria Action Plan (GMAP) as a guide for malaria control and elimination for the following years. GMAP elaborated global and regional strategies for fighting malaria and quantified the resources needed to halve the malaria burden by 2010, achieve the MDGs for malaria by 2015 and move towards elimination (coll-seck: 2009)

2.8 Strategic Direction for Malaria Control

The Malaria Control Programme was established in 1948 as Nigeria Malaria Services, basically for research purposes. It was later incorporated into the Department of Primary Health and Disease Control (now the Department of Public Health) in 1986 as the National Malaria and Vector Control Division. To reflect the country's vision of a malaria-free Nigeria, the National Malaria Control Programme was renamed the National Malaria Elimination Programme (NMEP) in 2013. Over the years, Nigeria has implemented three National Malaria Strategic Plans (NMSPs) and is currently in the midst of a fourth plan, as follows:

• **2001-2005:** Developed after the African Summit on Roll Back Malaria to build partnerships and garner political will

• **2006-2010:** Addressed vulnerable populations (pregnant women, children less than age 5, people living with HIV/AIDS) as primary target groups for interventions

• **2009-2013:** Provided a road map for malaria control in Nigeria, focusing on universal and equitable access and rapid scale up of a package of core interventions

• **2014-2020:** Aims to achieve pre-elimination status (less than 5,000 cases per 100,000 persons) and reduce malaria-related deaths to zero by 2020

The followings are the seven strategic objectives to be achieved by 2020 in the 2014 – 2020 strategic plans.To ensure that all persons with suspected malaria who seek care are tested with RDT or microscopy by 2020

1. All persons with confirmed malaria seen in private or public health facilities receive prompt treatment with an effective anti-malarial drug by 2020
2. At least 80% of the population practice appropriate malaria prevention and management by 2020
3. To ensure the timely availability of appropriate antimalarial medicines and commodities required for prevention, diagnosis and treatment of malaria in Nigeria by 2018
4. All health facilities report on key malaria indicators routinely by 2020
5. To strengthen governance and coordination of all stakeholders for effective program implementation towards an A' rating by 2020 on a standardized scorecard.

2.9 The core intervention strategies of malaria eliminations

2.9.1 Malaria Prevention

Distribution of the Long Lasting Insecticidal Nets (LLINs) through mass campaign and mobilization is one of the key strategies for the prevention of malaria in the country.The objective of this intervention is to ensure that 50% of pregnant women attending ANC in both public and private health facility receive LLINs, 20% of pregnant women attending ANC in both public and private health facilities receive at least 3 doses of SP for IPT

2.9.2Malaria Diagnosis

Diagnosing malaria through Rapid Diagnostic Test (RDT) or microscopy in all health facilities. To ensure that all persons with suspected malaria who seek care are tested with RDT or microscopy by 2020. This strategy is expected to scale up parasitological confirmation of fever cases from 48.38% to 60%, ensuring quality assurance/quality control (QA/QC) procedures are carried out in 40% of secondary health facilities.

2.9.3 Malaria Treatment

This strategy ensures that all persons with confirmed malaria seen in private or public health facilities receive prompt treatment with an effective anti-malarial drug by 2020. Hence, the objective of this strategy is to ensure that 100% of all confirmed cases of uncomplicated malaria are treated according to the national guidelines, ensuring that 50% of all confirmed cases of severe malaria are treated according to the national guidelines and to ensure that 60% of public, and private (HF) are provided with updated national treatment guideline

2.9.4 Advocacy, Communication and Social Mobilization

Activities are centered on massive scale-up of demand creation through radio jingles, production and distribution of 7,000 information, education and communication (IEC)/behavior change communication (BCC) materials, distribution of 1,397 textbook for primary school pupils and secondary school students, 190 IEC/BCC materials which include, T-shirts, fez caps and hijabs as well as road shows, sensitization meetings, quiz competition among primary school and press briefing to mark annual malaria day.

This strategy seek to mold the behavior of the household's health behavior towards malaria elimination, therefore the main objective of this strategy is to ensure at least 80% of the population practice appropriate malaria prevention and management by 2020. Other specific objectives includesholding quarterly coordination meeting of ACSM core group and conduct advocacy visits to 10 major stakeholders at the State level on the release of funds for malaria activities, step up community-based awareness of malaria elimination practices by increasing the number of wards in which CBOs are involved in malaria activities from 65% to 100% and to air 112 slots of radio jingles per week in English and other languages existing in the state on malaria elimination activities.

2.9.5 Procurement and Supply Management

The strategic objective of this activity is to ensure the timely availability of appropriate anti-malarial medicines and commodities required for prevention, diagnosis and treatment of malaria in Nigeria by 2018. Other specific objectives are to make LLINs available for routine distribution to 50% of health facilities, make SPs available to 10% of health facilities for pregnant women, ensure availability of RDT kits in 80% of health facilities (public and private) and microscopes and microscopy materials in three public facilities in each state, increase availability of ACTs to 50%of health facilities for ALL confirmed malaria cases and train 167 health facility staff in use of LMIS tools in each LGAs across the country, increase access to treatments for severe malaria in all 20 secondary health facilities and 2 tertiary health facilities in the each state of the federation.

2.9.6 Monitoring and Evaluation of Malaria

The aim of monitoring and evaluation is to strengthen routine data generation and flow from public/private facilities and community-based health providers for the National Health management information system (NHMIS), strengthen routine monitoring & supervision and strengthen Data Quality Assurance (DQA) at all levels of reporting. This will monitor deviation from the objectives and standard and take corrective measures.

2.9.7 **Programme Management**

The Strategic Objective of programme management is to strengthen governance and coordination of all stakeholders for effective program implementation towards an A' rating by 2020 on a standardized scorecard. Other specific objectives includes; strengthening Malaria Elimination programme (MEP) coordination at the State and LGAs through quarterly meeting of TWG, monthly meeting of SMEP with LGA MFPs and review the 2015 AOP for malaria programme biannually, develop that of 2016 and support LGAs to develop their 2016 annual work plan for malaria, implement planned ISS/OJCB visits to all Secondary Health Care facilities, improve the programme management capacity of health workers in both public and private facilities in the State through training and retraining

With the interventions highlighted above and many more not mentioned in this review one will expect a drastic reduction in the incidences of malaria in Nigeria. However, data have shown that the increase in malaria incidences is directly proportional to increases in malaria control interventions in Nigeria. Although literatures have given some reasons for the relationship it will be wise to investigate more on the effectiveness of the malaria control strategies and policies in Nigeria. This will enable policy makers to identify areas of flows and hence, take measures towards correcting them.

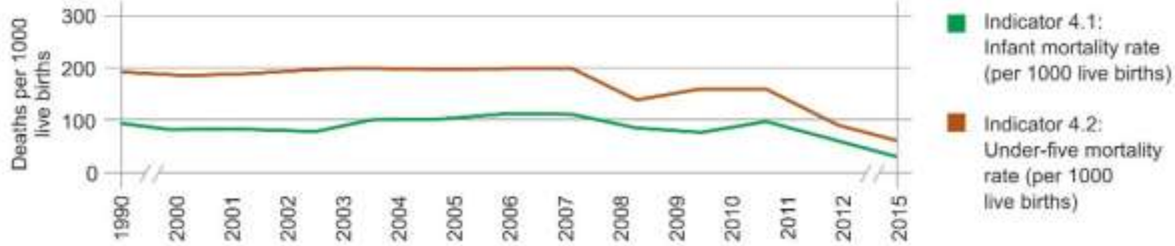
2.10 Trends in Under-five mortality in Nigeria from 1990 to 2015

From figure 2.2 below we observed that under-five mortality has witnessed a marginal decrease from 1990 to 2003 after which it continue to increase up to 2008 and declined again between 2008 to 2010. In 2011 there was again a marginal increase in under-five mortality. however, the period 2011 t0 2015 witnessed a sharp decline in under-five

mortality though, the decline still fail short of 26 death per 1000 live birth recommended in

Abuja declaration 2001.

Figure 2.4 Trends in infant mortality and under-five mortality rates (1990–2015)



Source: NBS (2016)

Table 2.4 Under- Five Morbidity and Mortality In Nigeria

CAUSE	INFANT MORBIDITY (%)	U5 MORBIDITY (%)	IMR (%)	U5MR (%)
MALARIA	38	30	27	41
DIARHOEA	27	22	24	24
ACUTE RESP. INFECTION	15	19	22	15
VACCINE PREVENTABLE DISEASES	17	16	10	15
OTHERS	3	3	5	8

Source WHO, 2012

The major causes of morbidity and mortality in under-five children in Nigeria are virtually the same as those responsible for ill health and death in infants. Malaria, diarrhea diseases, vaccine preventable diseases, and acute respiratory infections are responsible for about 95% of morbidity and almost 90% of mortality in under - five children. Malaria alone account for 41% of under-five mortality rate in Nigeria

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

The choice of methodology for this work is governed by three factors: the problem of the study; its objectives; and the review of theoretical literature and empirical studies of the problem. From the theoretical review, this study rely heavily on the human capital theories which are in form of production function where household expenditure, government expenditure and other non-health variables are seen as input in the production function. Therefore, the human capital theories are very relevant in our conceptual and theoretical framework. First, because it deals with production of health through investment in human capital, and health expenditure is seen as an input in the production function while health outcomes (under-five mortality) are considered as the output. Secondly, because of the simplicity of the theoretical construct of the model, it lends itself easy for modifying it from micro model to macromodel and allowing some key elements to be incorporated into large models. This enables us to analyze not only the impact of public health spending on under-five mortality but also how other variables (non-health expenditures) affect child health.

3.1Theoretical and Conceptual Framework

3.1.1 Theoretical framework

Based on the theoretical literature reviewed in chapter two, this study used Grossman (1972) framework for health outcome (under-five malaria mortality) in Nigeria. The justification for using Grossman framework is based on the development of literature (Cropper, 1974; Maurine, 1982; Fayissa and Gutema, 2005; Thorton, 2002 and Muthaka, 2013) all of which emphasized on investment in human capital (health and education) for better health outcomes and economic growth.

From the foregoing, Grossman (1972) health production function can be symbolically presented as follows;

H= f (A) ……………………….. 3.1

Where H = health outcomes (Life expectancy, infant mortality/ under-five mortality.

A = vector of other economic variables (income per capita), social (education), environmental (urbanization), demographic (population below or above certain age group) and health service variables (like population doctor ratio, population hospital ratio etc) variables affecting health status. Although, Grossman (1972) presented a model at micro level however,numbers of studies have tried to employ his specification at macroeconomic level (for example; Fayissa and Gutema, 2005 and Thorton, 2002). Representing the variables in their per capita form we can rewrite equation 3.1 in per capita extended form as follows;

h= f (e, d, p, s, n)…………………. 3.2

e = is economic factors in per capita terms affecting health status h (reduce mortality).

d = is demographic factors.

P = political factors.

S = social factors.

N = environmental factors.

The Grossman theoretical model presented above can be modified to Health production functions for estimating the relationship between public health expenditure and under-five malaria mortality. The relationship can be expressed as follows.

$$U5M = f(HEXPTOTAL, RGDPC) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

Where *U5M* is under-five malaria specific mortality rate.*RGDPC* is real income per capita). *HEXPTOTAL* is public health spending (public health care spending). Equation (3.3) assumed that increase in government health expenditure and increases in real percapita income leads to a reduction in under-five malaria mortality rates. The mechanism through which per capita income affects child healthare is by allocation of more financial resources to child health services. Public health expenditure influences child health through the following channels: availability of child health focused intervention such as immunization, free ITN distribution, nutrition boosters and, child growth monitoring. Public health expenditure also facilitates availability of adequate health workers, drugs and medical supplies and infrastructures (clinics and hospitals) which are seen as service delivery indicators (SDI) for provision of child health related health services. Hence, when equation (3.3) is transformed in a Cobb-Douglas health production model the relationship is expressed as;

$$U5M_{it} = A(RGDPC_{it})^{\alpha} * \left(HEXPTOTAL_{it}\right)^{\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.4$$

Taking the logarithms of equation (3.4) transforms it into a linear equation we obtained equation (3.5)

$$\ln U5M_{it} = \alpha_0 + \beta_1 \ln RGDPC + \beta_2 \ln HEXPTOTAL_{it} \ \ldots\ldots 3.5$$

Where β_1 is the coefficient of the log of income and β_2 is the coefficient of the log of public health expenditure respectively. Equation 3.5 gives us theoretical model for estimation on the measure of the impact of government health expenditure on under-five mortality. It explains the input and output model where the income and government health expenditure are seen as the input in the production of health while the medical equipments, physicians, nurses and other health workers are the immediate and tangible output and under-five mortality is seen as the health outcomes.

Therefore it is assumed that increased allocation of health resources through budgetary provision (capital and recurrent) by the government is likely to influence the quality of health care service delivery.The increased health spending by the government on health services has an incremental effect in reduction of under-five malaria mortality as conceptualized in the following chart.

Figure 3.0 depicts the input, output and outcome model of public health expenditure and under-five malaria mortality in Nigeria

3.1.2 Conceptual framework

Public health expenditure consist of recurrent and capital spending from government (federal) budgets, external borrowings, and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Hence this study conceptualizes public health expenditure to mean health intervention measured in terms of all the financial resources invested in the health sector with the objective of achieving under-five mortality reductions. The study also conceptualizes public health expenditure to be meant by some factors such malaria cases, real GDP per capita, environmental pollution, population growth rate, total debt stock which all reduce or increases public health expenditure and which is seen an input in the health production function while the under-five mortality is seen as the outcome. Therefore, public health expenditure is coneptualised to mean all investment (malaria intervention) and purchase of health goods and services which enhances positive health outcome. This is in line with Grossman (1972) which explained that the investment in health is specified as a function of medical care, the time spent investing in health and education as a technological shifter. Health investment according to Grossman includes medical expenses, income, environment (sanitation) and forms of investment which increases health.

Therefore it is assumed that increased allocation of health resources through budgetary provision (especially, financial resources) by the government is likely to influence the quality of health care service delivery.The increased health spending by the government on health serviceshaan incremental effect in reduction of under-five mortality as conceptualized in the following chart.

Figure 3.1. Conceptual model of Public health spending and health outcomes (Under-five mortality)

Source:Author'sillustration,

Assuming the government increased intervention through policies and public health spending (input) will result in immediate and tangible output such as physician density and nurses, health infrastructure, household's behaviors which are all regarded as service delivery indicators. Efficiency in service delivery indicators (immediate output) will result in better health outcome (low infant and low under-five mortality, low maternal mortality and higher life expectancy).

Service delivery indicators (SDI) such as physicians, drugs, equipments/facilities and the households behaviors affects the health outcome hence, efficient SDI (output as a result of financial input from government) will increases effectiveness of health resources allocated to health. Suppose we consider, the adequate physician and nurses density in the health care facilities, efficient health infrastructure (equipments, drugs, beds,) would improve service delivery. This improved health service delivery would improve health of the beneficiaries which would lead to lower child mortality.

However, Lewis (2006) identified issues such as absenteeism of health staff, lack of diagnostic accuracy, wastages, bribery for services, leakage such as diversion and stealing of medical supplies as constituting obstacles in achieving better health outcomes.

This work therefore, sees public health expenditures as an input in health production process. While service delivery indicators are regarded as the immediate and tangible outputs (physicians, nurses, drugs, equipments, infrastructure,) while under-five malaria mortality rate is considered to be the outcomes of the health expenditure. It is expected that increased health spending will have a positive effect in reducing under-five malaria mortality through the service delivery indicators.

3.2 Hypotheses

The hypotheses of this study are stated as follows:

i. H_o1: There is no significant relationship between under-five malaria mortality and its determinanats. H_0: α = 0

ii. H_02: The Public health expenditure has no significant impact on under-five malaria mortality trend in Nigeria. H_0: α = 0

iii. H_03: The shocks from public expenditures do not significantly affect on under-five malaria mortality in Nigeria. H_0: α = 0

iv. H_04: There is no significant relationship between public health expenditure and its determinants H_0: α = 0

3.3 Empirical models

In order to investigate the impact of Public health expenditure on health outcomes, four models are specified in line with our stated objectives in chapter one. The models contain public health expenditure and a set of control variables as outlined in the theoretical framework of Grossman model.

3.3.1 Model 1: Determinants of Under-five Malaria Mortality in Nigeria.

The first model captures objective one; determinants of under-five malaria mortality in Nigeria. The model assumed that the under-five malaria mortality may not only be influenced by insufficient funding from the government but as result of some factors which need to be identified hence, the need to identify those factors with a view to addressing them through appropriate policy. The econometrics model capturing this objective was adopted from the works of Imam and Koch (2004) on Determinants of Infant, Child and Maternal Mortality in Sub-Saharan Africa.

$$\Delta u5m_t = \Delta u5m_{t-i} + \alpha_1 \Delta rgdpc_{t-i} + \alpha_2 \Delta hivaids_{t-i} + \alpha_3 \Delta ma\ln utrn_{t-i} + \alpha_4 \Delta immrt_{t-i} + \alpha_5 \Delta fpmedu_{t-i} + \alpha_6 \Delta phyden_{t-i} + \lambda \mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots 3.6$$

Where *i represents the optimal lag which will be determined based on the information criterion (AIC, SIC, HIC). From the unit root test, the maximum order of differencing is denoted by* d_{max} *which is constant with the order of intergration of the series. Hence, the modified VAR in the spirit of Toda and Yamamoto (TY) is determine by* $i+d_{max}=g$.

Therefore from equation 3.6 the modified VAR model is given as,

$$\Delta u5m_t = \Delta\sum_{i=1}^{k} u5m_{t-i} + \alpha_1 \sum_{p=1}^{N} \Delta rgdpc_{t-g} + \alpha_2 \sum_{p=1}^{N} \Delta hivaids_{t-g} + \alpha_3 \sum_{p=1}^{N} \Delta ma\ln utrn_{t-g} + \alpha_4 \sum_{p=1}^{N} \Delta immrt_{t-g} + \alpha_5 \sum_{p=1}^{N} \Delta fpmedu_{t-g} + \alpha_6 \sum_{p=1}^{N} \Delta phyden_{t-g} + \lambda \mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots 3.7$$

Where $g \geq i$

U5M is under-five malaria mortality, ***rgdpc*** is income, ***hivaids*** is HIV/AIDS, ***malnutrn*** is malnutrition, ***immrt*** is immunization rate proxy for household's behavior, ***fpmedu*** is female education at primary level proxy for female literacy and ***phyden*** is physician density.

Hence, modified VAR technique of estimation is adopted for this model because of stationarity of the sries at different levels.

Table 3.1 Definations and a priori signs of the variables.

Dependent variable: Under-five malaria mortaliy

Independent Variables	**Definition of variable**	**a *priori sign***
Gdpc:	Gross domestic product per capita proxy for income	Negative (-)
Hivaids:	HIV/AIDS prevalence	Negative (+)
Immrate:	Immunization rate proxy for household's behavior	Positive (-)
Fpmedu:	Female litracy rate proxy forfemale primary school education	Negative (-)
Femlelfp:	Female labor force participation	Negative (-)
Phyden:	Physician density	Negative (-)

Per capita income is included in the model as a measure of the parents' income levels. This measures the socio-economic status, and is relevant in Nigerian context given the fact per capita income is low and this has a direct bearing on child health because it determines how much can be invested into child health care, both medical and otherwise. It is hence an underlying factor responsible for child health. It expected sign is negative. It is assumed that higher national income will impact positively on under-five mortality. Higher income will mean lower under-five malaria mortality and vice versal

HIV/AIDS prevalence rate prevalence of HIV refers to the percentage of people aged 15-49 that are infected with HIV. The expected sign is positive. The more the numbers of parents are affected with the virus the more of their income will go into treatment of the disease and less on on malaria treatment for their child which increase the risk of child death. Also HIV/AIDS infected parents may die thereby affecting the child health negatively.

Immunization coverage is measured by percentage of children ages 12-23 months that are immunized. Immunization coverage is relevant because it is an indicator of a preventive health care intervention in children, which is an investment in the health of the child.

Female or maternal literacy is measured by female primary school enrollment rates. This variable is relevant as the education status of the mother determines her knowledge about child care. It hence represents an investment in the health of a child. The expected sign is negative. Human capital theories have advocated increased spending on health and education for sustained economic growth which has impact on health outcome. The variable is crucial in Nigerian context because statistics have shown that a higher number of Nigerian female population are illiterate hence the need to examine this variable and its impact on child mortality.

Female labor force participation. Female labor as a percentage of the total of total labor force shows the extent to which women are active in the labor force. Labor force comprises people of ages 15 and older who meet the International Labor Organization's definition of the economically active population. The variable is relevant in the model because it assumed that the working class women have more income which can be used to invest in the child's health which is likely to reduce under-five malaria mortality rate. The expected sign for this variable is negative

Physicians include generalist and specialist medical practitioners. The variable is important in the model in the sense that we expect that the more the physician the more access to health care and less child mortality. The expected sign of the variable is negative and given the rapid growth of population and slow investment in training of medical doctors requires examination of correlation between physician density and under-five malaria mortality in Nigeria.

3.3.2 Model 2: The Impact of Public Health Expenditure on Under-Five Malaria Mortality in Nigeria

The second model addresses the second objective of the study of establishing the impact of Public health expenditure on under-five malaria specific mortality. The study applies cointergration, vector error correction model (VECM), and granger causality test and VAR

Cointergration test can be performed if the series are stationary at first difference, i.e. *I (1*). This is to determine the existence of long-run relationship between the variables under study. This can be done by Johansen and Juselius (1990) test for cointegration based on the error correction representation of the VAR model. The choice of this approach is premised on its relevancy when dealing with more than two variables in the equation. However, a general VAR model with a lag length, say, *Þ* can be expressed in VAR format following the work of Usman, H. M., Muktar, M and Inuwa, N. (2015) which was modified and adopted as follows.'

$$\Delta U5M_t = \rho_O + \rho\Delta U5M_{t-i} + \rho_1\Delta GHEXP_{t-i} + \rho_2\Delta MCASE_{t-i} + \rho_3\Delta HHEXP_{t-i} + \rho_4\Delta EDUEXP_{t-i} + \rho_5\Delta FEMALELFP_{t-i} + \rho_6\Delta INFLR_{t-i} + \rho_7\Delta RGDPC_{t-i} + \psi\mu_{t-1} + \varepsilon_t \qquad 3.8$$

Whrere; ***U5M***is Under-five malaria mortality as dependent variable while the independent variables are, ***GHEXP*** public health expenditure, ***HHEXP*** is the Household's health expenditure, ***MCASE*** is malaria cases reported, ***EDUEXP***is education expenditure, ***FEMALELFP*** is Female labor force participation, ***INFLR*** is Inflation rateand ***GDPC***is the real gross domestic product per capita while *εt* indicates their structural shocks. The appropriate lag length for Vector Autoregression (VAR) was selected based on Akaike Information Criterion (AIC).

Table 3.2: Definition and a *priori signs* of the variables

Dependent variable: Under-five malaria mortality

Independent Variable	**Definition of variable**	**a *priori sign***
GHEXP	Public health expenditure	Negative (-)
MCASE	Malaria cases reported	
HHEXP	Household's health expenditure	Negative (-)
EDUEXP	Education Expenditure	Negative (-)
FEMALELFP	Female labor force participation	Negative (-)
INFLR	Inflation rate	Positive (+)
GDPC	Gross domestic product per capita	Negative (-)

Under-five mortality (a proxy for under-five malaria mortality) is the number of reported death cases due to malaria of children below the age of five measured as the probability per 1,000 live births that a new born baby will die before reaching the age of five in the same year. It is the independent variable in the model. According to Grossman health production function, the under-five mortality rate is the output viewed as health outcomes.

Government health expenditure (capital and recurrent) a proxy for malaria expenditure includes grants, aids and donations from non-governmental organizations. Measured as the ratio of public health expenditure to total health expenditure in Naira (N). The variable is very important in the model and in Nigerian context because government expenditure on health play a significant role in public health. Developing country like Nigeria requires government support because it shows how government health expenditure affects the child mortality. The theory of public health expenditure recognized government spending as a tool for economic growth and development as demonstrated by Wagner, Wiseman and Peacock theory of public expenditure.

Household's health expenditure is the annual household's expenditure on health as percentage of total house expenditure. Measured as a ratio of households' health expenditure to total health expenditure in naira (N).The variable is included in the model to ascertain the contribution of households' health expenditure in reduction of under-five mortality. The household health expenditure is seen as an input in the production function of health where individual invest in health in order to increase his or her health stock as found in Grossman theory of health demand. The expected sign of the variable is negative because in Nigeria private health expenditure is found to the highest compare to government health expenditure and hence it inclusion in the model

The malaria cases reported is included in the model to find out the relationship between malaria cases reported and under-five malaria mortality. When malaria cases become prevalent and if there is no accessibility to medical health care the mortality rate is likelihood to increase. The variables is important because in Nigeria malaria cases constitute 60% of all illness reported in the hospital in children under the age of five

Government education expenditure (capital and recurrent) including grants, aids and donations from non-governmental organization.Measured as the ratio of public education expenditure to total education expenditure in naira (N). Education is seen an input in health production function in the Grossman model, also in the endogenous growth theory also recognizes education as human capital in knowledge economy. Educated people are more conscious about their health and wellbeing and this will affect the child health

Female labor force participation. Female labor as a percentage of the total of total labor force shows the extent to which women are active in the labor force. Labor force comprises people of ages 15 and older who meet the International Labor Organization's definition of the economically active population. The variable is relevant in the model because it assumed that the working class women have more income which can be use to invest in the child's health which is likely to reduce under-five malaria mortality rate.

Inflation is measured as CPI was included in the model to estimate it impact on child mortality. During inflationary period, prices of drugs also increases which may not be affordable by people with low income this could result purchase of substandard drugs for their children. This may affect the child health which could lead to high mortality rate. The variable is expected to carry a positive sign and it inclusion in the model is vital because of instability of prices and exchange rate which will affect cost of the drugs. Hence, if the prices of drugs are high households may not be able to afford it and which have negative consequences on the child survival.

3.3.3 Model 3: Response of Under-five mortality to health expenditures shocks.

To analyze the volatility of government health expenditures and to determine the sources of the shocks, we estimated a modified vector autoregressive (VAR) technique. The estimation is designed to ascertain if under-five malaria mortality responds to public health expenditure. We used a modified VAR technique to determine the influence of public health expenditure on under-five malaria mortality and also to determine the sources of shocks and their impacts. Here the public health expenditure is disagregated into the recurrent and capital health expenditures. The equation is as follows.

$$\Delta u5m_t = \Delta u5m_{t-1} + \alpha_1 \Delta rec\exp_{t-i} + \alpha_2 \Delta cap\exp_{t-i} + \alpha_3 \Delta immrate_{t-i} + \alpha_4 \Delta mcase_{t-i}$$
$$+ \alpha_5 \Delta popden_{t-i} + \lambda\mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.9$$

Where *i represents the optimal lag which will be determined based on the information criterion (AIC, SIC, HIC). From the unit root test, the maximum order of differencing is denoted by* d_{max} *which is constant with the order of intergration of the series. Hence, the modified VAR in the spirit of Toda and Yamamoto (TY) is determine by* $i+d_{max}=k$.

Therefore from equation 3.9 the modified VAR model is given as,

$$\Delta u5m_t = \Delta\sum_{i-1}^{N} u5m_{t-i} + \alpha_1 \sum_{p=1}^{N} \Delta rec\exp_{t-k} + \alpha_2 \sum_{p=1}^{N} \Delta cap\exp_{t-k} + \alpha_3 \sum_{p=1}^{N} immrate_{t-k}$$
$$+ \alpha_4 \sum_{p=1}^{N} \Delta mcasek_{t-k} + \alpha_5 \sum_{p=1}^{N} \Delta popden_{t-k} + \lambda\mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.10$$

Where $k \geq i$

Where;***U5m*** is under-five malaria mortality, ***recexp*** is recurrent health expenditure,***capexp***is capital health expenditure, ***immrate*** is immunization rate, ***mcase*** is malaria cases reported is ***popden*** is population rate.

Hence, the technique adopted for the determinants of public expenditure in Nigeria is modified VAR where all series are not intergrated of the same order.

Table 3.3: the a *priori signs* of the variables

Dependent variable: Under-five malaria mortality

Independent Variable	Definition of variable	a *priori sign*
U5M	Under-five malaria mortality	Negative (-)
RECEXP	Recurrent health expenditure	Negative (-)
CAPEXP	Capital health expenditure	Positive (-)
IMMRATE	Immunization rate	Negative (-)
POPDEN	Population Density	Negative (-)
MCASE	Malaria cases	Positive (+)

Recurrent Expenditure is the amount spent on personnel, overhead and other allowances in health sector. This variable is relevant in the model because it measures how under-five mortality respond to recurrent expenditure i.e how health workers welfare affect the under-five malaria mortality rate. Without the adequate man power the health system cannot function properly. This is one of the service delivery indicators.This kind of expenditure is captured in public expenditure theories of Wagner, peacock, Wiseman and Keynes.

Capital health expenditure measures in Naira are all expenditures on capital project such as buildings, purchase of hospital equipments or facilities and drugs, ITNs. This constitutes one of the service delivery indicators (SDI). The variable is included in the model because expenditure in capital project such as facilities, buildings have direct effect on the child health and captured in public expenditures theories

Child immunization measures the percentage of children ages 12-23 months who received vaccinations before 12 months or at any time before the survey.When a child is immunized against measles he or she is immuned against diseases which may prevent him from early dealth. This is another form of public spending and is very relevant to child survival. This can also be explained by public expenditure or intervention theories.

Population growth rate. This is the average exponential rate of growth of the population over a given period. It is calculated as ln(Pt/P0)/t where t is the length of the period expressed as a percentage. High population growth rate without corresponding increase in health facilities and health workers will bring about inefficiency and high ratio of patients to doctors. The inclusion of the variable shows the effect of population growth on child health. The Malthus population theory explains this phenomenon.

Malaria incidence is expressed as the number of new cases of malaria per 100,000 people each year. The number of cases reported is adjusted to take into account incompleteness in reporting systems, patients seeking treatment in the private sector, self-medicating or not seeking treatment at all, and potential over-diagnosis through the lack of laboratory confirmation of cases. The variable is important in the model because when malaria cases become prevalent, it is expected government expenditure will increase. This is consistent with Wagner's law of public expenditure theory.

Impulse response charts will be employed to observe how shocks transmit from one variable to another and how these shocks influence other variables. The impulse response functions (IRF) traces out the response of the dependent variable in the VARequations to shocks in the error terms arising from the independent variables.Such a shocks or changes will change $\mathbf{y_t}$ in the current as well as future periods. Butsince ***yt***appears in the $\boldsymbol{x_t}$regression, the change in μ_i will also have an impact on *xt*. Similarly, a change of one standard deviation in μ2 of the $x_t$equation will have animpact on y_t. The IRF traces out the impact of such shocks for several periods in thefuture. Impulse response charts were used to check how the shocks in one variableaffect the other variables and how long such impact would last.

3.3.4 Model 4: **Determinants of Public Health Expenditure in Nigeria**

The fourth model captures the fourth objective of the work which is to examine the response of government health expenditure to change in determinants of public health expenduture in Nigeria. There are factors responsible for increase in government health expenditure in any country and as explained by Wagner who maintained that it is the size of national income that determines the size of government expenditure and increasing state activities such as education and defense. Hence, the following econometric model was modified and adopted from Michael et.al (2014) on Determinants of Public Health Expenditure in Ghana.

$$\Delta ph\exp_t = \Delta ph\exp_{t-1} + \alpha_1 \Delta mcase_{t-i} + \alpha_2 \Delta rgdpc_{t-i} + \alpha_3 \Delta edu\exp_{t-i} + \alpha_4 \Delta co2_{t-i} + \alpha_5 \Delta popl_{t-i}$$
$$+ \alpha_6 \Delta debt_{t-i} + \alpha_7 \Delta immrt_{t-i} + \lambda\mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.11$$

Where *i represents the optimal lag which will be determined based on the information criterion (AIC, SIC, HIC). From the unit root test, the maximum order of differencing is denoted by* d_{max} *which is constant with the order of intergration of the series. Hence, the modified VAR in the spirit of Toda and Yamamoto (TY) is determine by* $i+d_{max}=p$.

Therefore from equation 3.11 the modified VAR model is presented as follows,

$$\Delta ph\exp_t = \Delta\sum_{i=1}^{k} ph\exp_{t-i} + \alpha_1 \sum_{p=1}^{N} \Delta mcase_{t-p} + \alpha_2 \sum_{p=1}^{N} \Delta rgdpc_{t-p} + \alpha_3 \sum_{p=1}^{N} \Delta edu\exp_{t-p}$$
$$+ \alpha_4 \sum_{p=1}^{N} \Delta co2_{t-p} + \alpha_5 \sum_{p=1}^{N} \Delta popl_{t-p} + \alpha_6 \sum_{p=1}^{N} \Delta debt_{t-p} + \alpha_7 \sum_{p=1}^{N} \Delta immrt_{t-p} + \lambda\mu_{t-1} + \varepsilon \ldots\ldots\ldots\ldots 3.12$$

Where $p \geq i$

Phexpis Public health expenditure, ***mcase*** is malaria case reported, ***rgdpc*** is national income per capita, ***eduexp*** is education expenditure, ***co2*** is environmental quality, ***popl,*** population density, ***debt*** is total debt stock, ***immrt*** is immunization rate proxy for house hold behavior

Therefore, the technique adopted for the determinants of public expenditure in Nigeria is modified VAR where all series are not intergrated of the same order.

Table 3.4: The definition and a *priori signs* of the variables

Variable	**Definition of variable**	**a *priori sign***
MCASE	Malaria case	positive (+)
RGDPC	Real GDP per capita	Positive (+)
CO_2	Carbon dioxide emission, proxy for environmental pollution	positive (+)
POPDEN	Population density	positive (+)
DEBT	Total debt stock	Positive (-/+)
EDUEXP	Education expenditure	Negative (+/-)
IMMRATE	Immunization rate	Negative (+/-)

Malaria incidence is measured as the number of new cases of malaria per 100,000 people each year. The number of cases reported is adjusted to take into account incompleteness in reporting systems, patients seeking treatment in the private sector, self-medicating or not seeking treatment at all, and potential over-diagnosis through the lack of laboratory confirmation of cases. The expected sign of the variable is positive (+) this is in consistent with Wagner's law of increasing government expenditure as a result of increase in the state activities. As malaria cases increases the government expenditure is also expected to increase.The variable is important in the model in Nigerian context becauseWHO (2012) reports that in Nigeria malaria cases accounts for 60% of out-patient visits and 30% of hospitalizations among children under five years of age.

Gross domestic product per capita: Real GDP per capita is the measurement of the total economic output of the country divided by number of people and adjusted for inflation. This is included in the model to establish the relationship between national income and public health expenditure. The Wagnerian theory (1883) contends that an increase in national income causes more government expenditure.

Total government education expenditure (capital and recurrent) including grants, aids and donations from non-governmental organizations. Measured as the ratio of public education expenditure to total education expenditure in naira (N). Education is seen an input in health production function in the human capital theories, also in the endogenous growth theory also recognizes education as human capital in the knowledge economy. Educated people are more conscious about their health and wellbeing and this will affect the health expenditure. The expected sign is negative because increase in education may less government expenditure on health because educated people are more health conscious and may indulge in out of pocket health expenditure which reduce government expenditure on health. This variable is relevant in Nigerian context given the statistics that more than 60% of Nigerian are illiterate NBS (2012)

Carbon dioxide emission proxy for environmental pollution is the emissions from residential buildings and commercial and public services which contains all emissions from fuel combustion in households, bad drainage and contarminated water. Emission from carbon dioxide are dangerous to health hence the variable is relevant in the model as this assist to know the effect of the emissions, bad drainage and contaminated water bread mosquitos with negative consequences on child health and mortality. Because in Nigeria most house hold uses fire wood for domestic and commercial cooking and also most vehicles in Nigeria are second hand and therefore the emission of carbon dioxide is high. It has negative externalities and it is expected to have positive sign in the sense that higher carbon dioxide produces negative externalities which the cost may be borne by government. This supports theoretical assertion of negative relationship between carbon dioxide emissions and life expectancy. Carbon dioxide emissions are produced by motor vehicles and industrial processes which constitute air pollution that is not good for human beings. Therefore, carbon dioxide emissions will cause much harm to the child health and hence it inclusion in the model.

Population influences the expansion of health expenditure, when additionalresources are needed for health services given its health endowment. This is the average exponential rate of growth of the population over a given period. It is calculated as ln(Pt/P0)/t where t is the length of the period expressed as a percentage. High population growth rate without corresponding increase in health facilities and health workers will bring about inefficiency and high ratio of patients to doctors. The inclusion of the variable is important given the rate of increase in population in Nigeria which currently stood at 182 million NBS (2014).The expected sign is positive because according to public expenditure theories increase in population increase the demand for services and hence increase in government expenditure.

Total debt stocks to gross national income. Total debt stock (domestic and external) is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. The debt variable is relevant in the model because it shows the impact of debt service on child mortality. The expected sign is negative in the short run but may be positive in the long run due to debt servicing; interest on loan repayment and this can be explained by debt over hang hypothesis. Resource which was supposed to be use in malaria funding is being diverted to loan repayment. The inclusion of this variable in Nigeria context is very important because Nigeria debt profile is high in both domestic and external loan.

Immunization rate a proxy for Household's behavior is the number of people who respond or visit hospital for malaria cases. Immunization rate is the ration of children who got immunized to the total number of children below the age of five. The variable is important in the model because households' behavior can influence government expenditure on outbreak of certain diseases if the households' sanitary behavior is poor. If the households' fail to visit hospital or use the ITN or refuse to show up for immunization then there is likelihood that malaria will increase and hence increased government spending. The households' behavior is also one of the service delivery indicators and also included as an input in health production function by Grossman model of demand for health and health seeking behavior.

3.4 Estimation Techniques.

From the literature reviewed from cross country to country specific studies, most studies employed the conventional estimators, such as ordinary least squares (OLS) or generalized least squares (GLS),two stage least squares 2SLS and Generalized method of moment (GMM).

These estimation techniques have flaws of biasness and inconsistency when apply to this kind of work.Other problems of applying least square regression is the problem of bad outliers, non-linearity of most systems, too many independent variables, The least squares method can sometimes lead to poor predictions when a subset of the independent variables fed to it are significantly correlated to each other, there is also the problem of Heteroskedasticity in applying OLS method, other problem includes selecting of the wrong independent variables (i.e. features) for a prediction problem is one that plagues all regression methods, not just least squares regression. Lastly is the problem of presence of noise in the independent variable.

Hence, to address these problems, the study employed modified Vector autoregressive (VAR) model. The choice of this technique is based on the fact that the series were not stationary at the same level

This technique have been employed in similar studies. Example of such studies includes Riati and Junard (2016), Ropert and Tiany (2014) and Olaride and Bello (2004). The VAR Model is simple such that one does not have to worry about determining which variable are endogenous and which one are exogenous. All variable in VAR are endogenous. The forecast obtain by VAR in many cases are better than those obtained from more complex simultaneous equation model.

However, VAR has it own short comings. For example there is the problem of choosing length of the lag (time) and result from transformed data may not be satisfactory. VAR solely in the 1^{st}difference may omit potentially important stationary variable i.e (error-correction, co integrating vectors) and hence parameters estimate may suffer from omitted variables. To solve the problems we specify the VAR models in levels. The use of the levels specification not only avoids the unit root issue. It also avoids the controversial issue of which cointegration restrictions may impose in estimation.

3.5 Unit Root Test

Unit root test was carried out to test whether the underlying processes that generated thedata series can be assumed to be invariant with respect to time.To carry out this test; we shall use the Augmented Dickey-Fuller (ADF) test, due to its robustness and its capacity to remove autocorrelation from the model. While the Augmented Dickey-Fullerapproach accounts for the autocorrelation of the first differences of a series in aparametric fashion by estimating additional nuisance parameters., the Phillips-Perron unit root test makes use of non-parametric statistical methods to take care of the serialcorrelation in the error terms without adding lagged difference terms (Gujarati and Porter, 2009). Augmented Dickey-Fuller Unit root test is specified as;

$$y_{it} = \alpha_0 + \alpha_1 y_{it-1} + \alpha_i \sum_{i=1}^{n} \Delta y_{it-n} + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.13$$

where: y_i= individual variables in the model.

$\alpha_0, \alpha_1 and \beta_1$ = parameters of the model. Each variable becomes stationary, if it is integrated at order zero {I(0)}, or else it becomes stationary at order in which it is differenced {I(d)} (Gujarati,2003).

3.6 Variable Defination and Sources of Data

The main sources of the data are; National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN), World Health Organization (WHO), UNICEF, World Bank, National Demographic Health Survey (NDHS), Federal Ministry of Health and world development indicators (WDI).We used annual data that spanned from 1990 to 2016. For the estimation, E-view Version 8 software was used. This software proved very efficient in estimating most of the econometrics models. The choice of this package was chosen because it is user friendly and provides sophisticated techniques for data analysis, regression and forecasting.

Table 3.5 Variable definition, measurement and sources of data

S/n	Variable Definition	Variable Description	Unit of Measurement	Data Source
1	Public health expenditure	Total government health expenditure (capital and recurrent) including grants, aids and donations from non-governmental organizations	Measured as the ratio of public health expenditure to total health expenditure in naira (₦)	NBS annual abstract of statistics, CBN statistical ,bulletin, WDI
2	Households health expenditure	Annual house expenditure on health as percentage of total house expe\nditure.	Measured as a ratio of households' health expenditure to total health expenditure in naira (₦).	World development indicators
3	Physician density	Number of physician per 1,000 population in the country.	Measured as the ration of physicians to patients in a year	NBS annual abstract of statistics, World development indicators.
4	Malaria cases reported	Number of malaria cases reported in government hospital per anum	Malaria incidence is expressed as the number of new cases of malaria per 100,000 people each year.	CBN statistical bulletin, NBS and WDI
5	Capital health expenditure	Health equipments such as building, drugs, beds	Measured as actual capital health expenditure in a year measured in (₦)	CBN statistical bulletin
6	Female primary school enrollment	Female gross enrolment for primary education, regardless of age, to the popu\lation of the aged group that officially corresponds to the level of primary education. This is a basic measure for literacy as ability to read, write and speak. A proxy for female literacy.	Ratio of total female enrolment for primary education in a year.	World development indicators, NBS annual abstract of statistics.
7	Immunization rate	Immunization rate is a proxy for household's behavior.	Ration of children who got immunized to the total number of children below the age of five.	Federal Ministry of health, WDI, WHO
8	Female labor force participation	Female labor force as a percentage of the total shows the extent to which	Measured by number of employed women in both private and public	National Bureau of Statistics (NBS), WDI

		women are active in the labor force. Labor force comprises people of ages 15 and older who meet the International Labor Organization's definition of the economically active population.	sector.	
9	Health recurrent expenditure	Actual health recurrent expenditure which comprise of personnel and overhead cost.	Ratio of recurrent health expenditure to total health expenditure in naira (₦).	Ministry of Health and Ministry of Finance, CBN
10	Under-five malaria mortality rate	The under-five malaria mortality rate is the probability per 1,000 live births that a new born baby will die owing to malaria before reaching the age of five in the same year.	Number of reported case of death for children below the age of five	WHO, UNICEF, NBS, WDI
11	Inflation rate	Continuous increase in the general price level	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	CBN statistical bulletin.
12	Carbon dioxide emission	Proxy for environmtal pollution. Carbon dioxide is emissions from residential buildings and commercial and public services contain all emissions from fuel combustion in households.	Measured as the rate at wich air is polluted as result of economics activities	WDI

13	Prevalence of Malnutrition	Prevalence of under nourishment. Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously	Data showing as 5 signifies a prevalence of undernourishment below 5%. Data showing as 5 signifies a prevalence of undernourishment below 5%.	WDI, WHO, NBS
14	Real GDP per capita	Real GDP per capita is the measurement of the total economic output of the country divided by number of people and adjusted for inflation	Nominal GDP divided by the current population of a country	CBN statistical bulletin, world development indicators.
15	Public education expenditure	Total government education expenditure (capital and recurrent) including grants, aids and donations from non-governmental organizations	Measured as the ratio of public education expenditure to total education expenditure in naira (₦)	CBN statistical bulletin.
16	Population	This is the average exponential rate of growth of the population over a given period.	It is calculated as ln(Pt/P0)/t where t is the length of the period expressed as a percentage.	WDI, NBS, CBN.
17	Debt stock	Total debt stock (domestic and external) is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt.	Total debt stocks to gross national income	WDI, CBN
18	HIV/AIDS	HIV refers to the percentage of people aged 15-49 that are infected with HIV	HIV/AIDS rate is percentage of people tested and found to be infected with HIV/AIDS	WDI, UNDP, WHO

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.0 INTRODUCTION

This chapter shows the results, interpretation and discussion of the results. The chapter is divided in to four sections, each section deals with one objectives of the study as outlined in chapter one. The discussion of the results comes after the interpretation of all the results then followed by findings. Analyses of the data were done with the use of e-views software version 8.

4.1 Data Transformation

The data used for this work were pulled together from world development indicator (WDI), the Central Bank of Nigeria (CBN) statistical bulletin and annual reports, National Bureau of Statistics (NBS) for various years. Some of the variables used for the analysis were very large and therefore were transformed for ease of analysis. The transformation ranges from the use of log to the derivation of variables through division, multiplication, calculation of ratios and rates.

4.2 Time Series Characteristics.

Unit root test was carried out using the Augmented Dickey Fuller (ADF) to ascertain the stationarity of all the time series data of all the variables used in the models. Some became stationary at level form, some at first difference while some at second differencing. In addition pre-estimation test such as normality, stability and LM serieal correlation test were carried out to ascertain the robustness of the model.

Table 4.1 :Results of Unit Root Test (Stationarity Test)

S/N	Variables	ADF test at level	ADF test at 1st difference	ADF test at 2nd difference	p-value	conclusion
1.	lu5m	-0.0173	-4.0571	-10.5961**	0.0000	I(2)
2.	lco2	-1.6688	-2.9862	-3.6121**	0.0000	I(2)
3.	Limmrate	-3.1410	-6.1486**	-135789	0.0000	I(1)
4.	Lgdpc	-2.1376	-4.7695**	-13.3241	0.0010	I(1)
5.	Lpopden	-10.9953**	-352.4616	-952.8953	0.0000	I(0)
6.	Ldebt	-4.2528	-3.6996	-13.6153**	0.0000	I(2)
7	leduexp	-4.80088**	-6.4791	12.9703	0.0009	I(0)
8	lfpmedu	-2.7278	-5.7175*	13.5149	0.0000	I(1)
9.	lhivaids	0.3272	-5.8000	-8.0994*	0.0000	I(2)
10.	lmalntrn	-0.9739	-2.6434	-4.3447**	0.0128	I(2)
11.	lphyden	-3.7488**	-6.5344	-7.4656	0.0366	I(0)
12.	lcapexp	-1.4262	-10.6504*	-10.2345	0.0000	I(1)
13.	lrecexp	-3.0793	-10.6405*	-2.2481	0.0000	I(1)
14	Lmcase	-2.4575	-10.1868*	-9.7232	0.0000	I(1)
15.	Lfemalelfp	-0.7452	-10.5113*	10.8893	0.0000	I(1)
16.	Lhexptotal	-2.4013	-9.9841*	-12.0000	0.0000	I(1)
17.	Lhhexp	-3.4237	-10.1523*	-12.2474	0.0000	I(1)
18.	Linflr	-2.6004	-10.1676*	11.3614	0.0000	I(1)

Source: eview 8 output, 2018.

Table 4.1 shows the stationarity of the variables used in the models. The under-five malaria mortality was not stationary at the level form but, became stationary after the second difference. The calculated value for the under-five mortality is stationary at 10.5961 in absolute value, and is greater than the values of the critical value for all levels of significance with P-value of 0.0000

The stationarity test for immunization rate, a proxy for household's behavior was not stationary at level form but however, became stationary after the first differencing with P-value of 0.0000. Carbon dioxide emission was not stationary at level form even after first differencing but became stationary for all level of significance after the second differencing with absolute value of -3.6121 with P-value of 0.0000. The real gross domestic product per capita (income) is stationary at second differencing for all levels of significance. The P-value for the test shows the value of 0.0010.

A closer look at table 5.1 for the population density evidently confirm the case of stationarity at level form with an absolute value of -10.9953 for all levels of significance are all greater than the calculated value. The P-value for the test is 0.0000.

The total debt stock (domestic and external) was not stationary either at level form or after the first differencing but became stationary when it was differenced at second level. The absolute value was -13.6153 at significant levels with a P-value 0f 0.0000.

The stationarity test for the education expenditure indicates that it is stationary at level form with the absolute value of -4.8008 at all levels of significance and a P-value of 0.0009. The female primary education a proxy for female literacy was not stationary at level form. It became stationary after the first differencing with ADF value of -5.7175 at all levels of significance and with a P-value of 0.0000

The ADF unit root test for HIVAIDS became stationary at the second differencing with the absolute value of -8.0994 and a P-value of 0.0000. The variable malnutrition also was not stationary at level form and even after first differencing but however, became stationary at second differencing with the statistical value of -4.3447 at all levels of significance with the P-value of 0.0128.

The stationarity test for physician density was found stationary at level form and has absolute value of -3.7448 at all levels of significance, the P-value of 0.03666 indicate presence of a unit root. Other variables such as capital expenditure, recurrent expenditure, malaria case and female labour force participation were all stationary after the first differencing with absolute value of -10.6504, -10.6405, -10.1868, and -10.5113 respectively at levels of significance and P-values of 0.0000 for all the variables.

Similarly, Public health expenditure, household's health expenditure and inflation rate all became stationary after the first differencing with ADF values of -9.9841, -10.1523 and -10.1676 correspondingly at all levels of significance and with their respective P-values of 0.0000 for all the absolute values.

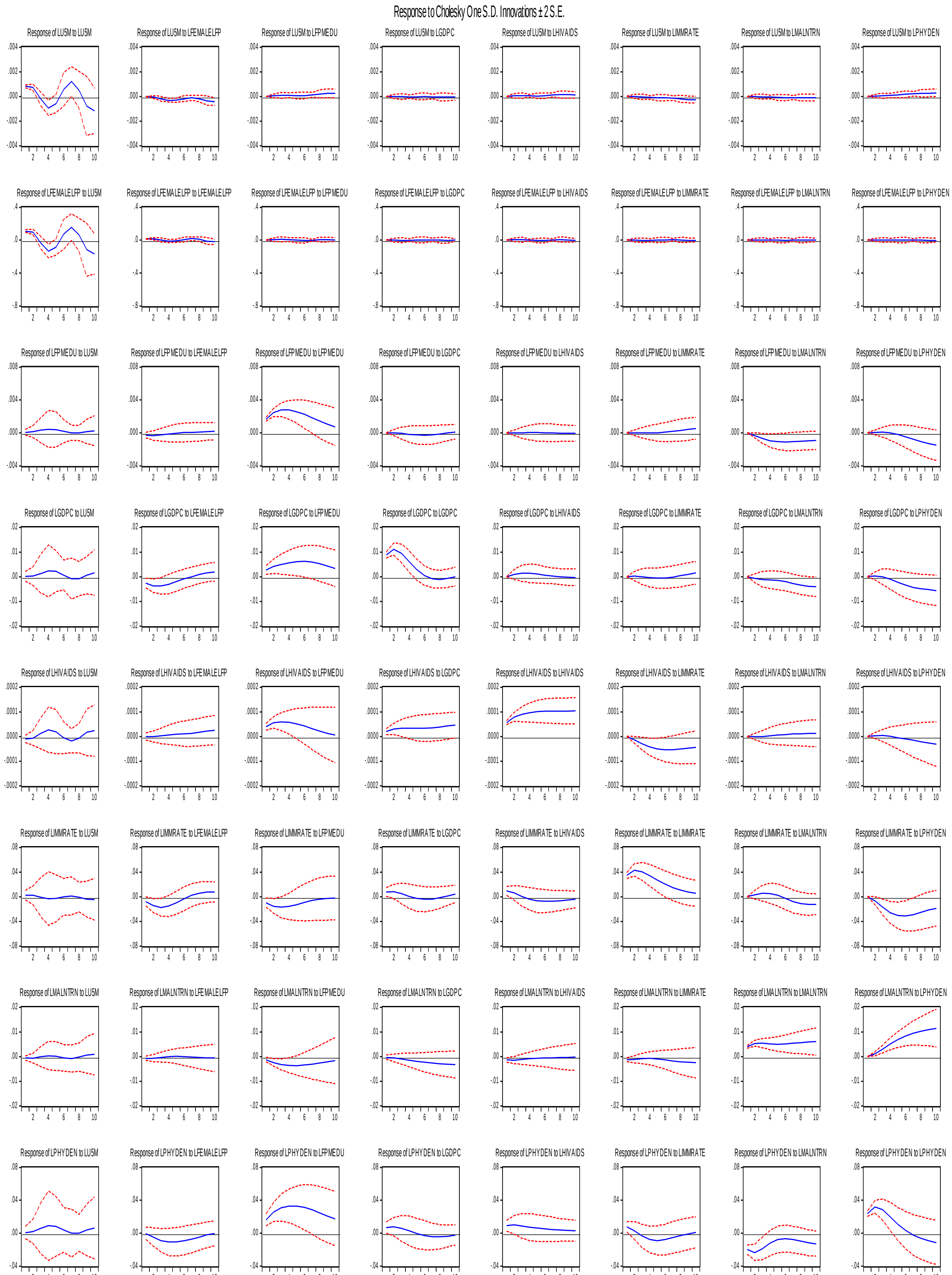
4.3 Determinants of Under-five Malaria Mortality in Nigeria.

To understand the factors responsible for under-five mortality in Nigeria we estimated data on under-five mortality and variables assumed to be responsible for under-five mortality in Nigeria. The variables (under-five mortality, female labour force participation, female literacy, income, household's behavior, malnutrition, physician density and HIV/AIDS) were stationary at different levels (table 4.2). hence, we used modified VAR, in the spirit of Toda and Yamamoto (1995) and Bello and Sanusi (2018). The VAR lag order selection criterion was also employed in selecting maximum lag order (see appendix 5).

4.3.1 Modified VAR Model Results

Modified VAR model was employed investigate the determinants of under-five mortality in Nigeria. Other results ancillary to the VAR estimation (impulse response function, variance decomposition and granger walds causality test) is presented and discuss below.

Figure 4.1 Impulse Response Function results



4.3.2 Interpretation and discussion of the Impulse Response Function Results

From figure 4.1 it is observed that female labour force participation affects under-five malaria mortality negatively. This result suggests that when women are employed under-five malaria mortality decreases. In other words, as more women are gainfully employed they become empowered and able to provide better medical care for their sick children which inturn reduce the number of children dying from severe malaria attack. The result is in line with our priori expectation of negative relationship between employment and reduction in under-five malaria mortality. The results also concurred with findings of Imam and Koch (2004) that identified positive impact of female employment on under-five mortality. Female literacy produced positive shock to under-five malaria mortality. This implies that under-five malaria mortlity increases as female literacy increase. The result did not conform to our a priori expectation of negative relationship between female literacy and under-five malaria mortality. Income affects under-five malaria mortality positively though very weak. The result is in line with the apriori expectation. This implies that as income increases under-five malaria mortality decreases. Because income enable individual to be more efficient in preventing malaria through purchase of insecticides, drugs and get treatment on time without allowing it to become complicated. This seriously reduces under-five malaria mortality. The finding is in consistent with findings of Riatu and Junaid (2016) who established negative relationship between income and under-five mortlity.

Under-five malaria mortality responds negatively to shocks from household's behavior. This conformed to the a priori expectation of the study that when household's behaviors improve positively (increase) under-five malaria mortality decreases. Positive household's health behavior such usage of ITNs, maintaining clean environment, treatment of malaria, regular immunization will reduce malaria morbidity and mortality. However, if the household's behavior is negative i.e not allowing children to be immunized, not going to hospital and following some customs and traditions as still found in some part of Nigeria will increase malaria morbidity and mortality.

Malnutrition affects under-five malaria mortality negatively though weak. The result does not conform to the a priori expectation of the study which assume positive relationship between malnutrition and under-five malaria mortality. We expect increase in malnutrition to increase under-five malaria mortality due loss of immunity resulting from malnutrition. However, the activities of free care givers, NGOs, in taking care and feeding of poor may make malnutrion ineffective in determining under-five malaria martality in Nigeria. Because of the assistance by these NGOs greatly reduces malnutrition. However, the current home grown school feeding programe if sustained will reduce malnutrition especially in children attending school. Physician density produces positive shocks to under-five mortality instead of negative shock. This implies that increase in physician density do not have effect on under-five malaria mortality. This does not agree with the a priori expectation of the study of negative relationship. However, the reason for this may be because of incessant strikes by doctors and other health workers which may impact negatively on the under-five malaria mortality outcomes. Secondly, despite the increase in supply of doctors there is the issue of resistant of malaria parisites to some malaria drugs which make the drug administration ineffective therby increasing under-five malaria mortality.

Under-five malaria mortality produces positive shock to female labor force participation which last for just two years before dying out. Under-five malaria mortality produce weak positive shock to income with a lag of 3 years before taking effect. The shock began at third year and dies out in the six year. Under-five malaria mortality also produces positive shock to physician density. The shock started at the second year after a year lag and dies out in the seventh year.

The response of income to shocks in female literacy is positive and strong. The shocks which began from the first year did not die out at all. This means that increase in female letracy rate will increase there chances of employment which leads to increase in their income level. The response of household's behavior to shocks from female literacy is negative and strong. This means that as more women are educated the more they enlightened on advantages of immunizations and drug administration. Female literacy rate also produce strong negative shocks to malnutrition which last throughout. This infers that female literacy will reduce malnutrition.

Income produces a strong negative shock to malnutrition which increases throughout without dying out. This implies as people income increases more will be spent on diet food and consumption of food that have nutritive value. Household's behavior transmit a strong negative shocks to HIV/AIDS which continues without dying out. This implies that if household's are well mobilized and informed about HIV/aids there will be positive bahavioural change in their sex life which will reduce the infection.

Table 4.2: Variance Decomposition of Determinants of Under-five Malaria Mortality

Variance Decomposition of LU5M:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.000810	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.001094	99.44989	0.277530	0.091757	0.009945	0.119636	0.017667	0.020117	0.013456
3	0.001139	95.21248	3.412248	0.480628	0.077028	0.354074	0.224028	0.125222	0.114290
4	0.001532	91.68689	6.426688	0.533284	0.109362	0.269492	0.462062	0.237481	0.274739
5	0.001682	88.20688	8.868673	0.567746	0.133801	0.247353	0.804699	0.480849	0.689994
6	0.001803	86.72784	8.904221	0.593074	0.140181	0.279813	1.166401	0.786000	1.402475
7	0.002192	88.63927	6.321044	0.633336	0.118256	0.388810	1.291586	0.807279	1.800418
8	0.002294	85.74256	6.493016	1.235154	0.157836	0.719659	2.020678	0.964868	2.666235
9	0.002500	82.30785	7.546761	1.963731	0.198410	0.889753	2.806836	0.989396	3.297259
10	0.002845	81.03276	8.164380	2.206162	0.195109	0.804834	3.145588	0.914515	3.536655

Variance Decomposition of LFEMALELFP:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.109476	98.55890	1.441101	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.147047	98.17511	1.677838	0.083660	0.004801	0.053144	0.004885	0.000120	0.000446
3	0.150827	97.83747	1.596139	0.370919	0.027624	0.113317	0.050249	0.000668	0.003611
4	0.202742	98.16740	1.369091	0.309292	0.025071	0.062884	0.061153	0.000390	0.004722
5	0.220078	98.16584	1.395809	0.262526	0.021297	0.092898	0.053616	0.003433	0.004583
6	0.231599	98.15454	1.354234	0.277136	0.027231	0.107899	0.063865	0.010862	0.004230
7	0.280188	98.25032	1.375823	0.198656	0.022872	0.077015	0.061967	0.010426	0.002921
8	0.287101	98.17033	1.421294	0.204479	0.021935	0.107952	0.059920	0.009931	0.004159
9	0.310024	98.21764	1.361937	0.218680	0.022719	0.101468	0.057890	0.009559	0.010107
10	0.354649	98.27285	1.383257	0.169678	0.018047	0.086619	0.047902	0.007440	0.014202

Variance Decomposition of LFPMEDU:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.001671	0.113415	3.145317	96.74127	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.003033	0.237483	2.261453	96.22740	0.002180	0.000122	0.000537	1.235235	0.035592
3	0.004204	0.659887	1.561533	94.22553	0.020665	0.001033	0.001436	3.478503	0.051413
4	0.005156	1.199519	1.107282	91.70609	0.132179	0.003664	0.001781	5.815036	0.034453
5	0.005886	1.388884	0.853096	89.43126	0.317791	0.005133	0.001630	7.856234	0.145978
6	0.006422	1.243295	0.718022	87.31005	0.491373	0.004605	0.014323	9.552263	0.666064
7	0.006820	1.103562	0.645172	84.77817	0.580840	0.004781	0.079456	10.93814	1.869880
8	0.007133	1.009487	0.611734	81.56715	0.579562	0.008761	0.254354	12.05398	3.914963
9	0.007408	0.974640	0.610504	77.60439	0.538366	0.016335	0.576640	12.89806	6.781065
10	0.007679	0.996044	0.627034	73.05704	0.522620	0.025242	1.028818	13.46097	10.28223

Variance Decomposition of LGDPC:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.009518	0.001543	7.649747	8.082523	84.26619	0.000000	0.000000	0.000000	0.000000
2	0.015664	0.015567	8.566420	9.911203	80.97727	0.274218	0.015621	0.210248	0.029453
3	0.019413	0.382887	9.376019	13.08536	76.01786	0.620326	0.010172	0.485720	0.021659
4	0.021553	1.409921	9.634692	17.44557	69.54785	0.864072	0.038562	0.770824	0.288512
5	0.022955	2.096995	9.268267	22.31851	62.75630	0.956937	0.105370	1.151667	1.345951
6	0.024159	1.955794	8.525258	26.62141	56.67778	0.929384	0.148882	1.786865	3.354626
7	0.025423	1.889972	7.698555	29.33324	51.30517	0.846762	0.141572	2.821081	5.963640
8	0.026690	1.820592	7.087138	30.38435	46.74051	0.769556	0.143751	4.272651	8.781452
9	0.027911	1.703416	6.786291	30.13539	42.81338	0.713215	0.245074	5.949747	11.65349
10	0.029134	1.861752	6.652852	28.94460	39.29169	0.667685	0.489294	7.520837	14.57129

Variance Decomposition of LHIVAIDS:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	7.19E-05	2.226911	0.000608	29.30222	7.500157	60.97011	0.000000	0.000000	0.000000
2	0.000125	1.010692	0.003554	29.54765	8.181642	59.89054	1.285557	0.014250	0.066108
3	0.000171	1.049378	0.016678	27.80734	8.148093	59.18894	3.707473	0.009003	0.073099
4	0.000213	2.180924	0.100763	25.05533	7.736446	58.56740	6.296476	0.015392	0.047274
5	0.000249	2.117657	0.214040	22.44453	7.398386	59.06539	8.630311	0.056689	0.072994
6	0.000281	1.710267	0.310289	19.97153	7.232464	59.98141	10.46961	0.125719	0.198706
7	0.000309	1.797734	0.414605	17.57031	7.253265	60.65665	11.67006	0.202997	0.434393
8	0.000334	1.588769	0.595867	15.46304	7.517955	61.42832	12.34948	0.277308	0.779258
9	0.000358	1.592339	0.883722	13.60393	7.932493	61.85818	12.55364	0.344760	1.230934
10	0.000381	1.774852	1.197544	12.02233	8.429094	61.92888	12.44272	0.407143	1.797435

Variance Decomposition of LIMMRATE:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.038443	0.400558	4.097440	6.689455	3.747636	5.670095	79.39482	0.000000	0.000000
2	0.062973	0.258857	7.024697	8.709314	3.034672	2.983490	76.64593	0.180032	1.163002
3	0.080992	0.169338	8.885050	9.842992	2.184634	1.805289	71.50409	0.526161	5.082442
4	0.094525	0.255741	9.191396	10.09567	1.606199	1.517215	65.45448	0.680149	11.19914
5	0.104611	0.286331	8.436822	9.809112	1.391252	1.655531	60.02215	0.590260	17.80854
6	0.112002	0.250729	7.461328	9.298918	1.372314	1.912489	55.65415	0.585356	23.46472
7	0.117465	0.233556	6.815448	8.754354	1.360012	2.133530	52.19100	0.978856	27.53324
8	0.121586	0.226190	6.581076	8.279067	1.292112	2.276021	49.45136	1.778383	30.11579
9	0.124827	0.328911	6.577450	7.898509	1.234189	2.348638	47.25387	2.735316	31.62311
10	0.127420	0.450193	6.648978	7.611601	1.293487	2.374083	45.51951	3.576359	32.52579

Variance Decomposition of LMALNTRN:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.004723	1.858506	3.098173	7.918896	0.718019	8.806967	8.070754	69.52868	0.000000
2	0.007947	1.385781	1.952226	12.51969	0.860413	6.761926	5.252191	69.34468	1.923095
3	0.010738	0.775419	1.161987	16.19451	1.331892	5.051172	3.546328	63.14338	8.795315
4	0.013579	0.532475	0.726560	17.45251	2.053851	3.641226	2.557243	53.67964	19.35649
5	0.016617	0.357256	0.486403	16.64142	2.823102	2.620734	2.086422	44.85416	30.13050
6	0.019811	0.337822	0.344717	14.82570	3.461634	1.932480	1.984982	38.14413	38.96854
7	0.023065	0.384400	0.272709	12.80346	3.919265	1.474953	2.098960	33.47650	45.56975
8	0.026276	0.308371	0.240114	10.94066	4.242446	1.164395	2.298885	30.33045	50.47468
9	0.029416	0.286286	0.224112	9.310357	4.491917	0.943208	2.504773	28.11678	54.12257
10	0.032459	0.304900	0.221480	7.926040	4.723334	0.780969	2.688016	26.47350	56.88176

Variance Decomposition of LPHYDEN:

Perio...	S.E.	LU5M	LFEMALELF...	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
1	0.037410	0.029621	0.017555	18.14014	3.261710	5.804524	4.253335	28.67001	39.82311
2	0.061854	0.123601	0.657614	23.76592	2.714086	4.667601	1.796991	25.20368	41.07050
3	0.078599	0.593081	1.735484	30.16769	2.197865	4.054831	1.334465	21.28108	38.63551
4	0.090199	1.420672	2.790892	36.34375	1.754782	3.687853	1.795921	17.97686	34.22927
5	0.098521	1.897788	3.544717	41.68454	1.472474	3.462531	2.352217	15.71254	29.87320
6	0.104610	1.817176	3.956132	45.93137	1.380017	3.317700	2.654140	14.35724	26.58623
7	0.109280	1.665908	4.070846	48.85637	1.418759	3.203263	2.695093	13.68138	24.40838
8	0.112964	1.559012	3.984093	50.54315	1.491413	3.103757	2.597285	13.58214	23.13915
9	0.116049	1.583953	3.811084	51.15485	1.520586	3.013397	2.466666	13.91614	22.53332
10	0.118837	1.774825	3.635897	50.90123	1.487477	2.927946	2.357382	14.48114	22.43410

Cholesky Ordering: LU5M LFEMALELFP LFPMEDU LGDPC LHIVAIDS LIMMRATE LMALNTRN LPHYDEN

4.3.3 Interpretation and Discussion of Variance Decomposition Results

The variance decomposition in table 4.3 shows ten years chosen for the forecast policy on determinants of under-five mortality in Nigeria. In the first year 100% of forecast error variance in under-five malaria mortality is explained by the variable itself. Meaning that other variables in the model do not have any influence on under-five mortality in the first year. However, as we move in to the future the forecast error variance dwindles to 81% in the 10th year..

The variable female labor force participation influences under-five malaria mortality at an average of 8% in the both periods (short and long run). This implies that increase in female labour force participation decreases under-five malaria mortality in the both periods (short and long run). The forecast error variance of female literacy is also weak at 2.2% in the long run. This infer that increase in female literacy does not affect reduction in under-five malaria mortality significantly. Income, malnutrition and HIV/AIDS do not have significantly influence in reduction of under-five mortality both in the short and long run.

Household's behavior and physician density influences the under-five malaria mortality by 3% in the 10th year respectively. This explains that increase in positive household's behaviours will diminish under-five malria mortality and like wise increase in number of physician will reduce the rate of under-five malaria mortality in both the short and long run respectively.

Under-five malaria mortality has a strong influence on female labour force participation. The variance forecast error is 98% from the first year to the tenth year. This implies that increase in under-five malaria mortality will reduce the participation of women in labour force because of the time they require to take care of their child. However, decrease in under-five malaria mortality will mean more time for the women to participate in labor.

Female literacy influences malnutrition with 17% forecast error variance in the 4th year. It began to dwindle after the 6th year signifying that female literacy in the long run has less influence on malnutrition. The results shows that increase in female literacy will reduce malnutrition because of the knowledge of balance diet acquired through literacy. Income has influence on malnutrition with about 10% forecast error variance in the 8th year. This infers that increase in income will reduce hunger and improve the consumption of richer food which could lead to decrease in malnutrition. HIV/AIDS does not have influence on malnutrition. Household's behavior has 8% forecast error variance on malnutrition and dwindles as we move in to the future. This signifies that household's behavior towards consumption of balace diet food will reduce malnutrition. Malnutrition is strong influencer of itself in the first three years with an average of 69% forecast error variance, but it declines after the 4th year which continues till the 10th year. Physician density has a strong influence on malnutrition in the long run with 56% forecast error variance. This means that with more number of physician people have access to physicians and health information on combination of balance diet food which can result in reduction of malnutrition.

4.3.4 Granger Walds Causality Test.

This is the post diagnostic test of the Determinnats of Under-five malaria mortality in Nigeria

Table 4.3 Granger Wald Causality Test of Determinants of Under-five Malaria Mortality

Null hypothesis	WaldChi-square test	P – value	Conclusion
FEMALELFP does not Granger Cause U5M	21.93900	0.0000	Reject H_o
U5M does not Granger Cause FEMALELFP	0.032286	0.9840	Cannot Reject H_o
FPMEDU does not Granger Cause U5M	0.251423	0.8819	Cannot Reject H_o
U5M does not Granger Cause FPMEDU	2.941059	0.2298	Cannot Reject H_o
GDPC does not Granger Cause U5M	0.173051	0.9171	Cannot Reject H_o
U5M does not Granger Cause GDPC	2.932802	0.2298	Cannot Reject H_o
HIVAIDS does not Granger Cause U5M	0.432936	0.8054	Cannot Reject H_0
U5M does not Granger Cause HIVAIDS	3.143315	0.2075	Cannot Reject H_o
IMMRATE does not Granger Cause U5M	0.266769	0.8751	Cannot Reject H_o
U5M does not Granger Cause IMMRATE	2.482998	0.2890	Cannot Reject H_o
MALNTRN does not Granger Cause U5M	0.022303	0.9889	Cannot Reject H_o
U5M does not Granger Cause MALNTRN	16.59331	0.0002	Reject H_o
PHYDEN does not Granger Cause U5M	0.040351	0.9800	Cannot Reject H_o
U5M does not Granger Cause PHYDEN	10.38933	0.0055	Reject H_o

From table 4.4 the post diagnostic granger walds test shows that female labor force participation cause under-five mortality to decrease. For example, if Women do not participate in labor they lack income to give good treatment to their child with malaria and this could leads to more number of under-five malaria mortality. Under-five malaria mortality also causes physician density to increase. This implies that with increase in under-five malaria mortality government will likely respond by recruitment more number of physicians to increase the doctor-patient ration to treat malaria cases to avert more number of deaths. Other variables such as female literacy, income, HIV/AIDS, household's behavior and malnutrition do not cause under-five mortality to decrease.

4.4 Impact of Government health expenditure on Under-five Malaria Mortality

The objective of this section is to investigate the impact of public health expenditure on under-five mortality in Nigeria. The ADF test shows that all the variables (under-five mortality, public health expenditure, female labour force participation, inflation rate, and income) are stationary at first difference (appendix 2b, table 4.2). Hence, the Johansen cointegration is employed to test for long run relationship between the dependent variable (under-five malaria mortality) and the explanatory variables (public health expenditure, female labour force participation, inflation rate, income, household health expenditure, malaria cases, household's behaviour)

4.4.1 Cointegration Test

Using the Johansen cointegration framework and testing for long run relationship among the variables, both the Trace and Max-Eigen statistics indicates that the dependent variable (under-five malaria mortality) is cointegrated with the explanatory variables (public health expenditure, female labour force participation, inflation rate, income, household health expenditure, malaria cases, household's behaviour) As such the test statistics strongly reject the null hypothesis. The results concluded that the variables (public health expenditure, female labour force participation, inflation rate, income, household health expenditure, malaria cases, and household's behaviour) have long run impact on Under-five malaria mortality in Nigeria.

The maximum lag for the test was selected based on the Akaike information criterion (AIC) and the null hypothesis of no cointegration is rejected at 5% level based on the Mackinnon-Haug-Michelins (1999) P-values.

Table 4.4 Result of Johansen cointegration test

	Hypothesized No. of CE(s)	Eigenvalue	Test Statistic	0.05 Critical Value	Prob.**
	None *	0.680078	254.7277	69.81889	0.0000
	At most 1 *	0.333868	137.3410	47.85613	0.0000
	At most 2 *	0.285039	95.49543	29.79707	0.0000
Trace statistics	At most 3 *	0.261956	60.93605	15.49471	0.0000
	At most 4 *	0.250134	29.64966	3.841466	0.0000
	None *	0.680078	117.3867	33.87687	0.0000
	At most 1 *	0.333868	41.84555	27.58434	0.0004
Max=eigen statistics	At most 2 *	0.285039	34.55938	21.13162	0.0004
	At most 3 *	0.261956	31.28640	14.26460	0.0000
	At most 4 *	0.250134	29.64966	3.841466	0.0000

*Source: computed by the researcher using Eviews software version 8 * indicates cointegrating equations at 5% level of significance*

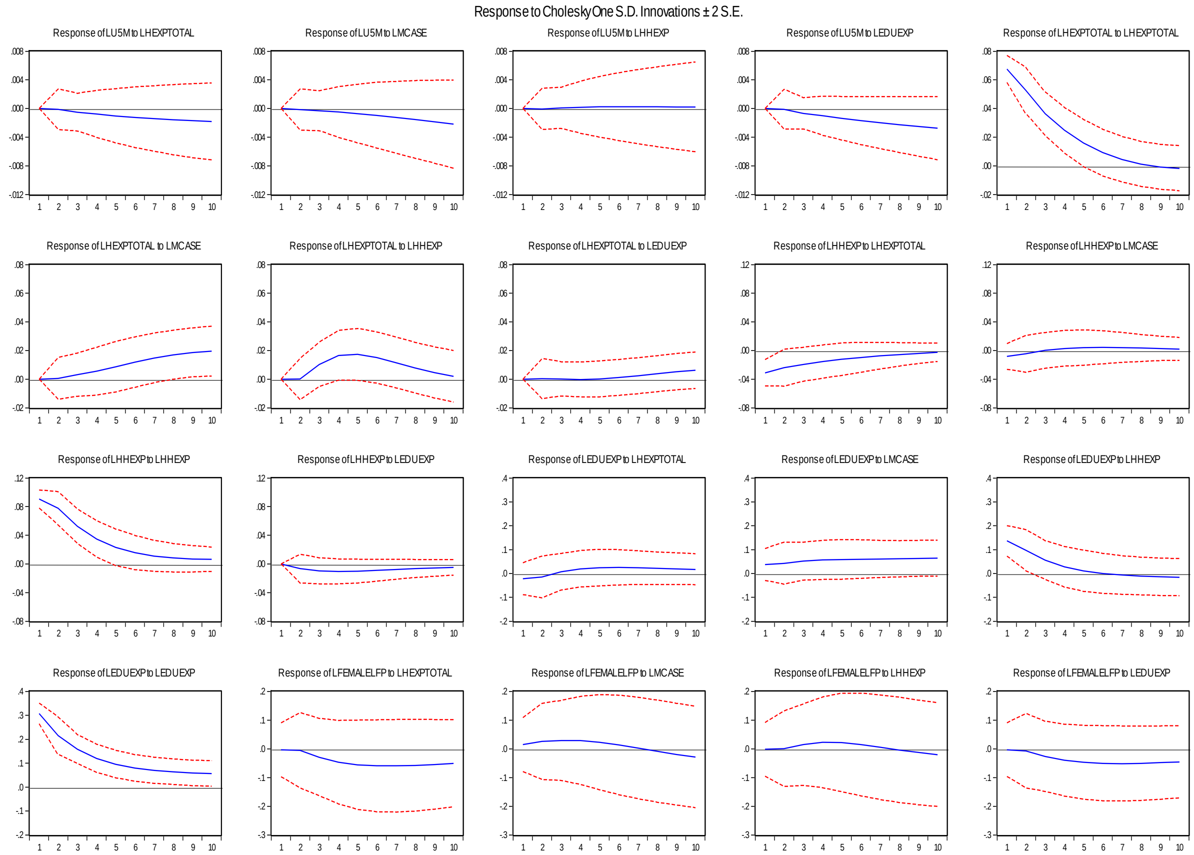
Since the long run cointegration is affirmed, a long run relationship is said to exist amoung the variables (public health expenditure, female labour force participation, inflation rate, income, household health expenditure, malaria cases, household's behaviour) of the study. This however, justifies the use of Vector Error Correction Model (VECM) to examine the relationship among the variables.

4.4.2 Vector Error Correction Model (VECM)

The ECM results (see appendix 6,) indicates that the coefficient of public health expenditure, female labour force participation, income, household health expenditure, household's behaviour have positive and statistically significant effect on under-five malaria mortality in Nigeria, while inflation rate and malaria cases have negative and ststistically significant effect on under-five malaria mortality. The results of Error Correction Model (ECM) has negative sign and the significance of the Error Correction term (ECT) indicated that there exist long run relationship between under-five malaria mortality and Government health expenditure and its takes more years to attain equilibrium. The ECM indicates a feedback of approximately 2.3% of the previous year's disequilibrium from long run elasticity of the explanatory variables. That is, the disequilibrium in the increase in under-five malaria mortality arising from shortfall of public health expenditure will adjust to longrun equilibrium at the speed of 2.3% accompanied by other variables in the model.

Having established the cointergration and the existence of long run relationship among the variables, VAR model (variance decomposition and impulse response function) are used to forecast the behavior and interactions of the variables in both short and long run.

Figure 4.2 Inpulse Response of Under-five Malaria Mortality to Public Health Expenditure Shocks



4.4.3 Interpretation and Discussion of Impulse response Function Results

In figure 4.2, the response of under-five malaria mortality to shocks from public health expenditure is negative. This implies that change in public health expenditure will reduce under-five malaria mortality. The result conformed to the a priori expectation of negative relationship between public health expenditure and under-five malaria mortality. For example, increase in public health expenditure in terms of recurrent expenditure through recruitments of doctors, nurses and community health workers will add value to services provided and enhance access of more qualify health personnel. Also increase in public health expenditure such as construction of more primary health care centers in both the rural and urban centers, purchse of diagnostic equipments and other hospital equipments, training and retraining of health personnel, purchase and distribution of ITNs, will affect under-five malaria mortality positively. Though increase public health expenditure in Nigeria is not commensurate with number of children dying before the age of five due to issue of quality of governance and corruption. The finding of negative relationship between under-five malaria mortality and public health expenditure is in line with that of Bello (2005), Sede (2015) and Mosunmola and Udodo (2016)

The variable malaria cases produce negative shocks to under-five malaria mortality. We expected a positive shock from our apriori expectation. The result implies that increase in malaria cases will reduce under-five malaria mortality. The reason for this is that if there is increase malaria cases in the society will triger government to respond by purchse of anti-malaria drugs and ITNs. These activities will in the overall reduce malaria death in children of less than five years.

The variable education expenditure produced negative shocks to under-five malaria mortality all through. This conformed to the a priori expectation of the study which assume negative relationship between education expenditure and under-five malaria mortality. The result infers that when education expenditure (investment in human capitl) will in the long run increase more number of educated citizens both male and female who are more health conscious and are able afford the cost of treatment of malaria. Furthermore, education expenditure will fast track economic development which could lead to elimination of malaria and decrease in under-five malaria mortality in Nigeria. The finding of this study conformed to Farasat A. S. Bokhari et.al (2006), Okeke and Bernard (2014), Muthaka (2013), Anja and Schoeps (2015) and Nwanosike et.al (2015) who reported negative relationship between education expenditure and under-five mortality.

The shocks from malaria case affect public health expenditure positively after the second year and remain positive all through. This signifies that public health expenditure will increase with increase in reported malaria cases. The increase in expenditure can be either in recurrent or capital health expenditure. Recurrent wise, government will recruit and train more health personnel in advocacy, communication and social mobilization, diagnosis and treatment of malaria cases in rural communities, monitoring and evaluation of malaria programmes. In terms of capital health expenditure government expenditure can be increased through purchase of ITNs for free distribution, purchase of anti-malaria drugs, diagnosis equipments like Rapid Diagnostic Test (RDT) or microscopy materials and logistics. All these increases public health expenditures when malaria cases increases in the country.

Table 4.5 Variance Decomposition of Under-five malaria Mortality to Public Health Expenditure

Variance Decomposition of LU5M:

Perio...	S.E.	LU5M	LHEXPTOT...	LMCASE	LHHEXP	LEDUEXP	LFEMALELF...	LGDPC	LINFLR
1	0.013394	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.016362	99.51524	0.004560	0.009982	0.002096	0.006142	0.359432	0.102217	0.000330
3	0.019706	98.72816	0.070346	0.033381	0.003380	0.128336	0.785591	0.211756	0.039048
4	0.022496	97.53574	0.173704	0.073571	0.008417	0.305934	1.401603	0.395146	0.105883
5	0.025177	96.05524	0.306251	0.138580	0.015037	0.545820	2.091128	0.625374	0.222566
6	0.027723	94.33923	0.452309	0.233975	0.020459	0.821168	2.838231	0.909632	0.384995
7	0.030197	92.44853	0.601989	0.365081	0.024137	1.121235	3.602127	1.243646	0.593256
8	0.032618	90.42520	0.748195	0.535768	0.026092	1.435357	4.360204	1.626500	0.842685
9	0.035006	88.30739	0.886612	0.748327	0.026630	1.756283	5.092489	2.054878	1.127393
10	0.037371	86.12666	1.014881	1.003450	0.026084	2.078260	5.785606	2.524977	1.440082

Variance Decomposition of LHEXPTOTAL:

Perio...	S.E.	LU5M	LHEXPTOT...	LMCASE	LHHEXP	LEDUEXP	LFEMALELF...	LGDPC	LINFLR
1	0.067625	0.008290	99.99171	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.085656	0.018436	99.95041	0.005192	4.56E-05	0.001574	0.001694	0.022487	0.000158
3	0.094240	0.020615	97.39293	0.111794	1.195060	0.001686	0.001553	0.077424	1.198937
4	0.100367	0.022578	91.94454	0.402297	3.774270	0.001939	0.002902	0.208902	3.642568
5	0.105513	0.022353	85.45160	1.045790	6.095032	0.002148	0.011474	0.495693	6.875915
6	0.110247	0.021197	78.96432	2.129499	7.439880	0.012781	0.032280	0.971217	10.42883
7	0.114814	0.019634	72.95488	3.617990	7.873124	0.055685	0.067726	1.618039	13.79293
8	0.119289	0.018225	67.59482	5.390956	7.730353	0.152957	0.117285	2.383704	16.61170
9	0.123642	0.017365	62.92279	7.296684	7.333114	0.314875	0.178285	3.201953	18.73493
10	0.127793	0.017304	58.92183	9.198105	6.887756	0.535886	0.247239	4.012535	20.17935

Variance Decomposition of LHHEXP:

Perio...	S.E.	LU5M	LHEXPTOT...	LMCASE	LHHEXP	LEDUEXP	LFEMALELF...	LGDPC	LINFLR
1	0.295070	0.082644	10.41144	0.745061	88.76085	0.000000	0.000000	0.000000	0.000000
2	0.395857	0.074943	9.678055	0.566733	89.10841	0.276152	2.33E-05	0.155526	0.140161
3	0.449651	0.088377	9.958752	0.470355	88.20745	0.716489	5.05E-05	0.399486	0.159044
4	0.484512	0.103763	10.32476	0.472946	87.06073	1.202487	6.92E-05	0.679921	0.155322
5	0.510776	0.121790	10.59814	0.528615	85.99016	1.620475	0.000114	0.983981	0.156727
6	0.532450	0.141734	10.76609	0.600170	85.08992	1.936189	0.000329	1.295254	0.170311
7	0.551281	0.163794	10.84678	0.664907	84.36458	2.161864	0.001068	1.592273	0.204733
8	0.568091	0.187889	10.86509	0.712787	83.78353	2.322281	0.002918	1.858238	0.267268
9	0.583299	0.213966	10.84381	0.742352	83.30937	2.439783	0.006597	2.084355	0.359768
10	0.597138	0.241903	10.80034	0.756721	82.91072	2.530568	0.012813	2.269031	0.477910

4.4.4 Interpretation and Discussion of Variance decomposition Results

The table 4.5 above gives the variance decomposition or forecast error variance of under-five malaria motality. The forecaste error variance of public health expenditure in the long run (10th year) stood 1.10%. This implies that the influence of public health expenditures on under-five is very low given the 1.10% forecast error variance. Similarly, the influence of malaria cases on under-five malaria mortality in the long run is weak given the forecast error variance of 1%. This infers that malaria cases do not cause much variation in under-five mortality. However, the forecast error variance of malaria cases on public health expenditure is strong given the value of 9.19% in the 10th year. Because increase in malaria cases will increase public health expenditure through some form of intervention in terms of prevention, diagnosis, treatment, advocacy, communication and social mobilization.

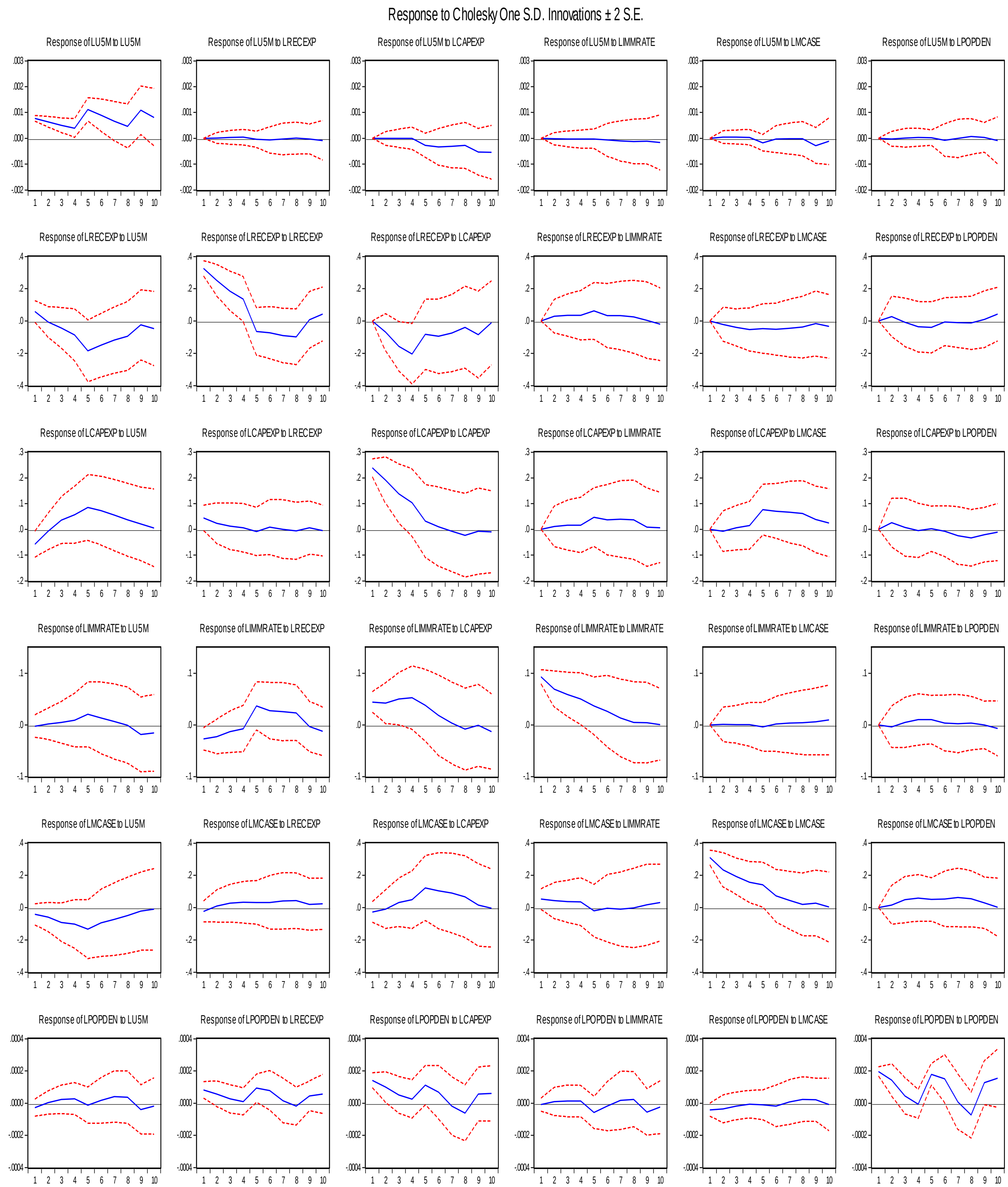
Education expenditure (recurrent and capital) produce forecast error variance of 1.8% from the 7th year to 2.01% in the 10th year. This signifies that in the long run education expenditure influences the variation in under-five malaria mortality. Female labor force participation have more significant effect on vaiation of under-five malaria mortality in the long run given th forecast error variance of 5.78% in the 10th year. This suggest that when women are gainfully employed, they able to earn income and this will have positive effect through reduction in under-five malaria mortality. The influence of income on under-five malaria mortality in the long run stood at 2.52% forecast error variance. This implies that income affect positively under-fie malaria mortality. When income increases more resources will be available for treatment of malaria and other illness this decreases the U5M . Similarly, the forecast error variance of income on public health expenditure from the first year to sixth year was not significant. However, the forecast error variance increases from 1.6% in the 7th year to 4.02% in the 10th year. This implies that income influences the variation in public health expenditure in the long run. The forecast error variance of inflation on under-five malaria mortality is not significant even in the long run given the value of 1.44% in the 10th year. This implies that inflation does not significantly influence the variation of under-five malaria mortality. However, it influences the level of public health expenditure in the long run given the forecast error variance of 6.7% in 5th year which continue to increase to 20.17% in the 10th year. This shows that as we move in to the future inflation significantly influence the variation in public health expenditure. Cost of living and drugs are usually high in the presence of inflation and this may affect negatively public health expenditure if indivual can not afford the drugs and treatment of malaria in children which could lead to increase in the mortality rate.

Under-five malaria mortality has forecast error variance of 0.017% on public health expenditure this shows that U5M does not influence increase in public health expenditure.

4.5 Public Health Expenditure shocks and under-five malaria mortality.

To fully capture the responds of under-five mortality to shocks from public health expenditure we decompose the health expenditure in to capital health expenditure and recurrent health expenditure. The variables (under-five malaria mortality, recurrent health expenditure, capital health expenditure, household's behavior, malaria cases and population density) in the model were subjected to ADF stationarity test (appendix 2). The series were stationary at different levels hence, we employed Modified VAR in line with Toda and Yamamota (1995) and Bello and Sanusi (2018) to estimate the variables. The VAR lag order selection criterion was used in selecting the lag length (appendix 4).

Figure 4.3 Impulse Response Function



4.5.1 Interpretation and Discussion of Impulse response Results

Itis observed in figure 4.3 that recurrent expenditure (salaries, allowances, workshops and conferences) does not transmit shocks to under-five mortality this implies that shocks in recurrent expenditure does not have influence on under-five mortality rate. This does not conform to the a priori expectation of the study. We expect increase in health workers salaries and allowances will not only motivate but make them more efficient in their duries, hence reduction in under-five malaria mortality. Though, corruption and ghost workers in the payroll could be responsible for recurrent expenditure without corresponding positive impact on child health (Riati and Junaid, 2016). Secondly, incessant strikes in the health sector is probably responsible for neutral effect of resurrent expenditure on underfive malaria mortality.

Capital expenditure produced negative shocks to under-five mortality after a period of four years which remain negative through without dying off. This in consistent with the a priori expectation of negative relationship between capital health expenditure and under-five malaria mortality. This infers that capital expenditure (training of doctors and other health worker, construction of health centres, purchase of drugs and hospital equipments, ITNs and LLINs) have significant impact in reducing under-five malaria mortality in the long run. This implies that when more clinics or hospital are built with more facilities/equipments and drugs there will be more access to health care services and this will reduce under –five mortality. This finding is in line with finding of Adeleke and Sijuola (2016) who found statistical significant influence of capital expenditure on under-five mortality. This is also in line with with government health capital expenditure policy of building basic health care facilities in all the wards across the country. However, the result does not conform to the existing reality in Nigeria. In reality increase in government capital expenditure in Nigeria does not decrease under-five malaria mortality because of corruption. Inspite effort to increase budgetary allocation to health (capital expenditure) it is not matched with the expected decrease in under-five malaria mortality. Money meant for projects are diverted for personnal use ans are also used for workshops, seminar and conferences which do not have direct impact on the beneficiaries (Yaqub et.al 2013).

Household's behavior produce negative and weak shock to under-five mortality after a lag of about five years. The result conforms to the a priori expectation of negative relationship between positive households behavior and under-five mortality. Increase in positive household's behavior in form of sleeping in ITNs and LLINs, keeping clean and safe environment from mosquitos and regular immunization of children will reduce under-five malaria mortality. The malaria control programe in Nigeria has unit of advocacy, communication and social mobilization were sensitization, advocacy visits and media are used in sensitizing households on how to prevent malaria and importance of immunization (RBM, 2010). This activities change influence household's health behavior positively thereby reducing under-five malaria mortality. However, studies (Malar J (2014), Malar J (2013), Koenker and Kilian (2014) have shown that despite the advocacy, communication and social mobilization some household's do not use the ITNs given to them (RBM, 2010). Secondly, some household's behavior is still shaped by their understanding of religion and culture thereby avoiding immunization for their children or refusing to attend or go to any health facility when their children fell ill and resulting to traditional treatment which have often increase the under-five malaria mortality rate (Ramesh and Sam (2007)

Population density affects under-five malaria mortality positively. This implies that high population without corresponding health facilities will rrestrict some individual from having access to health care facilities especially in the rural areas and this may increase under-five malaria mortality. This is in consistent with the a priori expectation of the study of positive relationship between population density and under-five mortality. the result is in line with the findings of John and Andrew (2007), Erick (2013) and Quinhas (2014) that uncontrol population could lead high demand of health facilities which may not be available. This may result to increase in child mortality rate. According to 2017 estimate Nigeria population stood at 190.632,261(NBS, 2018) of children between the ages of 0-14 constitute 42% of the total population. The increase in children population has not met with corresponding increase in health care facilities thereby causing long que, over stretched health facilities and high doctor-patient ratio. The resultant which has always been increase in under-five malaria mortality.

Under-five mortality produces positive shocks to recurrent expenditure which stabilize after two years before turning negative. Under-five mortality has positive influence on recurrent expenditure in the long run. Recurrent expenditure is likely to be increased when under-five mortality increases because more health personnel especially community health worker, nurses will be employed and deployed to communities for malaria prevention, diagnosis, case management and treatment to avert further malaria mortality rate. For example, the the Roll Back Malaria (RBM) programe of federal government and malaria programs at state level are case in point.

Under-five mortality transmits negative shocks to capital expenditure. This means the response of capital expenditure to schocks from under-five malaria mortality is negative. This implies that a sudden decrese in under-five malaria mortality as a results of improvement in environmental quality, positive house hold behaviours would lead to a dercrease in capital health expenditure like purchse of drugs, ITNs, malaria diagnostic equipment.

Capital health expenditure transmits positive shocks to recurrent health expenditure. For example when Capital expenditure increases by building of health centres, equipments, clinics and hospital wards, they will require personnel ranging from doctors, nurses, mid-wives and community health workers. This implies additional salaries and allowances which will increase the size of the recurrent expenditure. Capital health expenditure transmits negative shocks to under-five mortality. This implies that capital health expenditure affects malaria cases positively. When capital health expenditure increases we assume that more clinics are built bringing people closer to health facilities. More equipment, drugs are purchased for diagnosis and treatment of malaria and this is expected to decrease under-five malaria mortality. With new facilities and drugs the efficiency in the malaria prevention and diagnosis will be improved and this will reduce under-five malaria mortality.

House hold's behavior produce positive shocks to malaria cases. For example, negative Household's behavior such as not keeping clean environment, absconding from child immunization and non use of ITNs will strongly increase malaria cases. Dirty environment produce mosquitos and also aparthy towards immunization reduce children immunity to fight back mosquito bites this will increase malaria cases. When malaria cases increase the government responds by purchase of ITN, anti-malaria drugs, this raises capital health expenditure budget.

Capital health expenditure also has positive influence on house hold's behavior in the short run. When capital expenditure increases through the provision of more hospitals, purchase of equipments and drugs it make health services more accessible and this change the behavior of household's because of nearness of the health facility and availability of drugs. Capital health expenditure also significant influence population density positively. Provisions of health care delivery services to communities will reduce malaria cases and under-five mortality.

Table 4.6 Variance Decomposition Results

Variance Decomposition of LU5M:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.000772	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.001002	99.65708	0.010085	0.009003	0.037074	0.233066	0.053690
3	0.001122	99.43350	0.085341	0.007761	0.096015	0.320827	0.056551
4	0.001192	99.09961	0.206448	0.007124	0.157313	0.373333	0.156172
5	0.001667	95.61444	0.183419	2.728542	0.100975	1.279932	0.092691
6	0.001925	93.25011	0.270994	5.067151	0.205469	0.990054	0.216222
7	0.002062	91.49113	0.258363	6.738213	0.451682	0.870463	0.190150
8	0.002137	89.93677	0.240626	7.977151	0.760483	0.814272	0.270702
9	0.002473	86.41700	0.195680	10.49225	0.784329	1.892986	0.217752
10	0.002669	83.41474	0.266308	13.15604	1.043426	1.822980	0.296508

Variance Decomposition of LRECEXP:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.331904	3.133970	96.86603	0.000000	0.000000	0.000000	0.000000
2	0.424323	1.939278	94.24701	2.668524	0.498723	0.236763	0.409700
3	0.494138	2.214866	83.56914	12.16463	0.900276	0.820269	0.330826
4	0.563048	4.057363	70.18202	22.46441	1.092931	1.536380	0.666891
5	0.608638	12.76917	61.19586	21.10396	1.994734	1.930089	1.006186
6	0.641157	17.00245	56.42302	21.21843	2.063629	2.378314	0.914149
7	0.665030	18.98966	54.27798	21.01221	2.171274	2.680543	0.868340
8	0.681471	19.98820	53.75922	20.33465	2.205953	2.854232	0.857749
9	0.687375	19.76627	52.84998	21.48355	2.172725	2.861537	0.865943
10	0.692915	19.92548	52.40314	21.16507	2.220241	3.058824	1.227246

Variance Decomposition of LCAPEXP:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.250158	5.341540	3.125589	91.53287	0.000000	0.000000	0.000000
2	0.317133	3.381428	2.500685	93.28446	0.116110	0.049503	0.667814
3	0.348525	3.831984	2.187728	92.99728	0.303530	0.074264	0.605210
4	0.368667	5.794332	1.981378	90.95195	0.476644	0.241790	0.553910
5	0.390150	9.864525	1.816945	81.90649	1.897441	4.017419	0.497178
6	0.405077	12.34752	1.731990	76.03789	2.595746	6.792130	0.494722
7	0.416917	13.39406	1.635056	71.81172	3.371359	8.980593	0.807212
8	0.426738	13.53824	1.581696	68.84301	3.969400	10.69108	1.376578
9	0.429666	13.58648	1.580486	67.93508	3.953880	11.34814	1.595931
10	0.430753	13.53470	1.585623	67.64381	3.957411	11.62615	1.652317

Variance Decomposition of LIMMRATE:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.106605	0.059137	6.541789	17.24301	76.15606	0.000000	0.000000
2	0.135977	0.053174	6.794442	20.14971	72.92568	0.003700	0.073291
3	0.157224	0.123923	5.800311	25.35658	68.56358	0.004688	0.150918
4	0.174010	0.361523	4.910443	29.87549	64.36258	0.005610	0.484357
5	0.186846	1.529437	8.105431	29.97105	59.64004	0.043936	0.710106
6	0.192022	1.944025	9.695111	29.28042	58.32800	0.049052	0.703389
7	0.194332	2.003125	11.16599	28.61921	57.42870	0.081304	0.701673
8	0.196047	1.969824	12.38888	28.30725	56.48983	0.126426	0.717792
9	0.197081	2.827367	12.28779	28.01331	55.93960	0.221548	0.710386
10	0.198887	3.366966	12.47478	27.94610	54.92938	0.453709	0.829073

Variance Decomposition of LMCASE:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.320407	1.718996	0.545731	0.697045	2.728118	94.31011	0.000000
2	0.403708	3.226665	0.403365	0.494079	2.881089	92.83225	0.162553
3	0.463076	6.405704	0.637568	0.863329	2.843677	88.00314	1.246586
4	0.507876	9.366047	0.953276	1.675225	2.872590	82.71327	2.419590
5	0.560690	13.37494	1.098209	6.036633	2.474953	74.21258	2.802693
6	0.585991	14.84947	1.308267	8.676230	2.272606	69.48597	3.407448
7	0.603622	15.43683	1.699056	10.37904	2.163811	66.05004	4.271230
8	0.613455	15.56662	2.122142	11.25190	2.097204	64.04972	4.912419
9	0.616011	15.56904	2.207335	11.22527	2.167545	63.72977	5.101042
10	0.617343	15.53178	2.343787	11.18173	2.403627	63.45797	5.081114

Variance Decomposition of LPOPDEN:

Perio...	S.E.	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
1	0.000261	1.196911	9.836998	29.49729	0.141081	2.615926	56.71179
2	0.000321	0.798429	9.634467	28.97864	0.186290	3.055207	57.34697
3	0.000330	1.212013	9.723610	29.68117	0.348225	3.177741	55.85724
4	0.000333	1.863653	9.660550	29.78352	0.475979	3.176197	55.04010
5	0.000409	1.330548	11.54544	27.06108	2.382784	2.176888	55.50326
6	0.000450	1.229977	12.62561	24.68960	2.162479	1.960821	57.33151
7	0.000453	2.022517	12.57728	24.54657	2.273887	1.958471	56.62127
8	0.000466	2.503271	12.05743	24.92974	2.403690	2.096057	56.00981
9	0.000493	2.888010	11.54501	23.55641	3.408499	2.035589	56.56648
10	0.000524	2.679659	11.37941	22.12898	3.244779	1.833554	58.73362

Cholesky Ordering: LU5M LRECEXP LCAPEXP LIMMRATE LMCASE LPOPDEN

4.5.2 Interpretation and Discussion of the Variance Decomposition Results

In table 4.6, in the first quarter (1-4 year) recurrent expenditure does not have impact on under-five malaria mortality. The forecast error variance of recurrent expenditure on under-five mortality is 0.26% in the long run. This implies that changes in recurrent health expenditure (salaries, allowances, conferences, workshop and meetimgs) does not have significant influence on under-five malaria mortality even in the long run. Capital expenditure (provision of health care centers, purchase of hospital equipments, drugs) does not influence under five mortality in the first quarter, however, in the long run capital expenditure influence decrease in under-five malaria mortality by 13.15%. This infers that capital health expenditure influences reduction in under-five malaria mortality when compared to recurrent health expenditure. Even though, the result shows that an increase in capital health expenditure will results in decline of under-five malaria mortality, the existing reality in Nigeria does not support our claims. Increase capital health expenditure over the years has not actually led to the expected decline in U5MM because of Nigeria's disease (corruption, wastages and mismanagement of public resources). Resources budgeted for health are often misappropriated and mismanaged living little impact on child's health (Yakub et.al 2013)

The household's behavior influences the decrase in under-five malaria mortality by 1.04% in the runlong run. This implies that when households change their behavior positively by complying with immunization routine for children, keeping clean environment, sleeping inside ITNs will significanlty reduce under-five malaria mortality.

Change in Malaria case accounts for 1.82% change in under-five malaria mortality in the long run. This infers that as more cases of malaria are reported. It may likely result in the increase of malaria death of children less than five years. Under-five malaria mortality influences the change in recurrent health expenditure in first quarter by 4.05%, but as we move in to the long run, U5MM influence the change in recurrent expenditure by 19.92% implying that as U5MM increase the need for malaria programe such as prevention and treatment will increase and more health personnel will be recruited for the job hence, increase in salaries and allowances. Capital expenditure has 0% influence on recurrent expenditure in year one. But as we move in to the future change in recurrent expenditure is accounted by 21.16% change in capital expenditure. A change in house hold's behavior in the long run will cause about 2.22% fluctuation in the recurrent expenditure. Change in malaria case in the long run will cause 3.05% fluctuation in recurrent expenditure.

Under-five mortality influences the change in capital expenditure by 9.5% in the fifth year. In the 10th years, a change in under-five mortality can influence the change in capital expenditure by 13.53%. This explains the need for more investment in health such as more purchase of insecticide treated mosquito nets (ITNs), indoor residual spray (IRS), malaria diagnostic equipments, more provision of health care centres to ensure more access to health care delivery. This will in the long run decrease cases of Under-five malaria mortality.

The influence of recurrent expenditure on capital expenditure is weak because in the long run it accounted for just 1.5% influence on capital expenditure. The influence of household's behavior on capital expenditure in the long run is 3.95% malaria cases does not have influence on capital expenditure in the first quarter, but in the 10th years malaria cases influences the capital expenditure by 11.62%. Population density influences capital expenditure in the long run by 1.65%.

Recurrent influence the household's behavior in the long run by 12.47%. The capital expenditure influences the change in household's behavior from 20.14 in the first year and increase to 27.94 % in the 10th year. The malaria case and population density have no significant influence on household's behavior in the long run.

Under-five mortality accounts for change in malaria case by 15.53% in the long run. the recurrent expenditure has no influence on malaria case in the first four years. However, as move in to the future, recurrent expenditure influence the change in malaria cases by 2.34%. a change in capital expenditure brings about 11.18% decrease in malaria cases. Household's behavior influences the change in malaria cases at an average of 2.40% in the 10th year. Population density influence on malaria cases gradually increases from 2.41% in the fourth year to about 5.08% in the 10th year.

Recurrent expenditure influences changes in population density. In the long run recurrent expenditure brings about 11.37% changes in population density. Capital expenditure has greater influence on population density. In the first year capital expenditure influences change in population density by 29.49% however, as we move in to the future the forecast error variance of capital expenditure on population density reduced to 22.12%. In the long run, the household's behavior accounts for 3.24% changes in population density. Malaria case has weak effect on population density as it is affected by 2.03% in the 9th year.

4.5.3 Granger Walds Causality Test

Table 4.7 Ganger Walds Causality Test: Public Health Expenditure Shocks and Under-Five Malaria Mortality

Null hypothesis	**WaldChi-square test**	**P – value**	**Conclusion**
RECEXP does not Granger Cause U5M	0.141795	0.9996	Cannot Reject H_o
U5M does not Granger Cause RECEXP	5.448642	0.3636	Cannot Reject H_o
CAPEXP does not Granger Cause U5M	9.773538	0.0819	Cannot Reject H_o
U5M does not Granger Cause CAPEXP	16.51069	0.0055	Reject H_o
IMMRATE does not Granger Cause U5M	0.232302	0.9987	Cannot Reject H_o
U5M does not Granger Cause IMMRATE	4.809907	0.4395	Cannot Reject H_o
MCASE does not Granger Cause U5M	5.175967	0.3948	Cannot Reject H_o
U5M does not Granger Cause MCASE	3.007403	0.6988	Cannot Reject H_o
POPDEN does not Granger Cause U5M	32.50345	0.0000	Reject H_o
U5M does not Granger Cause POPDEN	4.339618	0.5016	Cannot Reject H_o

From table 4.7 the granger wald causality test shows that recurrent expenditure and capital expenditure does not cause capital expenditure to increase or derease however, under-five malaria mortality causes capital health expenditure to increase. The government will respond to increase in under-five mortality by increasing it health expenditure by construction of clinics, purchase of anti-malaria drugs, purchase and distribution of ITNs etc. Population density granger cause under-five mortality and the relationship is uni-directional. This implies that with increase in population there may be insufficient facilities to meet up with increasing demand for health care services especially treatment of malaria which could lead to increase in child malaria mortality rate.

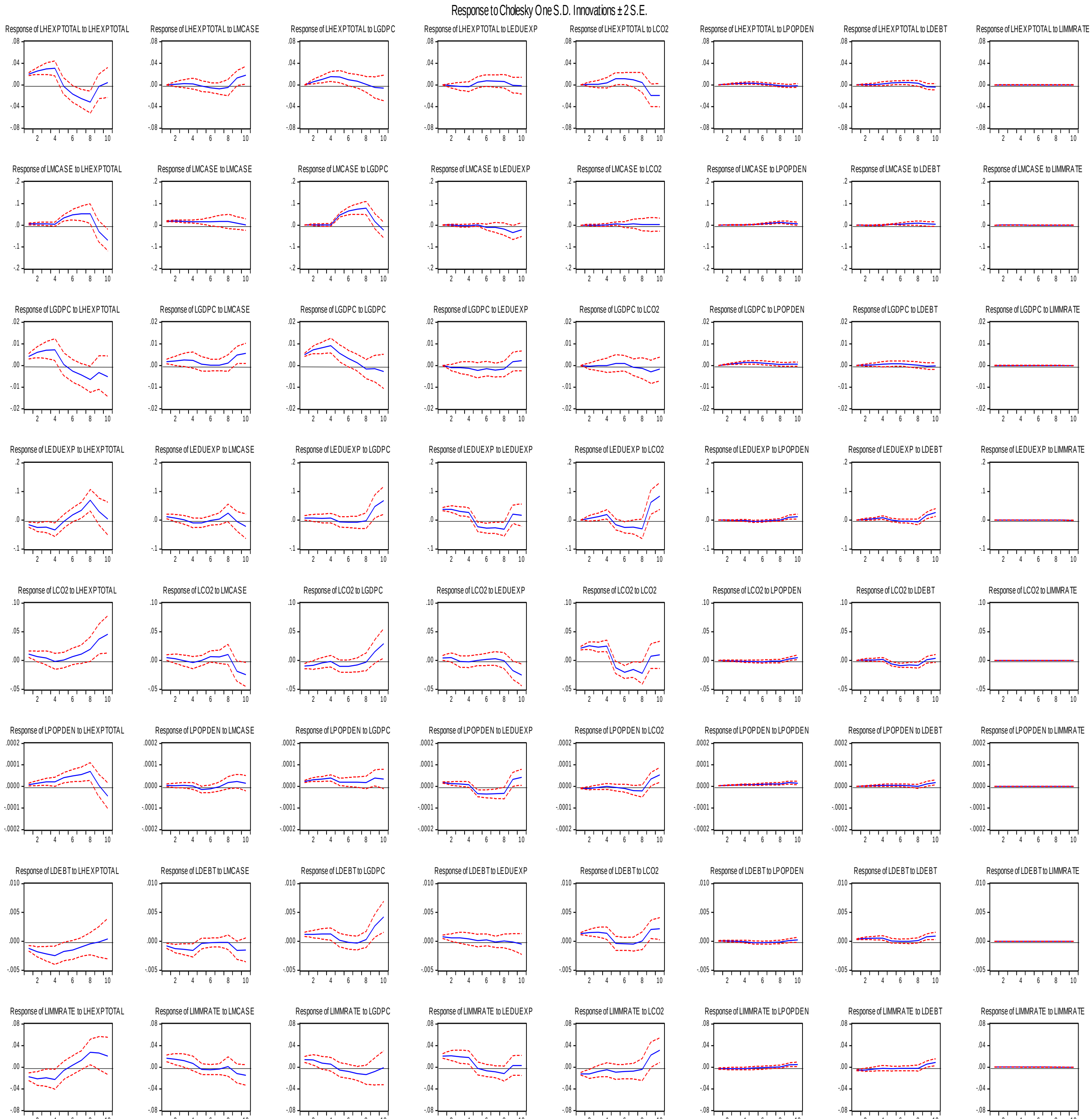
4.6. Determinants of Public Health Expenditure in Nigeria.

The fourth model captures the fourth objective of the work. First, given the absence of co integration among the variables and secondly, the ADF test shows that the variables (total health expenditure, malaria cases, income, environmental pollution, population, total debt stock, education expenditure and household's behavior) are not integrated of order one (see table 4.2 in appendix 4b). We employed modified VAR following the spirit of Toda and Yamamoto (1995) and Bello and Sanusi (2018) where VAR estimation can be used even if the data are stationary in different orders. Hence, we employed modified VAR to examine the response of public health expenditure to changes in determinants of health in Nigeria. Diagnostic test (granger wald causality test) was used to check for causality amoung the variables. The VAR lag order selection criteria was used in selecting the lag lenth (see appendix 4)

4.6.1 Results of the Vector Autoregressive (VAR) model

Modified VAR model was employed investigate the influence of health determinants on public health expenditure. Other results ancillary to the VAR estimation (impulse response function, variance decomposition and granger walds causality test) is presented and discussed below.

Figure 4.4 Impulse Response Function (IRF) of determinants of Government Health Expenditure in Nigeria.



4.6.2 Interpretation and Discussion of Impulse Response Function Results.

Figure 4.4 gives the impulse response results of determinanats of public health expenditure in Nigeria. Response of government health expenditure to government health expenditure (own shock) is affecting itself positively which last for about five years before dying off. This infers that public health expenditure is an important variable in determining health outcome in Nigeria.

The variable (malaria case) transmits a positive shock to government health expenditure from initial state which last for about four years before adjusting to equilibrium. This implies that change in malaria cases will increase government health expenditure in the shortrun. This conformed to our a priori expectation of positive relationship between malaria cases and government health expenditure. We expect that as malaria cases increases government health expenditure (capital) in form of increase in distribution of ITNs and drugs should be increased significantly. Though we expect a strong positive shock however, the reason for weak and positive relationship could be explained within the context of quality of governance in Nigeria where imbezzlement and diversion of public funds is common hence, release of funds to takle malaria cases may not get to the beneficiaries (Yaqub 2012). This will affect productivity of labour and welfare in the both periods. The result is in conformity to findings of Nwasinoke (2015) who found that mlaria cases have positive and significant effect in variation of government health expenditure in Nigeria.

The variable Income transmits positive shock to government health expenditure from the initial period which diminishes gradually until it dies off after the 8th year. The result is in line with our a priori expectation. The result shows that an increase in national income has a positive long run effect on public health spending. The implication is that increases in income tend to raise public expenditure in the long run. Thus as Nigeria's income rises, it has the potential to spend extra more on the health sector of the economy. Though, Nigeria's rgdpc have been rising since 1990 to 2017 reaching an all time high of 3,224.695 USD in 2014 and recording low of 492.490 USD in 2017 (ceicdata, 2018) but share of health allocation in budget in Nigeria has not increase with increase in RGDPC of the country.

Education expenditure did not have effect on government expenditure at the initial stage untill after the 4^{th} year when it began to produce positive and weak shock which dies off after the 8^{th} year. This implies that an increase in education expenditure will increase public health expenditure. The result did not comformed with our a priori expectation of negative relationship between education expenditure and public healh expenditure because of the trade-off between the two. Both education and health are human capital therefore; as more is allocated to health fewer resources will be available to education and vice-versal. The positive relationship in the longrun may be due to increasing demand for health services as a result of more educated people who are now more conscious of their health will demand for more health services from government.

Environmental pollution transmits positive shock to government expenditure only after the 4^{th} year and dies off in the 9^{th} year. This implies that when environmental pollution increases government health expenditure increases. This is consistent with our a priori expectation of positive relationship between pollution and increase in public expenditure. It is asummed when environmental pollution increases such as bad drainage system, accumulation of bad water in the drainage and lack of general cleaniness and good sanitation will increase mosquitos and more cases of malaria morbidity and this will increase government health expenditures in the form of malaria case management and diagnosis. The finding of this study is consistent with Huabouni and Abednnadher (2010) who found negatve relationship between public health expenditure and environmental pollution.

Population density and debt transmit a very weak and positive shock to government expenditure from the 3rd year which dies off in the 10th year. This conformed to our priori expectation of positive relationship between public health expenditure and population growth. This infer that as population increases there will more demand for health care service in the form of construction of more healthcare facilities, recruitment of physician, nurses and other health workers. The finding of this study conforms to the findings of Ilori (2015) and Alihussain and Enayatollah (2014) who examined the determinants of public health expenditure in Nigeria and Malaysia respectively.

The variable debt transmits positive and weak shock to public health expenditure. This conformed to the a priori expectation of the study that increase in financial resources of government will increase its expenditure. Loans make more financial resources available to government hence, more allocation to health especially fight against malaria scourge by production and distribution of ITN, IRS, malaria drugs and other malaria intervention programmes. The result aligned with that of Ekwueze (2012) in his study public expenditure and economic growth in Nigeria.

Household's behavior does not produce any shock to government health expenditure; the result shows that the effect of household's behavior on public health spending is neutral. Income responds positively to shocks from government health expenditure after four years. This infers that increase in government health expenditure will lead to increased income in Nigeria. For example, Increase in health expenditure especially capital health expenditure (construction of clinics, purchase of hospital equipments and facilities and training of doctors and nurses) will mean more easy access to qualify doctors and nurses. Secondly, more estanblishment of health care facilities in line with government policy of providing basic health care facilities in all the wards in LGAs across the country for easy accessibility (NPHCC 2015). This will in the overall produce healthier individual and this will in turn, increase their participation in productive activity and earn higher income. This is consistent with economic theory of marginal productivity of labor and the findings of Imam and kosh (2014).

Table 4.8 Variance decomposition of Determinants of Public health expenditure in Nigeria.

Variance Decomposition of LHEXPTOTAL:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.019638	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.032746	96.46730	0.120635	2.943148	0.308356	0.063461	0.092554	0.004546	4.48E-07
3	0.045565	92.07117	0.297774	6.642827	0.629255	0.102582	0.237288	0.019097	5.97E-06
4	0.057152	86.67889	0.294506	11.24283	0.812640	0.423579	0.445601	0.101911	3.95E-05
5	0.060524	77.48132	0.437813	15.90750	1.365183	3.754822	0.663506	0.389786	6.38E-05
6	0.065370	73.05988	1.073992	15.77159	2.505200	6.223717	0.647025	0.718479	0.000113
7	0.071924	73.00722	1.946858	13.86823	2.905401	6.821443	0.537497	0.913199	0.000158
8	0.079388	76.42182	1.976466	11.39114	3.015294	5.862118	0.468987	0.864012	0.000167
9	0.082989	70.08285	4.027328	10.76922	2.766740	10.90110	0.509130	0.943483	0.000153
10	0.087461	63.34514	7.667689	10.16000	2.527276	14.71776	0.484282	1.097713	0.000138

Variance Decomposition of LMCASE:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.018041	7.971527	92.02847	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.026904	8.858578	90.74799	0.316810	0.010220	0.012520	0.008260	0.045573	4.95E-05
3	0.032733	9.461453	89.35521	0.234011	0.812561	0.043334	0.047152	0.046219	5.71E-05
4	0.036695	8.496967	90.06577	0.187460	1.047315	0.073850	0.091345	0.037225	7.10E-05
5	0.069774	25.09851	29.77568	43.59613	0.333919	0.744283	0.110283	0.341100	9.10E-05
6	0.108610	29.49043	14.22545	54.30747	0.969950	0.344895	0.330801	0.330917	9.31E-05
7	0.143789	30.52712	9.579591	57.34723	1.120298	0.375057	0.625657	0.424860	0.000187
8	0.174214	29.78984	7.430246	59.09572	1.930944	0.266048	0.967473	0.519409	0.000312
9	0.181477	30.13776	7.108025	55.33969	5.424880	0.261866	1.174325	0.553085	0.000374
10	0.197452	38.19206	6.010345	48.20161	5.789474	0.228275	1.059595	0.518249	0.000394

Variance Decomposition of LGDPC:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.006642	39.21202	7.100407	53.68758	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.011687	39.21139	5.247994	54.54659	0.764061	0.088116	0.140424	0.001425	1.64E-06
3	0.016096	39.73981	5.037650	53.91484	0.858389	0.047388	0.375807	0.026071	4.17E-05
4	0.020108	38.35430	4.639763	55.17010	1.060189	0.030488	0.663156	0.081892	0.000114
5	0.021065	34.99711	4.316097	57.07570	2.192858	0.236469	1.009864	0.171708	0.000194
6	0.021557	34.86086	4.123332	56.52489	2.567445	0.393563	1.237026	0.292562	0.000329
7	0.022207	36.98194	3.888359	53.58382	3.398223	0.532280	1.295539	0.319400	0.000442
8	0.023328	41.24607	3.724976	49.11756	3.579029	0.830057	1.210307	0.291476	0.000527
9	0.024341	39.68487	7.260254	45.53120	3.760668	2.313160	1.160904	0.288285	0.000660
10	0.025792	39.40557	11.00697	41.72288	4.015870	2.501699	1.074087	0.272127	0.000798

Variance Decomposition of LEDUEXP:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.043965	12.63853	8.462766	3.106707	75.79200	0.000000	0.000000	0.000000	0.000000
2	0.064602	20.49720	5.159138	2.901301	70.49416	0.815622	0.003257	0.129276	3.96E-05
3	0.076678	24.31541	3.680873	2.624645	65.89898	3.004060	0.011922	0.463877	0.000236
4	0.091208	30.53977	3.735423	2.471044	55.13873	6.928248	0.016272	1.169969	0.000549
5	0.096186	27.66315	4.377874	2.612268	55.38588	8.664129	0.243291	1.052887	0.000523
6	0.105313	26.15263	3.666827	2.584303	53.42026	12.84949	0.336667	0.989380	0.000437
7	0.116858	29.76838	3.119212	2.521407	48.70566	14.70420	0.284683	0.896094	0.000359
8	0.144973	42.39318	4.931337	1.651161	36.29931	13.75766	0.185681	0.781433	0.000237
9	0.169932	33.96614	3.657760	9.067381	27.89319	23.37217	0.517782	1.524967	0.000604
10	0.205832	23.19706	3.644569	17.31876	19.67870	32.73749	0.714635	2.707714	0.001066

Variance Decomposition of LCO2:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.026712	17.18534	3.386066	13.61772	2.796575	63.01430	0.000000	0.000000	0.000000
2	0.038863	11.09067	2.185952	10.80954	2.856765	73.00023	0.012797	0.044040	4.92E-07
3	0.045720	8.920732	1.595918	8.680503	2.243302	78.42331	0.061770	0.074461	8.20E-06
4	0.052491	6.874769	1.731711	6.658663	1.886773	82.55618	0.131204	0.160681	1.71E-05
5	0.055260	6.210071	1.563325	9.464076	1.704223	79.50177	0.216142	1.339553	0.000835
6	0.061343	6.366290	2.512597	10.44387	1.463176	75.70852	0.300496	3.203216	0.001842
7	0.065642	8.264996	3.100961	10.52995	1.524060	72.05092	0.307479	4.219072	0.002558
8	0.073353	13.65624	4.507608	8.566510	1.225247	67.01814	0.267150	4.756228	0.002880
9	0.087896	27.50300	7.712294	9.053348	4.754534	47.37276	0.276018	3.325937	0.002106
10	0.109773	34.72595	10.01926	12.95377	8.491090	31.17934	0.394261	2.234967	0.001369

Variance Decomposition of LPOPDEN:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	3.18E-05	7.690708	2.177818	50.94841	29.22330	9.031508	0.928260	0.000000	0.000000
2	4.99E-05	11.81832	1.477489	59.79728	18.42154	7.118757	1.318326	0.048256	3.76E-05
3	6.58E-05	17.27753	1.424443	61.02383	13.73398	4.560123	1.775194	0.204669	0.000230
4	8.06E-05	18.41551	0.978785	64.38905	10.23524	3.052595	2.339131	0.589101	0.000580
5	9.97E-05	27.90036	2.922659	46.12930	17.83104	2.306939	2.201119	0.707789	0.000793
6	0.000120	36.31197	2.858999	34.63791	21.17985	2.188510	2.172693	0.649195	0.000871
7	0.000139	42.47914	2.111524	27.49265	21.77685	3.410021	2.221011	0.507956	0.000845
8	0.000162	49.22556	2.650796	21.42317	19.88817	4.248038	2.189761	0.373712	0.000795
9	0.000176	41.81410	3.969374	23.05462	20.38143	7.239804	2.793771	0.745692	0.001214
10	0.000199	37.89108	3.675323	21.02466	20.43077	12.78972	2.791378	1.395370	0.001699

Variance Decomposition of LDEBT:

Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.002456	24.27248	11.28155	23.54985	9.923122	28.83030	0.046477	2.096210	0.000000
2	0.003912	31.36788	15.10038	18.92142	6.352693	25.82502	0.023490	2.409071	5.26E-05
3	0.005171	35.95544	15.93050	16.81072	4.966527	23.85429	0.016450	2.465969	0.000113
4	0.006277	40.13057	17.18945	15.36122	3.756475	21.09662	0.023122	2.442383	0.000159
5	0.006557	44.25479	16.11341	14.12449	3.475613	19.63248	0.148637	2.250418	0.000157
6	0.006762	46.66075	15.28204	13.35727	3.390093	18.92254	0.271300	2.115854	0.000154
7	0.006870	47.33052	14.88662	13.18126	3.307437	18.88244	0.361654	2.049899	0.000168
8	0.006895	47.36925	14.85581	13.25085	3.284494	18.75797	0.406481	2.074896	0.000244
9	0.007874	36.36610	15.41935	21.75847	2.547732	21.07546	0.328128	2.504290	0.000473
10	0.009390	25.77417	13.42699	35.64792	2.042870	20.12554	0.294442	2.687377	0.000686

Variance Decomposition of LIMMRATE:									
Perio...	S.E.	LHEXPTOT...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
1	0.037388	22.98964	18.82696	14.34932	29.97336	10.97281	0.554819	2.330810	0.002289
2	0.053701	27.06540	16.66170	12.82889	30.17268	10.64484	0.556477	2.067954	0.002051
3	0.062606	29.84344	15.80289	10.93872	31.53817	9.428663	0.589901	1.856406	0.001809
4	0.069702	34.74516	13.73049	9.393475	31.86749	8.065774	0.616698	1.579352	0.001562
5	0.070983	34.27036	13.54107	9.613886	30.85551	9.406065	0.648169	1.663332	0.001611
6	0.072536	33.06794	13.36726	10.45767	30.40834	10.33820	0.646836	1.712158	0.001594
7	0.075597	33.17520	12.53859	12.07722	29.39401	10.55695	0.596959	1.659594	0.001476
8	0.082770	38.81580	10.47895	12.97216	26.68236	9.101679	0.502601	1.445216	0.001234
9	0.090957	40.21132	10.32562	11.53436	22.19528	13.53653	0.626462	1.569142	0.001290
10	0.099915	37.44201	10.79294	9.574433	18.46478	20.95085	0.731486	2.042036	0.001470

Cholesky Ordering: LHEXPTOTAL LMCASE LGDPC LEDUEXP LCO2 LPOPDEN LDEBT LIMMRATE

4.6.3 Interpretation and Discussion of the Variance Decomposition Results.

From table 4.8 across the rows the figures indicates the percentage of forecast error variance by the variable at top head (dependent variable). Ten years period was chosen for the forecast error variance. In the first year 100% of forecast error variance in government health expenditure is explained by the variable itself. Meaning that other variables in the model do not have any influence on government health expenditure. However, as we move in to the future the forecast error variance dwindles to 63.34%.

Malaria case has a weak impact on government health expenditure with just about 7.66% forecast error variance in the 10th year. This implies that malaria will influence the level of government expenditure by 7.66% in the longrun. Income will influence changes in government health expenditure in the short run by 15%. This implies that income has the capacity to change the level of government expenditure in the short run. Educational expenditure is strongly exogenous (weak impact on government expenditure) throughout the years with a forecast error variance of 2.5%. This means that in the longrun education expenditure will cause public health expenditure to expand by 2.5%. Environmental pollution is also strongly exogenous in the first four years however, in the 9th to 10th year the variance forecast error for government health expenditure increases to 10.9 and 14.71%. This means that in the long run bad environmental pollution will influence increase in government health expenditure by 14.71%. Population density, debt and household's behavior are all strongly exogenous i.e having weak influence on government health expenditure.

Taking malaria case as the dependent variable, government expenditure is a strong influencer of malaria case from year five. The forecast error variance of government health expenditure to malaria case in the fifth year was 25% which continue to rise up to 38% in the tenth year. About 92% of forecast error variance in malaria case is explained by the variable itself. However, it continues to dwindle as we move on to the future such that by 10th year the forecast error variance dwindled to 6%. Income in the first four years is strongly exogenous (weak impact on malaria case). However, influence of income on malaria case increase from 5th to 8th year and begin to fall in 9th to 10th year with forecast error variance of 55.33% to 48.20% respectively. Other variables such as education expenditure, environmental pollution, population density, debt and household's behavior do not any influence on malaria cases.

On the average of 50%, the forecast error variance in income is explained by the variable itself. About 39% of forecast error variance of income is explained by government health expenditure. The government health expenditure has 12% forecast error variance on education expenditure. The influence of government health expenditure on education expenditure continue to increase from the 2nd year up to eighth year with 42% after which it decline in the 8th and 10th year from 33% to 23% respectively. Education expenditure is a strong influencer of itself with about 75% of forecast error variance. However, it continues to decline over the years and resting in the 10th with 19.6% forecast error variance.

Government health expenditure has influence on population density. The forecast error variance was 7.7% in the 1st year. The influence continues to increase up to 49.22% in the 8th year after which it decline to 37% in the 10th year. Income has influence on population density. The forecast error variance population density is explained by variation in income from 50.94% in the year one and continue to increase up to 64% in the 4th year after which it continue to dwindled up to 21% in the 10th year. Education expenditure also influences population density on the average of 20% throughout the forecast period. It is interesting to note that population density is not a strong influencer of itself judging from the values of 0,9% in the year one and 2.7% in year 10.

Change in debt can be explained by the forecast error variance of government health expenditure. In the 1st years the forecast error variance was 24% which continue to increase steadily up 47% in the 8th year after which it declined to 25% in the 10th year. Malaria case on the average influences debt with forecast error variance of 15% which is sustain over the forecast period. Income also influences the variation in debts in the long run giving the variance of 35% of forecast error variance. The debt is not a strong influencer of itself. Government health expenditure influences the variation in household's behavior on the average. From year one it increases steadily over the entire forecast period from 22.9% to 40% in the 9th year. Malaria also influences household's behavior. The impact of income on household's behavior is strongly exogenous. Education expenditure also influences house hold behavior over the entire forecast period with an average of 30%

4.6.4 Granger Walds Causality Test of Determinants of Public Healths Expenditure

Table 4.9 Granger Walds Causality Test of Government Health Expenditure Determinants in Nigeria.

Null hypothesis	WaldChi-square test	P – value	Conclusion
MCASE does not Granger Cause HEXTOTAL	25.79820	0.0002	Reject H_o
HEXTOTAL does not Granger Cause MCASE	5.179111	0.5211	Cannot Reject H_o
GDPC does not Granger Cause HEXTOTAL	8.995405	0.1736	Cannot Reject H_o
HEXTOTAL does not Granger Cause GDPC	45.69040	0.0000	Reject H_o
EDUEXP does not Granger Cause HEXTOTA	20.82930	0.0020	Reject H_o
HEXTOTAL does not Granger Cause EDUEX	19.04966	0.0041	Reject H_o
CO2 does not Granger Cause HEXTOTAL	4.956773	0.5494	Cannot Reject H_o
HEXTOTAL does not Granger Cause CO2	46.77253	0.0000	Reject H_o
POPDEN does not Granger Cause HEXTOT	27.11053	0.0001	Reject H_o
HEXTOT does not Granger Cause POPDEN	49.90962	0.0000	Reject H_o
DEBT does not Granger Cause HEXPTOTAL	41.82224	0.0000	Reject H_o
HEXPTOTAL does not Granger Cause DEBT	6.611877	0.3584	Cannot Reject H_o
IMMRATE does not Granger Cause HEXPTO	7.068751	0.3145	Cannot Reject H_o
HEXPTO does not Granger Cause IMMRATE	6.417743	0.3781	Cannot Reject H_o

The results of Granger wald causality test is reported in Table 4.9 above. The results suggest that causality is running from Public health expenditure to determinants of health (malaria case, income, education expenditure, environmental pollution, population, debt and household's behavior. There is also evidence of bi-directional causality between public health expenditure and income, Public health expenditure and environmental pollution, public health expenditure and debt.. The probability values of F statistics is given, the P-values suggested we can reject null hypothesis. From table 4.4 we observed that malaria cases cause public health expenditure to increase. This implies that increase in malaria cases reported induce government to increase it health expenditure and the relationship is uni-directional. Income does not granger cause public health expenditure but public health expenditure causes income to increase. This is in consistent with Wagner's law of public health expenditure. Education expenditure cause public health expenditure to increase and the relationship is bi-directional. As people become educated they become more conscious of their health which leads to increase in demand for health care services resulting to higher public health expenditure. Environmental pollution does not granger cause public health expenditure. Increase in Population density causes government health expenditure to increase due to increase in demand for health services and the relationship is bi-directional. Debt causes public health expenditure to increase. When governments go for loans resources becomes more available which can lead to increased allocation to health in budget. Household's behavior does not cause government health expenditure to increase.

4.7 Findings

The study investigated the impact of government health expenditure on under-five malaria mortality in Nigeria. The study has four objectives which includes; examining the determinants of under-five malaria mortality in Nigeria, examining the impact of public health expenditure on under-five malaria mortality in Nigeria, investigating how shocks from public health expenditure affects under-five malaria mortality in Nigeria and lastly, identifying the determinants of public health expenditure in Nigeria. Findings from the study revealed the followings.

i. The impact of Public health expenditure on under-five malaria mortality in Nigeria is weak.
ii. Female labor force participation is a good determinant of under-five malaria mortality
iii. Household's behavior has impact on under-five malaria mortality
iv. Malaria cases determines the variation in public health expenditure in Nigeria
v. Shocks in capital health expenditure affect under-five malaria mortality.rate in Nigeria
vi. Environmental quality strongly determines changes in public health expenditure in Nigeria
vii. Educational expenditure is major determinants of under-five malaria mortality

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

The chapter summarizes the research findings emanating from the study. Conclusions were drawn from the research findings and recommendations were made based on the major research findings. Contribution to knowledge was identified and suggestions were made for further research.

5.1 Summary of Findings.

The results of this research work have been discussed extensively in chapter four. The results were discussed according to the four objective of the study which includes determinants of under-five mortality in Nigeria, impact of public health expenditure on under-five mortality, determining public health expenditure shocks and it effects on under-five mortality and examining the determinants of public health expenditure in Nigeria.

Findings relating to determinants of under-five malaria mortality in Nigeria revealed that, female labor force participation determines under-five malaria mortality given 8.16% forecast error variance. This implies that under-five mortality will decrease when female labour force participation increases. This conformed to our apriori expectation. Female literacy was weak in determining under-five malaria mortality given the forecast error variance of 2.20%. Household's behavior and physician density were found to determine under-five mortality by 3.14% and 3.53% respectively. Income, HIV/AIDS and malnutrition do not determine under-five mortality in Nigeria. The granger causality walds test shows that except for female labor force participation all other variables in the model do not granger cause under-five malaria mortality in Nigeria.

Objective two investigate the impact of public health expenditure on under-five malaria mortality. Findings revealed weak impact of public health expenditure on under-five malaria mortality given 0.17% and 1.01% forecast error variance in both the short and long period respectively. Similarly, malaria cases also exhibit weak impact on variation of under-five malaria mortality given 1% forecast error variance in the long run. However, female labour force participation, education expenditure and income were found to have relatively significant impact on under-five malaria mortality give their forecast error variance of 2.07%, 5.78% and 2.52% respectively.

To understand the shocks to under-five malaria mortality, the public health expenditure was decomposed into recurrent health expenditure and capital health expenditure. Findings revealed that shocks from recurrent expenditure do not significantly influence under-five malaria mortality given 0.266% forecast error variance in the long run. However, shocks from capital health expenditure exert positive influence on under-five malaria mortality with 13.15% forecast error variance in the long run. This implies that an increase in capital health expenditure will have a positive effect on under-five malaria mortality rate. Other findings show that malaria cases will in the long-run influence recurrent and capital health expenditure by 3.05% and 11.62% respectively. Household's behavior was also found to be influenced positively by capital health expenditure at 27.94% forecast error variance in the long run.

In objective four, we found that Income is an important determinant of public health expenditure especially in the long run where it influences the variation in government health expenditure by 10.01%. Malaria cases also determine variation in public health expenditure given the forecast error variance of 7.66%. Education expenditure also has significant influence of about 12.90% in determining the size of public health expenditure. Debt stock is very weak especially in the long run in determining the change in public health expenditure given 1.09 percent forecast error variance. Household's behavior does not have influence in variation of government health expenditure. Environmental pollution significantly influence change in the size of public health expenditure by 34.72%. The post diagnostic check of granger walds causality test revealed that all the variables (malaria cases, debt, population density and education expenditure) granger cause increase in government health expenditure except income, household's behavior and environmental pollution.

5.2 Conclusion

Based on the analysis of results from this study, public health expenditure does not have much impact on under-five malaria mortality in Nigeria. This means that there are non-malaria related issues surrounding under-five malaria mortality in Nigeria. Hence, this study concludes that;

i. Public health expenditure in Nigeria does not significantly explain the variation in under-five malaria mortality.

ii. Under-five malaria mortality can be reduced if there is an increase in female labour force participation in Nigeria.

iii. Household's positive health behavior such as routine child immunization, environmental sanitation and prompt medical attention to the child are capable of reducing under-five malaria mortality in Nigeria.

iv. The extent to which government varies its spending on health will depends on prevalence of malaria cases.

v. Even though findings show that the impact of public health expenditure on under-five malaria mortality is weak. However, if the public health expenditure is disaggregated in to capital and recurrent health expenditure, decrease in capital health expenditure may result in increase of death from malaria especially in children under the age of five compared to recurrent health expenditure. On the other hand, increasing capital health expenditure (purchase of anti-malaria drugs, ITNs, equipments for malaria diagnosis) will result in decrease of under-five malaria mortality.

vi. Quality of environment results in less breeds of mosquitoes and hence reduction in malaria cases and consequently less cases of under-five malaria mortality which will in the overall reduce government health expenditure.

vii. Educational expenditure will not only produce more enlightened citizens with positive health behaviors but individual who are more proactive in seeking medical care for their sick child. Educated citizens have more advantage in having access to health information which limits the chances of their child dying before the age of five due to malaria.

5.3 Recommendations

Based on the conclusion above, the following policy recommendations are pertinent to ensure efficient government health expenditure and reduction in under-five malaria mortality in Nigeria.

i. Since the impact of public health expenditure on under-five malaria mortality is weak, federal government should increase its budgetary allocation to health by 15% as recommended by Abuja declaration 2001 and establishment of financial crime unit in health agencies to monitor income and expenditure will increase fiscal discipline will strengthened the current malaria programs and reduction in under-five malaria mortality..

ii. Since female labour force participation was found to reduce under-five malaria mortality, the roles of Federal Character Commission (FCC) should be expanded to cover gender sensitive in employment opportunities in government and private sectors in Nigeria.

iii. Household's behavior towards healthcare (routine immunization, sanitation) was found to reduce under-five malaria mortality hence, it should be encouraged through extensive advocacies, communication and social activities by relevant agencies such National Orientation Agencies (NOA) and government media houses.

iv. Finding reveals malaria cases causes government health expenditure to increase, hence, government should declare malaria as a state of emergency by creating malaria unit in all ministries, departments and agencies (MDAs)

v. Since capital health expenditure was found to be more potent in reducing under-five malaria mortality than recurrent health expenditure, government should increase purchase of anti-malaria drugs, purchase and distribution of ITN, In-door residual spray (IRS) and fumigation of environment to reduce breeding of mosquitos, reduction in malaria cases and reduction in malaria under-five malaria mortality.

vi. Environmental pollution was found to increase public health expenditure, hence, National Environmental Standard and regulations Enforcement Agency (NESREA) should reintroduce and enforce monthly environmental sanitation in homes and offices with punishment to violators. This will ensure environmental quality and reduction in mosquitoes, malaria and under-five malaria mortality.

vii. Since, government education expenditure impact positively on under-five malaria mortality, government should increase funding to education by resuscitating public primary and secondary schools. Increase school enrolment rate and making primary and secondary education free. This policy will increase literacy level and health conscious citizens and reduction in under-five malaria mortality.

5.4 Suggestions for Further Research.

This study has looked into determinant of public health expenditure, factors affecting under-five malaria mortality, impact of public health spending on under-five mortality and how shocks from public health spending affect under-five malaria mortality. Further research is necessary to determine the impact of public health spending on adult malaria mortality in Nigeria. This can be made possible with available data on adult malaria mortality. Studies on different specific age group on malaria will enble a more targeted and focused policy on each age group for efficient malaria program. Secondly, further studies could look at issues of fake drugs as one of the factors explaining under-five mortality rate in Nigeria.

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Appendices

Appendix 1

Summary of Empirical Works:Public Health Expenditure and Under-Five Mortality

	Authors	Countries	Problem	Dependent variable	Independent variable	method	Result
1	Sarah & Zahra. 2016	OECD countries (1996 – 2012)	Effect of governance indicator on under-five mortality	Under-five mortality	GDP per capita, public health expenditure per capita, total fertility rate, and improvement of governance indicators (control of corruption and rule of law) GDP per capita, public health expenditure per capita, total fertility rate, and improvement of governance indicators (control of corruption and rule of law)GDP per capita, public health expenditure per capita, total fertility rate, and improvement of governance indicators (control of corruption and rule of law)	Generalized Method of MomentsGeneralized method of moment (GMM)	1% increase in public health expenditure per capita resulted in a 0.03% decrease in under-five mortality rate.

2	Daniel J. Corsi1 and Subramanian 2014	SSA Countries 1990 - 2012	Association between coverage of maternal and child health interventions, and under-5 mortality: a repeated cross-sectional analysis of 35 sub-Saharan African countries Daniel J. Corsi1 and S. V. Subramanian2* Association between coverage of maternal and child health interventions, and under-5 mortality: a repeatedcross-sectional analysis of 35 sub-Saharan African 3countries	Under-five mortality	..Goverment Intervention, PCGDP,martenal education, mother's age, house hold wealth, quantiles, area of residence, birth order.	OLS	At the ecologic level, a unit increase in standardized CCI was associatedwith a reduction inunder-5 child mortality rate (U5MR) of 29.0 per 1,000 (95% CI: _43.2, _14.7) after adjustment for survey period effects and country-level per capita gross domestic product (pcGDP).Increase in public health expenditure decrease under-five mortality
3	Jacob Novignon1*, Solomon A Olakojo1 and Justice Nonvignon2 Novignon et.el 2012	Cross-country Sub-sahara countries (SSA) 1980-2012	The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis The effects of public and private health care expenditure on health status in sub-Saharan	Health outcomes (Child mortality, life expectancy)	Private health expenditure, public health expenditure, population age	Generilized least square (GLS)	Both public and private health care spending showed strong positive association with health status even though public health care spending had relatively higher impact.

			Africa: new evidence from panel data analysis				
4	SCHOLASTICAScholastica. 2014	SSA Countries (2000- 2011)	HEALTH CARE SPENDING AND HEALTH OUTCOMES IN SUBSAHARAN AFRICA: EVIDENCE FROM DYNAMIC PANELHealth Care Spending and Health Outcomes In Sub Saharan Africa: Evidence From Dynamic Panel	Under-five Mortality rate	Private health expenditure, public health expenditure, total health expenditure, real GDP per capita, HIV prevalence rate, total fertility rate, measles immunization rate, female literacy rate, female labour participation rate and transparency international corruption perception index	Linear Dynamic Panel Data ModelGMM , Linear Dynamic Panel Data Model	The empirical results suggest that total health expenditure reduces under-five mortality in SSA. The results also show that when public health expenditure is stronger in reducing under-five mortality it crowds out the relative effects of private health expenditure. Lowering corruption is essential in achieving low under-five mortality rates. The empirical results suggest that total health expenditure reduces under-five mortality in SSA. Lowering corruption is essential in achieving low under-five mortality rates.
	Micheal and Ramu 2015	Ghana (1990 - 2012)	HEALTH CARE SPENDING AND HEALTH OUTCOMES IN SUBSAHARAN AFRICA: EVIDENCE FROM DYNAMIC PANELHealth Care Spending and Health Outcomes in Sub-Saharan Africa: Evidence From Dynamic Panel	Infant Mortality	RGDP(rela per capita income), Public health expenditure, literacy level and female labour force participation rate	OLS	The results revealed that public healthcare expenditure is associated with improvement in health status through reduction in infant mortality.
	LalitagauriK	Five BRICS	Health Inputs, Health	Infant	Insurance ,Adult literacy	OLS	The public health expenditure is

	ulkarni 2016	nations, Brazil, India, China, Russian Federation and South Africa. (1995-2010)	Outcomes and Public Health Expenditure: Evidence from the BRICS Countries	Mortality Rate (H)	Rate,Public Health Expenditure, Out Of Pocket Expenditure , Total health expenditure, Co2Emissions, Female workforce Participation, Age dependency Ratio		showing a positive elasticity with IMR. This implies that higher public expenditure indicates higher IMR or lower health outcomes.
	Yaqub, et.el (2013)	Nigeria. (1980-2008)	Public Health Expenditure And Health Outcome In Nigeria: The Impact Of Governance	Health outcome	Per Capita GDP, Public Health Expenditure, Index of Corruption, Public Health Expenditure	OLS/ two-stage-least squares	The result obtained showed that public health expenditure has negative effect on infant mortality and under-5 mortalities when the governance indicators are included.
	John and Andrew (2007)	47 African countries (1985-2005)	Health expenditure and Health outcome in Africa	Health outcomes	Health outcome (under-five mortality or infant mortality rate); Regional/Country-specific effect; Per capita health expenditure (total or government/public); Index of ethno linguistic fractionalization; Female literacy rate; Urban population, as a measure of urbanization; , GDP per capita in international dollars; , Number of Physicians (per 100,000 population)	Ordinary Least Squares (ROLS) model using lagged explanatory variables; and two-stage least squares (R2SLS)	They found out that Health expenditures have a statistically significant effect on infant mortality and under-five mortality. The results imply that total health expenditures (as well as the public component) are certainly important contributor to health outcomes

	Yashum (2014)	West African Countries (1995-2012)	Examining how various health investments culminate in child health outcomes in Africa, case study the ECOWAS region	Health outcomes	child health in country, maternal health in country, maternal literacy in country, childhood immunization coverage in country, per capita income in country, improved sanitary facilities in country, improved water source in country and prevalence of undernourishment in children below the age of 5	fixed effects estimations and ordinary pooled OLS.	Results reveal that there is a significant relationship between some health investments and child mortality, and health investments culminate in greater child health outcomes in developing countries than in the developed world. Also, socioeconomic status was found to impact on child mortality.
	George C.K et.al (2013)	Ghana (1995-2012)	Public Expenditure and Health Status in Ghana	Infant mortality/ under five mortality rate,	GDP Per Capita measured in local currency unit (LCU), Public expenditure on health as a percentage of GDP (LCU),Physician per population, Health Insurance (proximate by dummy)	OLS regression analysis	They found that despite the relationship between health status and many other possible determinants, the most important factors relevant to health status in Ghana are health insurance policy, and the availability of physicians. It would imply that, better health status seem to be associated with higher health spending and more physicians.
	Novignon et al (2012)	SSA (1995-2010)	The effects of public and private health care expenditure on health status in sub-Saharan	Health status	Total health expenditure as percentage of real national income, per capita real income which	Fixed and random effects panel data	The results show that health care expenditure significantly influences health status through improving life

			Africa: new evidence from panel data analysis		acts as a control variable for the demand for health services and other economic factors. Population age groups of below 14, 15–64 and above 65 years respectively expressed as a percentage of total population.	regression models/ Generalized Least Squares (GLS)	expectancy at birth, reducing death and infant mortality rates. Both public and private health care spending showed strong positive association with health status even though public health care spending had relatively higher impact
	Savas and Okan (2013)	Cross-Country (9180-2010)	public spending on health care and health outcome: Cross country comparison	Health outcome (U5M)	GDP per capita, Government health expenditure % of GDP ,total health expenditure ,Law and order ,expected year of schooling ,Population ,Dummy for sub-Sahara, Dummy for OECD, Dummy for high income Non OECD, Dummy for high income Non OECD, Total health expenditure % GDP	cross country regressions	Their findings revels a statistically significant and robust result. They found government health spending as share of GDP negatively associated with lower level of under five mortality.
	Tae and Shannon (2013)	Developed countries/USA (1985-2010)	government health expenditure and public health outcomes: A comparative study among 17 countries and implication for US Health care return.	Health outcomes	Public Health expenditure (% of total health expenditure, Real GDP per capita,Gini coefficient, Unemployment rate ,Rate of ageing	Regression analysis	Their findings revealed a statistically significant association between government health expenditure and public health outcome. Particularly it showed a negative relationship between government health expenditure and

					population.		infant mortality rate and a positive relationship between government health expenditure and life expectancy of birth. This result suggest that higher government spending on medical goods and services and can be shown to provide better overall health result for individuals.
	John N and Philippe N (2006)	Nigeria (1995-2010)	Examining the relationship between health care expenditure and health outcome.	Health outcome	Health expenditure, lifestyle, environmental factor, occupational factor, No physician, nutrition and pollution as independent variables.	Fixed effect model (Panel data) 1980-1995.	Results Shows that increase in healthcare expenditure are significantly associated with large improvement in infant mortality but only marginally in relation to life expectancy.
	Erick A. (2013)	SSA (1995-2011)	Investigating the effect of health expenditure, health outcome and economic growth in SSA.	Health outcome, GDP	Per capita expenditure, vector of health system variable, socio-economic variables,(percapita income, cleanwater, education, population and age structure.	Generalized lest squares estimator using fixed and random effect model	The results shows that health expenditure has two fold effect, first by improving health outcomes, through reduction in mortality and contributing to economic growth as an investment in health capital which improve health outcome.
	Kaushalendra Kumar et.al (2013)	India	Public Spending on Health and Childhood Mortality in India	Per capita public health expenditur e	Infant mortality rate, child mortality rate, life expectancy at birth, incidence and prevalence of infectious/chronic diseases	Ordinary least squares, generalized least squares and fixed effects	The findings suggest insignificant association between public spending on health and childhood mortality both at the country level and for the EAG states

						regression models	
	RopertoJr Deluna and Tiany Faith Peralta (2014)	Philippines	Public Health Expenditures, Income and Health Outcomes in the Philippines	Percapita Health expenditure	GDP per capita, infant mortality, under-five mortality and life expectancy	VAR and Granger Causality	Results revealed that health expenditure per capita increases growth rate and GDP with decrease in IMR, U-5MR and increase in life expectancy. However, VAR results revealed that the past values of public health expenditure has no effect on under-five mortality rates but affects infant mortality rate.
	Farasat A. S. Bokhari et.al (2006)	Developing Countries	Government Health Expenditures and Health Outcomes	Per caAGpita government health expenditure	U-5 mortality rate, maternal mortality rate, Per capita GDP, education, roads, sanitation, per capita donor funding	Iinstrumental variables techniques (GMM-H2SL)	No statistical significant relationship between Government health expenditure and health outcomes
	Olarinde and Bello (2014)	Nigeria (1990-2012)	Public Healthcare Expenditure And Health Sector Performance In Nigeria: Implications For Sustainable Economic Development	Health outcomes (infant mortality, U5MR)	Government healthcare expenditure, Government healthcare expenditure, Literacy rate, Gross domestic product per capita is used as a proxy for level of poverty, Urban Population	Autoregressive distributed lag (ARDL) and VECM.	The empirical results from ARDL bound testing approach provide strong evidence of the existence of a long-run and short- run stable relationship among the variables included in both models.
	M Farahani, SV Subramanian, and D	India (1998-1999)	Effects of State-level Public Spending on Health on the mortality Probability in India	Mortality rate	Public health spending, private health spending, percapita income, access to toilet.	Probit and logit.	Negative relationship between health expenditure and child and adult mortality.

	CanningFarahan, and Canning (2010)						
	Kristine Kristine et.al (2012)	Ethiopia (2011-2015)	Prioritizing Child Health Interventions in Ethiopia: Modeling Impact on Child Mortality, Life Expectancy and Inequality in Age at Death.	Infant mortality, life expectancy	Health intervention (public health expenditure)	Lives save tools	Health intervention reduces child mortality and increases life expectancy in Ethiopia.
	Paul Campbell (2012)	USA (1995-2003)	Resources That May Matter: The Impact of Local Health Department Expenditures on Health Status	Health outcomes	Smoking and obesity prevalence, infectious disease morbidity, infant mortality, deaths due to cardiovascular disease and cancer	fixed-effects regression	An increase in LHD expenditures, aggregated to the state level, was associated with a statistically significant decline in state-level infectious disease morbidity An increase in LHD expenditures, aggregated to the state level, was associated with a statistically significant decline in state-level infectious disease morbidity
	Innocent Makuta and Bernadette O'Hare (2015)	SSA (1996-2001)	Quality of governance, public spending on health and health status in Sub Saharan Africa: a panel data regression analysis Innocent Makuta1,2 and Bernadette O'Hare3,4*	Under-five mortality	Public health spending, quality of governance, female literacy , rule of law, sanitation, voice of accountability, control of corruption.	2SLS	Public spending on health has a statistically significant impact in improving health outcomes. Its direct elasticity with respect to under-five mortality is between −0.09 and −0.11.

			Quality of governance, public spending on health and health status in Sub Saharan Africa: a panel data regression analysis				
	Sanjay Budhdeo (2015)	Eurpean Union (1995-2010)	Changes in government spending on healthcare and population mortality in the European union, 1995–2010: a cross-sectional ecological study	Neonatal mortality, postneonatal mortality, U5M mortality, adult male mortality, adult female mortality.	GDP per capita, rate of inflation, unemployment, government debt as percent of gross domestic product, urbanisation, access to number of calories per day, number of hospital beds, number of physicians, outof-pocket expenditure, private health spending as a percentage of gross domestic product.	Multivariate regression analysis Multivariate regression analysis	A 1% decrease in government healthcare spending was associated with significant increase in all mortality metrics.
	Micheal and Ramu (2015)	Ghana (1990-2012)	Public Health Expenditure and Health Status in Ghana	Infant mortality rate	Public health expenditure, per capita income, literacy level, and female participation in the labour market,	Standard OLS and Newey-west estimation	Result revealed declining or falling infant mortality rate in Ghana has been influenced by public health spending among other factors. Thus, public healthcare expenditure is associated with improvement in health status through reduction in infant mortality.

	Joseph (2013)	Cross-country	The effect of government health expenditure on under-five mortality	Under-five mortality	Economic development, democratization, and government health spending	Fixed effect model	Result shows that on average a 1% increase in domestic government health expenditure leads to a 0.34% decrease in under-five mortality.
	Faisal Abbas (2010)	Pakistan (1972-2008)	Public health sector expenditures, health status and their role in development of Pakistan	Health Status (infant mortality)	Development health expenditure, per capita income, unemployment, female life expectancy, population, calories in take.	Johansen cointegratio nmethodolo gy	using cointegration and Granger bivariate causality analysis for health status of the population it is estimates that per capita health expenditures are negatively related with infant mortality rate and positively related with female life expectancy
	Odhiambo (2014)	SSA Countries (2000-2011)	Health Care Spending and Health Outcomes in Sub-Saharan Africa: Evidence from Dynamic Panel	Child and adult healt	Public health expenditure, private health expenditure, per capita income, total fertility rates, ethnic fragmentation, female literacy rate, female labour participation, HIV prevalence.	GMM-IV method on a panel of 41 SSA countries	The study results indicate that health expenditure significantly reduces under-five mortality and adult mortality in SSA countries. Public health expenditures have significant negative effect on under-five mortality and positive effect on adult mortality.
	Muthaka (2013)	Kenya	the study results indicate that health expenditure significantly reduces under-five mortality and adult mortality in SSA countries. Public xiv health expenditures have significant negative	Under-five mortality	Public health expenditure, private health expenditure, Mother.s highest level of education, head of h/h level of education	Linear probability model (LPM) and Control function approach (CFA)	Public and private health expenditures have no effect on deaths of neonates but significantly influence the mortality of infants and children below the age of five.

			effect on under-five mortality and positive effect on adult mortality. Health Expenditures And Child Mortality: Evidence From Kenya				
	Adeleke and Sijuola(2016)	SSA countries (Nigeria,Uganda and S/A) 1998-2012	Public Health Expenditure Efficiency And Infant Survival Rates In Three Selected Sub-Saharan African Countries: A Stochastic Frontier Analysis For The Period 1998-2012	Infant Survival rate	Gpvernment recurrent expenditure, government capital expenditure, RGDP per capita, public healthexpenditure per capita	Stochastic Frontier Analysis (SFA) model	Changes in infant survival rate were due to improvements in the capital health expenditure efficiency while the recurrent health expenditure efficiency had no statistically significant effect on changes in infant survival rate.
	Enayatollah (2013)	Eastern Mediterranean Countries (1995-2015)	Comparison of the Effects of Public and Private Health Expenditures on the Health Status: A Panel Data Analysis in Eastern Mediterranean Countries	Infant Mortality	Public health expenditure, private health expenditure, GDP, female labour participation rate, fertility rate, population under the age of 15, proportion of population in urban area, years of schooling.	OLS panal data	The results showed that the public health expenditures had a strong negative relationship with infant mortality rate.
	Craig and Hristos (2016)	OECDA	The impact of healthcare spending on health outcomes: A meta-regression	Infant Mortality, under-five mortality.	Public health spending	Meta-regression analysis (MRA).	MRA results reveal that the spending elasticity for the mortality rate is particularly sensitive to data aggregation, the

			analysis				specification of the health production function, and the nature of healthcare spending.
	Okeke, Bernard (2014)	Nigeria (1980-2010)	IMPACT OF PUBLIC SECTOR SPENDING ON HEALTH AND EDUCATION OUTCOMES IN NIGERIA By Okeke, Bernard Chukwudi PG/M.Sc/09/50991Impact Of Public Sector Spending On Health And Education Outcomes In Nigeria	Under-5 mortality rate and total school enrolment Under-5 mortality rate and total school enrolment	GDP per capita, govt health expenditure, female education, primary school enrollment and urban population.	vector error correction mechanism (VECM)	The results suggest that government health expenditure significantly reduces under-5 mortality rate.
	Issa and Ouattara (2005)	Low income and high income countries (1980-2000)	The Effect of Private and Public Health Expenditure on Infant Mortality Rates: does the level ofdevelopment matters?	Infant Mortality	per capita real GDP (RGDPPC), female secondary level enrolment ratios (FEMENROL), and CO2 emission, which captures the cleanliness of the environment	OLS and panel data techniques	The result shows a strong negative relation between health expenditure and IMRs. However, this effect is channeled through public expenditure at low development levels and through private expenditure at high development stages. It was also found that strong negative relationship between IMRs and per capita income and female education. The effect of the environment variable is statistically weak.

Table 2.5.2: Public Health Spending and Malaria Mortality

Authors	Countries	Problem	Dependent variable	Independent variable	method	Result
Bello (2005)	Nigeria	Reducing the impact of malaria in Nigeria: A public expenditure conundrum	Malaria Mortality	public health spending, per capita income, non-public health expenditure and political instability	OLS	The study revealed negative relationship between death from malaria and public health expenditure.
Yoko and Rifat (2010)	SSA counries (2002–2008).	Impact of international financing of malaria control on under-five mortality in sub-Saharan Africa	under-five mortality	ITN/IRS coverage, service delivery, investment and child health.	panel data regression analysis	Impact of ITN/IRS coverage on under-five mortality was significant among major child health interventions such as immunization showing that 10% increase in households with ITN/IRS would reduce 1.5 [95%CI: 0.3–2.8] child deaths per 1000 live births.
Thomas P. (2012)	SSA (2001-2010)	estimates of child deaths prevented from malaria prevention scale-up in Africa 2001-2010	child deaths prevented	number of child deaths by cause projected to occur in each year (including population growth parameters over time); the protective	Lives Saved Tool (LiST) model	Malaria prevention intervention scale-up over the past decade has prevented 842,800 (uncertainty: 562,800-1,364,645) child deaths due to malaria across 43 malaria endemic countries in Africa,

				effect (PE) on cause-specific mortality (PE = 1-relative risk 100) for each intervention being scaled-up; and increases in population coverage of each intervention		compared to a baseline of the year 2000.
Sandra et al (2013)	Tnzania (1997-2009)	Child mortality patterns in rural Tanzania: an observational study on the impact of malaria control interventions by government	Child mortality	ITNs ownership, food security, nutrition, environmental and socioeconomic factors	Poisson regression	All malaria control interventions by government were associated with decreases in child mortality, accounting for the effect of rainfall and food security.
Nwanosike (2014)	Nigeria	Nexus between health spending and malaria reduction	public health expenditure	Malaria cases	cointegration,	public health spending significantly reduce malaria cases in Nigeria
Nwano et.el (2015)	Nigeria (1990-2014)	malaria prevalence and health outcome in Nigeria	Under-five mortality	government health expenditure, per capita income, literacy rate, malaria cases	OLS	Government health expenditure impact positively on under-five mortality
Nwanosike et.al (2015)	Nigeria (1970-2013)	progressive implication of malaria spending and malaria incidence on Nigeria health outcomes	Under-five mortality	public health spending, education spending, literacy rate and per capita income.	OLS, cointegration	Government health expenditure and educational expenditure are major means government spends on malaria incidence in terms of providing essential infrastructural services and that malaria mortality decrease as more resources are spent by government.

Sede (2015)	Nigeria (1990-2013)	Government Health Expenditure and Malaria in Nigeria	Malaria death	government recurrent expenditures on health sector, per capita income and malaria cases reported	ECM, cointegration	Government health expenditure is significant in reducing malaria deaths in Nigeria
Ododo (2016)	Nigeri (1990 to 2014)	public health expenditure on malaria morbidity and mortality in Nigeria	government health expenditure	malaria index, non-health expenditure and health GDP	correlation and regression analysis	The result revealed that the relationship between government spending and malaria case and mortality were positive. Suggesting that increase in government spending does decrease malaria mortality.
Olalekan and Nuradeen (2013)	Nigeria	impact of health spending on malaria reduction in Asa local government area of Kwara state of Nigeria	Public health spending	number of nurses, physicians, out of pocket expenditure	Logit regression	The result revealed that public health spending does not reduce malaria in the study area.

Table 2.5.3 : Determinants of under-five mortality

Authors	Countries	Problem	Dependent variable	Independent variable	Method	Result
Riayati Ahmad and JunaidahHasan 2016	Malaysia (1984 - 2009)	Public Health Expenditure, Governance and Health Outcomes in Malaysia	Under 5 mortality, Infant Mortality, Life Expectancy,	income level, public health expenditure, corruption and government stability	Autoregressive Distributed Lag (ARDL) cointegratAutoregressive Distributed Lag (ARDL) cointegration	The results based on the bounds testing procedure show that a stable, long-run relationship exists between health outcomes and their determinants; namely income level, public health expenditure, corruption and government stability. The results also reveal that public health expenditure and corruption affect long- and short run health outcomes in

						Malaysia.
Ramesh and Sam (2007)	25 OECD countries. (1980- 2005)	economic, institutional, and social determinants of health outcomes.	Health outcome	economic, institutional, and social determinants of health outcomes	panel data approach with fixed effect (FE) and random effect (RE) models	Results indicates that increasing spending on health employment and personnel will definitely increase access to health care and help in improving life expectancy and reducing mortality. The most important factor affecting IMR includes physician supply, followed by immunization.
Aeron et.al (2016)	African countries (2000 - 2103)	Factors associated with declining under-five mortality rates from 2000 to 2013: an ecological analysis of 46 African countries	Under-five mortality	Public health financing and good governance, ICT, child survival intervention, maternal health, access to health care, clinical and health condition.	Linear regression.	Under five mortality is negatively related to all the explanatory variables
Katherine (2011)	UN member	Health system determinants of	Under-five mortality,	Human health resources, health	Mixed effect linear regression model	All the explanatory

	countries	infant, child and maternal mortality: A cross-sectional study of UN member countries	infant mortality and maternal mortality	service coverage, health financing, medical product, vaccines and technology, leadership and governance, health demographic variables		variables are significantly related to under-five mortality and were found to be significant risk factor to under-five mortality.
Imam and Koch (2004)	SSA 1999-2003	THE DETERMINANTS OF INFANT, CHILD AND MATERNAL MORTALITY IN SUB-SAHARAN AFRICA B M Imam and S F Koch* THE DETERMINANTS OF INFANT, CHILD AND MATERNAL MORTALITY IN SUB-SAHARAN AFRICA B M Imam and S F Koch*The Determinants Of Infant, Child And Maternal Mortality In Sub-Saharan	Infant and child mortaliy	GDP per capita, adult HIV/AIDS infection rate, health care,immunization rate against DPT, female labour force participation, the femaleliteracy rate and the prevalence of war.	OLS	All the independent variables determines public health expenditure

		Africa				
Gbesemete and Jonsson (1993)	African Countries	Determinants of under-five mortality, using data of 28 low and middle income African countries	Under-five mortality	social, economic, demographic, environmental and political factors	Fixed effect model	female literacy, health spending and urbanization are negatively related to infant mortality rate (IMR).
Mturi and Curtis (1995)	Tanzania	socio-economic determinants of IMR and Child mortality in Tanzania	Infant Mortality/ Child mortality	mother's education, father's education, immunization	OLS	All the variables considered are insignificant in explaining infant and child mortality rate in Tanzania.
Uddin et al. (2009)	Bangledesh	determinanats of child mortality in Bangladesh.	Child mortality	father's education, occupation of father, occupation of mother, standard of living index, breastfeeding status and birth order	logistic regression.	Father's educations, occupation of father, occupation of mother, standard of living index, breastfeeding status and birth order were significant determinants of child mortality in Bangladesh.

Mondal *et al.* (2009)	Bangledesh	factors influencing infant and child mortality in Rajshahi District of Bangladesh	Child Mortality	Immunization, ever breastfeeding, mother's age at birth and birth interval.	logistic regression model	The most significant predictors of neonatal, post-neonatal and child mortality levels are immunization, ever breastfeeding, mother's age at birth and birth interval.
Kamla-Raj (2009)	Bangledesh	Factors Influencing Infant and Child Mortality: A Case Study of Rajshahi District, Bangladesh.	Infant and Child mortality	immunization, ever breastfeeding, mother's age at birth, birth interval, toilet facilities, parent occupation and treatment places	multivariate technique	several socioeconomic, demographic and health related variables affects infant and child mortality
Chowdhury *et al.* (2010)	Nigeria	effects of demographic characteristics on neonatal, post neonatal, infant and child mortality	neonatal mortality	breast feeding practice, of post neonatal period as duration of marriage; order of birth and birth interval and of infant and child mortality	Logistic regression model.	All the variables are important predictors of neonatal and child mortality
Adepoju A.O et al (2010)	Nigeria	determinants of child mortality in rural Nigeria	Child mortality	Secondary and higher education of mother, age of	Logit regression model	Maternal education, access to adequate health

				mother at first birth, place of delivery, type of birth, child ever breastfed, sex of child,		care and increased awareness of benefits of breastfeeding were identified as the key factors to reducing child mortality in rural Nigeria.
Abinbola, Adepoju, Akanmi and Falusi (2012)	Nigeria 1990 -2010	Determinants of child mortality in Nigeria	Child mortality	maternal education, access to health care and breast feeding	logic regression model	Maternal education and access to health care facility were fund to be more significant in determining child mortality.
Kayode et al (2012)	Nigeria	risk factors and a predictive model for under five mortality in Nigeria	Under-five mortality	Maternal education, maternal occupation, marital status and maternal age.	Multivariable logistic regression method	Maternal, child, family and other factors were important risk factor of under five mortality in Nigeria
Iyywomi& Donald Ikenna (2013)	Nigeria	influencing factor on infant and child mortality in Nigeria	Infant and child mortality	Education attainment of the mother, place of delivery, women status in respecting decision in the house (Final say a mother	Regression Analysis	All the independent variables have positive linear association with infant and child mortality.

				health care, final say in making large h/h purchase final say on visits to family or relative, final say on deciding what to do with money husband earns).		
Bello & Joseph (2014)	Nigeria	Determinant of infant and child mortality in Oyo.	Infant and child mortality	poverty, malaria, postnatal care, Health scheme and breast feeding; HIV	Linear regression using binary logic	Poverty, malaria, postnatal care, health scheme and breast feeding are the major determinant of infant and child mortality
Sunday A. and Clifford O. (2014)	Nigeria	Under-five mortality in Nigeria: effects of neighborhood	Under-five mortality	Region of residence, place of residence, ethnic diversity, neighborhood, and infrastructure and community	multilevel Cox regression analysis	All the independents variables are determinants of Under-five mortality
Quinhas (2014)	Mozambique (2000-2010)	Effect of health system strengthening on under-five and infant and neonatal mortality in Mozambique	Neonatal, Infant and Under-five mortality	health work force density, maternal and child health nurse density, higher population by health facility and public financing per head	Binomial mixed model	under-five mortality have significant negative relationship with all the explanatory variables
Anja (2015)	Burkina Faso(2000-	health insurance and child mortality in	Under-five mortality	Socio-economic status, father's	Cox regression	Under-five mortality is

	2010).	rural Burkina Faso		education distance to the health facility, year of birth and insurance status of the mother at the time of birth		negatively related to all the explanatory variables
Riayati and Junaid (2016)	Malaysia (1984-2009)	public health expenditure, governance and health outcome in Malaysia	under-five mortality and infant mortality	public health expenditure, income level, corruption and government stability	ARDL, cointergration	Public health expenditure and corruption affect long and short run health outcomes in Malaysia.

Table 2.5.4: Determinants of public health expenditure

Authors	Countries	Problem	Dependent variable	Independent variable	method	Result
Micheal, Isaac, Pauline, Mustapha, Abdul-Aziz	Ghana (1970-2008)	Determinants of Public Health Expenditure in Ghana: A	Public health expenditure	GDPC, life expectancy, crude birth rate, inflation, carbon dioxide	cointergration	The results show that public health expenditure in Ghana is positively affected by real GDP, policies that aim to

and Ishaq (2014)		Cointegration Analysis		emission, urban population, rural population		improve healthiness of the population as measured by life expectancy and crude birth rates. They find strong evidence that healthcare is a necessity in Ghana.
Taudihir R (2008)	India	Determinants of public health expenditure: some evidence from Indian states between the periods 1971 to 1991..	Public health expenditure	RGDPC, literacy rate, physician density, population over 60 years of age and population of people per primary health care.	OLS	The result revealed that RGDPC, literacy rate determines public health expenditure while population over 60 years of age, population of doctors per primary health care was not statistically significant in determining public health expenditure
Huabouni and Abednnadher (2010)	Tunisia	Determinants of health expenditures in Tunisia during the period 1961-2008,	PHE	per capita health expenditure, GDP, population ageing, medical density and environmental quality	ARDL	The results of the bounds test show that there is a stable long-run relationship between per capita health expenditure, GDP, population ageing, medical density and environmental quality
George et.al (2013)		Public Expenditure and Health Status in Ghana, Using time series data from 2001-2010				they found that despite the relationship between health status and many other possible determinants, the most important factors relevant to health status in Ghana are health insurance policy, and the availability of

						physicians.
Folahan and Awe (2014)	Ngeria	An assessment of Health Expenditure Determinants in Nigeria from 1976-2010	Health expenditure,	Number of physicians, number of nurses, number of hospitals, reported cases of Malaria, HIV AIDS, tuberculosis, population and the GDP	cointegration	Numbers of physicians, number of nurses, and number of hospitals have a long run positive relationship with health expenditure in Nigeria.
Kehinde and Abayomi (2010)	Nigeria	Investigating the determinant of health expenditure in Nigeria between 1990 to 2008.	government health expenditure	GDPC, population rate and literacy rate	Regression analysis	The study confirmed that GDPC is more important in determining public health expenditure.
Khan, Razali and Shatie (2016)	Malaysia	modeling determinant of health expenditure in Malaysia between 1990 -2014	real percapita health expenditure	GDP, life expectanchy at birth, population age at 65 and population growth	OLS, ARDL	Only income and population growth were identified as the significant factors contributing to variation in public health spending.
Omitogon and Olawunmi (2014)	Nigeria	Determinant of public health expenditure in Nigeria for period between 1990-2012	public health spending	RGDP, population, government development policy, unemployment, consumer price index and political instability	Regression analyses	Result revealed that RGDP (income) and government policy development significantly contributes to factors explaining variation or change in public health expenditure. While, unemployment, and political instability exhibits negative

						relationship with public health expenditure.
Liviodi and David (2018)	Canada and Spain	Determinant of public health expenditures between Canada and Spain for the period spanning through 1981-2013 (Canada) and 2002-2013 (Spain)	public health spending	time trend, income, number of physician	Regression analysis	Time trend, income and number of physician are driver of public health expenditure between the two countries. However, the study found that number of physician does not drive public health expenditure in Spain.
Faisal A and Ulrich (2011)	Pakistan	Determinants of public health expenditure in Pakistan for the period spanning 1972-2006	public health spending	Income, urbanization and unemployment	Cointegration and error correction model (ECM)	Unemployment and urbanization and income explained the variation in public health expenditure in Pakistan.
Maughele and Ismaila (2013)	Nigeria	determinants of public health care expenditure in Nigeria between the period of 1986-2010	public health expenditure	children below the age of 14, development policy, GDPC, unemployment, physician density and consumer price index	Cointegration and error correction model (ECM)	Children under the age of 14 and development policy are significant in determining government health expenditure while physician density, unemployment and political instability were found insignificant in explaining the variation in government health expenditure.

Ilori (2015)		determinants of public health expenditure in Nigeria between 1981-2014	Public health expenditure	Population, tuberculosis, sickle cell, anemia, HIV/AIDS and income.	ECM	Only population, unemployment and tuberculosis as major determinant of public health expenditure in Nigeria while HIV/AIDS, income sickle cell and anemia were insignificant in determining variation in public health expenditure.
Alihussain and Enayatollah (2015)	ECOWAS countries	determinant of health expenditure in ECOWAS countries	Public health expenditures	GDPC, population below 15 years of age and above 65 years of age, number of doctors and urbanization	Panel Cointegration	long run relationship exist between all the variables and public health expenditure except children below 14 years of age and people aged above 65

Appendix 2a

Table 4.1: Summary of descriptive statistics

	LCO2	LDEBT	LEDUEXP	LGDPC	LHEXPTOTAL	LIMMRATE	LMCASE
Mean	8.378656	14.59940	3.893713	7.433462	3.302027	3.684974	14.96285
Median	8.480218	14.80876	4.388630	7.263330	3.252639	3.688879	14.77368
Maximum	9.509778	14.97866	5.616407	7.848934	3.604682	4.189655	17.07657
Minimum	6.973543	13.42985	-1.237874	7.125283	3.024806	3.044522	13.92615
Std. Dev.	0.597608	0.438968	1.733077	0.287555	0.155487	0.337449	0.873645
Skewness	-0.535971	-1.417681	-1.302771	0.249945	0.218848	0.031265	0.776405
Kurtosis	3.423312	3.843590	4.257549	1.292373	1.851253	1.896188	3.291224
Jarque-Bera	1.494285	9.844792	9.416562	3.561615	1.637130	1.375100	2.808036
Probability	0.473718	0.007282	0.009020	0.168502	0.441064	0.502806	0.245608
Sum	226.2237	394.1839	105.1303	200.7035	85.85269	99.49429	403.9970
Sum Sq. Dev.	9.285523	5.010021	78.09250	2.149887	0.604402	2.960667	19.84463
Observations	27	27	27	27	26	27	27

Source: eviews 8 output

Appendix 2b

(A) STATIONARITY TESTS

Test of Stationarity for Under-five Mortality Rate (order 1)

Null Hypothesis: D(LU5M) has a unit root
Exogenous: None
Lag Length: 7 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.921320	0.0526
Test critical values:	1% level	-2.588530	
	5% level	-1.944105	
	10% level	-1.614596	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LU5M,2)
Method: Least Squares
Date: 03/11/18 Time: 03:50
Sample (adjusted): 1992Q2 2016Q4
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LU5M(-1))	-0.087611	0.045600	-1.921320	0.0578
D(LU5M(-1),2)	-0.912389	0.096555	-9.449388	0.0000
D(LU5M(-2),2)	-0.912389	0.128711	-7.088657	0.0000
D(LU5M(-3),2)	-0.912389	0.154305	-5.912877	0.0000
D(LU5M(-4),2)	1.972307	0.354210	5.568185	0.0000
D(LU5M(-5),2)	1.972307	0.343103	5.748447	0.0000
D(LU5M(-6),2)	1.972307	0.331623	5.947432	0.0000
D(LU5M(-7),2)	1.972307	0.319732	6.168623	0.0000

R-squared	0.977540	Mean dependent var	2.38E-05
Adjusted R-squared	0.975812	S.D. dependent var	0.021256
S.E. of regression	0.003306	Akaike info criterion	-8.508893
Sum squared resid	0.000995	Schwarz criterion	-8.299186
Log likelihood	429.1902	Hannan-Quinn criter.	-8.424045
Durbin-Watson stat	2.000000		

Stationarity Test For Female labour Force Participation

Null Hypothesis: D(LFEMALELFP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.51138	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFEMALELFP,2)
Method: Least Squares
Date: 03/11/18 Time: 03:58
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFEMALELFP(-1))	-1.035613	0.098523	-10.51138	0.0000
C	-0.079530	0.088791	-0.895698	0.3725
@TREND("1990Q1")	0.002324	0.001433	1.621622	0.1079

R-squared	0.517542	Mean dependent var	0.000000
Adjusted R-squared	0.508174	S.D. dependent var	0.635665
S.E. of regression	0.445793	Akaike info criterion	1.249971
Sum squared resid	20.46936	Schwarz criterion	1.325351
Log likelihood	-63.24846	Hannan-Quinn criter.	1.280523
F-statistic	55.24514	Durbin-Watson stat	2.001562
Prob(F-statistic)	0.000000		

Test of Stationarity for Recurrent health Expenditure ()

Null Hypothesis: D(LRECEXP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.40549	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRECEXP,2)
Method: Least Squares
Date: 03/11/18 Time: 03:38
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRECEXP(-1))	-1.024672	0.098474	-10.40549	0.0000
C	0.103973	0.079498	1.307862	0.1938
@TREND("1990Q1")	-0.000843	0.001265	-0.666524	0.5066

R-squared	0.512487	Mean dependent var	-7.78E-18
Adjusted R-squared	0.503021	S.D. dependent var	0.564160
S.E. of regression	0.397715	Akaike info criterion	1.021729
Sum squared resid	16.29221	Schwarz criterion	1.097109
Log likelihood	-51.15164	Hannan-Quinn criter.	1.052281
F-statistic	54.13829	Durbin-Watson stat	2.001874
Prob(F-statistic)	0.000000		

Test of Stationarity for population Density

Null Hypothesis: D(LPOPDEN,2) has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.322676	0.0226
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPOPDEN,3)
Method: Least Squares
Date: 03/09/18 Time: 11:48
Sample (adjusted): 1995 2016
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPOPDEN(-1),2)	-1.290808	0.555742	-2.322676	0.0315
D(LPOPDEN(-1),3)	-0.224628	0.409035	-0.549165	0.5893
D(LPOPDEN(-2),3)	-0.332384	0.218610	-1.520446	0.1449

R-squared	0.796731	Mean dependent var	-2.01E-05
Adjusted R-squared	0.775334	S.D. dependent var	0.000870
S.E. of regression	0.000412	Akaike info criterion	-12.62271
Sum squared resid	3.23E-06	Schwarz criterion	-12.47394
Log likelihood	141.8499	Hannan-Quinn criter.	-12.58767
Durbin-Watson stat	2.056115		

Test of Stationarity for Physician Density

Null Hypothesis: LPHYDEN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.392946	0.0002
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPHYDEN)
Method: Least Squares
Date: 03/09/18 Time: 10:30
Sample (adjusted): 1991 2016
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPHYDEN(-1)	-0.208136	0.038594	-5.392946	0.0000
C	-0.201811	0.068353	-2.952484	0.0069

R-squared	0.547885	Mean dependent var	0.121663
Adjusted R-squared	0.529047	S.D. dependent var	0.243546
S.E. of regression	0.167136	Akaike info criterion	-0.666213
Sum squared resid	0.670428	Schwarz criterion	-0.569436
Log likelihood	10.66077	Hannan-Quinn criter.	-0.638345
F-statistic	29.08387	Durbin-Watson stat	2.098890
Prob(F-statistic)	0.000015		

Test of Stationarity for Malaria Cases

Null Hypothesis: D(LMCASE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.18688	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LMCASE,2)
Method: Least Squares
Date: 03/11/18 Time: 03:41
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LMCASE(-1))	-1.003683	0.098527	-10.18688	0.0000
C	0.030589	0.056515	0.541251	0.5895
@TREND("1990Q1")	-0.000291	0.000903	-0.322321	0.7479

R-squared	0.501869	Mean dependent var	-1.89E-17
Adjusted R-squared	0.492196	S.D. dependent var	0.399202
S.E. of regression	0.284473	Akaike info criterion	0.351535
Sum squared resid	8.335251	Schwarz criterion	0.426916
Log likelihood	-15.63138	Hannan-Quinn criter.	0.382087
F-statistic	51.88637	Durbin-Watson stat	2.000137
Prob(F-statistic)	0.000000		

Test of Stationary for malnutrition

Null Hypothesis: D(LMALNTRN,2) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.505574	0.0021
Test critical values:	1% level	-3.788030	
	5% level	-3.012363	
	10% level	-2.646119	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LMALNTRN,3)
Method: Least Squares
Date: 03/09/18 Time: 10:22
Sample (adjusted): 1996 2016
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LMALNTRN(-1),2)	-1.143223	0.253735	-4.505574	0.0003
D(LMALNTRN(-1),3)	0.485232	0.218375	2.222009	0.0401
D(LMALNTRN(-2),3)	0.408612	0.141475	2.888220	0.0102
C	0.006098	0.005518	1.105117	0.2845

R-squared	0.633706	Mean dependent var	-0.004822
Adjusted R-squared	0.569065	S.D. dependent var	0.035312
S.E. of regression	0.023181	Akaike info criterion	-4.521345
Sum squared resid	0.009135	Schwarz criterion	-4.322389
Log likelihood	51.47412	Hannan-Quinn criter.	-4.478167
F-statistic	9.803588	Durbin-Watson stat	2.296031
Prob(F-statistic)	0.000552		

Test of Stationarity for Inflation Rate

Null Hypothesis: D(LINFLR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.16767	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINFLR,2)
Method: Least Squares
Date: 03/11/18 Time: 03:52
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINFLR(-1))	-1.001820	0.098530	-10.16767	0.0000
C	0.023316	0.053993	0.431830	0.6668
@TREND("1990Q1")	-0.000297	0.000864	-0.344351	0.7313

R-squared	0.500925	Mean dependent var	-1.14E-17
Adjusted R-squared	0.491234	S.D. dependent var	0.381205
S.E. of regression	0.271905	Akaike info criterion	0.261168
Sum squared resid	7.615045	Schwarz criterion	0.336548
Log likelihood	-10.84189	Hannan-Quinn criter.	0.291720
F-statistic	51.69082	Durbin-Watson stat	2.000067
Prob(F-statistic)	0.000000		

Test of Stationary for Immunization Rate

Null Hypothesis: D(LIMMRATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.33065	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIMMRATE,2)
Method: Least Squares
Date: 03/11/18 Time: 03:54
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIMMRATE(-1))	-1.017812	0.098524	-10.33065	0.0000
C	-0.023884	0.021470	-1.112458	0.2685
@TREND("1990Q1")	0.000467	0.000344	1.356158	0.1780

R-squared	0.508874	Mean dependent var	6.24E-18
Adjusted R-squared	0.499338	S.D. dependent var	0.152041
S.E. of regression	0.107580	Akaike info criterion	-1.593267
Sum squared resid	1.192070	Schwarz criterion	-1.517887
Log likelihood	87.44316	Hannan-Quinn criter.	-1.562715
F-statistic	53.36117	Durbin-Watson stat	2.000536
Prob(F-statistic)	0.000000		

Test of Stationarity for HIVAIDS

Null Hypothesis: D(LHIVAIDS,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.51802	0.0000
Test critical values:	1% level	-3.493747	
	5% level	-2.889200	
	10% level	-2.581596	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHIVAIDS,3)
Method: Least Squares
Date: 01/08/12 Time: 14:34
Sample (adjusted): 1990Q4 2016Q4
Included observations: 105 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHIVAIDS(-1),2)	-1.278469	0.094575	-13.51802	0.0000
C	9.94E-07	1.03E-05	0.096646	0.9232

R-squared	0.639528	Mean dependent var	2.62E-07
Adjusted R-squared	0.636029	S.D. dependent var	0.000175
S.E. of regression	0.000105	Akaike info criterion	-15.45879
Sum squared resid	1.14E-06	Schwarz criterion	-15.40824
Log likelihood	813.5866	Hannan-Quinn criter.	-15.43831
F-statistic	182.7368	Durbin-Watson stat	2.033583
Prob(F-statistic)	0.000000		

Test of Stationarity for Household's health Expenditure

Null Hypothesis: D(LHHEXP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.094868	0.0000
Test critical values:	1% level	-4.049586	
	5% level	-3.454032	
	10% level	-3.152652	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHHEXP,2)
Method: Least Squares
Date: 03/11/18 Time: 03:55
Sample (adjusted): 1991Q2 2016Q4
Included observations: 103 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHHEXP(-1))	-1.459601	0.180312	-8.094868	0.0000
D(LHHEXP(-1),2)	0.458974	0.156129	2.939704	0.0041
D(LHHEXP(-2),2)	0.458356	0.127459	3.596096	0.0005
D(LHHEXP(-3),2)	0.457747	0.090116	5.079554	0.0000
C	0.005713	0.018455	0.309577	0.7575
@TREND("1990Q1")	-4.86E-05	0.000291	-0.166948	0.8678

R-squared	0.605829	Mean dependent var	0.000474
Adjusted R-squared	0.585511	S.D. dependent var	0.136385
S.E. of regression	0.087806	Akaike info criterion	-1.970890
Sum squared resid	0.747857	Schwarz criterion	-1.817411
Log likelihood	107.5008	Hannan-Quinn criter.	-1.908726
F-statistic	29.81718	Durbin-Watson stat	2.001784
Prob(F-statistic)	0.000000		

Test of Stationarity for Gross Domestic Product Per Capita (Income)

Null Hypothesis: D(LGDPC) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.60333	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDPC,2)
Method: Least Squares
Date: 03/11/18 Time: 03:57
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDPC(-1))	-1.044357	0.098493	-10.60333	0.0000
C	0.000752	0.005866	0.128276	0.8982
@TREND("1990Q1")	9.13E-05	9.43E-05	0.968618	0.3350

R-squared	0.521896	Mean dependent var	0.000000
Adjusted R-squared	0.512613	S.D. dependent var	0.042350
S.E. of regression	0.029566	Akaike info criterion	-4.176521
Sum squared resid	0.090034	Schwarz criterion	-4.101141
Log likelihood	224.3556	Hannan-Quinn criter.	-4.145969
F-statistic	56.21724	Durbin-Watson stat	2.002945
Prob(F-statistic)	0.000000		

Test of StationarityFemale Primary School Enrolment (Proxy for Female Literacy Rate).

Null Hypothesis: D(LFPMEDU) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.525483	0.0001
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFPMEDU,2)
Method: Least Squares
Date: 03/09/18 Time: 10:29
Sample (adjusted): 1992 2016
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFPMEDU(-1))	-1.112001	0.201250	-5.525483	0.0000
C	0.002648	0.002009	1.318494	0.2003

R-squared	0.570342	Mean dependent var	-0.000579
Adjusted R-squared	0.551661	S.D. dependent var	0.014351
S.E. of regression	0.009609	Akaike info criterion	-6.375554
Sum squared resid	0.002124	Schwarz criterion	-6.278044
Log likelihood	81.69442	Hannan-Quinn criter.	-6.348509
F-statistic	30.53096	Durbin-Watson stat	2.107720
Prob(F-statistic)	0.000013		

Test of Stationarity for Public health expenditure

Null Hypothesis: D(LHEXPTOTAL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.984184	0.0000
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHEXPTOTAL,2)
Method: Least Squares
Date: 03/11/18 Time: 03:56
Sample (adjusted): 1991Q3 2016Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHEXPTOTAL(-1))	-1.003420	0.100501	-9.984184	0.0000
C	0.008563	0.015234	0.562133	0.5753
@TREND("1990Q1")	-0.000137	0.000239	-0.573082	0.5679

R-squared	0.501721	Mean dependent var	0.000000
Adjusted R-squared	0.491655	S.D. dependent var	0.099568
S.E. of regression	0.070990	Akaike info criterion	-2.423579
Sum squared resid	0.498921	Schwarz criterion	-2.346374
Log likelihood	126.6025	Hannan-Quinn criter.	-2.392316
F-statistic	49.84197	Durbin-Watson stat	2.000073
Prob(F-statistic)	0.000000		

Test of Stationary for Education Expenditure

Null Hypothesis: D(LEDUEXP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.39660	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEDUEXP,2)
Method: Least Squares
Date: 03/11/18 Time: 03:59
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEDUEXP(-1))	-1.023750	0.098470	-10.39660	0.0000
C	0.113924	0.079409	1.434651	0.1544
@TREND("1990Q1")	-0.001150	0.001263	-0.910007	0.3649

R-squared	0.512059	Mean dependent var	3.13E-18
Adjusted R-squared	0.502584	S.D. dependent var	0.562344
S.E. of regression	0.396608	Akaike info criterion	1.016157
Sum squared resid	16.20168	Schwarz criterion	1.091537
Log likelihood	-50.85631	Hannan-Quinn criter.	1.046709
F-statistic	54.04552	Durbin-Watson stat	2.001918
Prob(F-statistic)	0.000000		

Test of Stationary for Debt Stock

Null Hypothesis: LDEBT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.307565	0.0000
Test critical values:	1% level	-3.493129	
	5% level	-2.888932	
	10% level	-2.581453	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LDEBT)
Method: Least Squares
Date: 01/08/12 Time: 14:39
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LDEBT(-1)	-0.016024	0.003019	-5.307565	0.0000
D(LDEBT(-1))	0.570975	0.073649	7.752662	0.0000
C	0.240140	0.045102	5.324408	0.0000

R-squared	0.882388	Mean dependent var	0.014748
Adjusted R-squared	0.880104	S.D. dependent var	0.017116
S.E. of regression	0.005926	Akaike info criterion	-7.390876
Sum squared resid	0.003618	Schwarz criterion	-7.315496
Log likelihood	394.7165	Hannan-Quinn criter.	-7.360324
F-statistic	386.3808	Durbin-Watson stat	2.171255
Prob(F-statistic)	0.000000		

Test of Stationarity for carbon Dioxide Emission

Null Hypothesis: D(LCO2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.153049	0.0161
Test critical values:	1% level	-4.374307	
	5% level	-3.603202	
	10% level	-3.238054	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCO2,2)
Method: Least Squares
Date: 03/08/18 Time: 17:41
Sample (adjusted): 1992 2016
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCO2(-1))	-0.845588	0.203607	-4.153049	0.0004
C	0.152487	0.153372	0.994233	0.3309
@TREND("1990")	-0.008206	0.009706	-0.845521	0.4069

R-squared	0.441576	Mean dependent var	0.012178
Adjusted R-squared	0.390810	S.D. dependent var	0.445562
S.E. of regression	0.347764	Akaike info criterion	0.837579
Sum squared resid	2.660670	Schwarz criterion	0.983844
Log likelihood	-7.469740	Hannan-Quinn criter.	0.878147
F-statistic	8.698289	Durbin-Watson stat	2.051853
Prob(F-statistic)	0.001647		

Test of Stationarity for Capital Health Expenditure ()

Null Hypothesis: D(LCAPEXP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.64059	0.0000
Test critical values:	1% level	-4.046925	
	5% level	-3.452764	
	10% level	-3.151911	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCAPEXP,2)
Method: Least Squares
Date: 03/11/18 Time: 03:45
Sample (adjusted): 1990Q3 2016Q4
Included observations: 106 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCAPEXP(-1))	-1.046601	0.098359	-10.64059	0.0000
C	0.108142	0.054316	1.990962	0.0491
@TREND("1990Q1")	-0.001041	0.000860	-1.211605	0.2284

R-squared	0.523646	Mean dependent var	0.000000
Adjusted R-squared	0.514397	S.D. dependent var	0.386293
S.E. of regression	0.269189	Akaike info criterion	0.241088
Sum squared resid	7.463663	Schwarz criterion	0.316468
Log likelihood	-9.777665	Hannan-Quinn criter.	0.271640
F-statistic	56.61298	Durbin-Watson stat	2.006027
Prob(F-statistic)	0.000000		

Appendix 3

Results of the Determinants of Public Health Expenditure in Nigeria.

Table 4b: Lag lenth selection

VAR Lag Order Selection Criteria
Endogenous variables: LHEXPTOTAL LMCASE LGDPC LEDUEXP LCO2 LPOPDEN LDEBT LIMMRA...
Exogenous variables: C
Date: 10/18/18 Time: 11:55
Sample: 1990Q1 2016Q4
Included observations: 97

Lag	LogL	LR	FPE	AIC	SC	HQ
0	250.5715	NA	9.29e-13	-5.001473	-4.789126	-4.915610
1	1974.509	3127.969	1.28e-27	-39.22699	-37.31586	-38.45422
2	2162.935	310.8062	1.01e-28	-41.79248	-38.18258*	-40.33281
3	2201.046	56.57706	1.83e-28	-41.25868	-35.95000	-39.11211
4	2235.597	45.59341	3.83e-28	-40.65149	-33.64403	-37.81802
5	2482.172	284.7042	1.11e-29	-44.41591	-35.70967	-40.89553
6	2617.711	134.1421*	3.67e-30*	-45.89095*	-35.48593	-41.68367*
7	2666.911	40.57749	8.77e-30	-45.58580	-33.48200	-40.69162

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4b: Modified VAR Estimation

Vector Autoregression Estimates
Date: 10/18/18 Time: 12:08
Sample (adjusted): 1993Q2 2016Q4
Included observations: 95 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LHEXPTOTA...	LMCASE	LGDPC	LEDUEXP	LCO2	LPOPDEN	LDEBT	LIMMRATE
LHEXPTOTAL(-1)	0.848352	-0.043373	-0.091633	-0.163231	-0.019806	-0.000429	-0.014994	-0.039383
	(0.11095)	(0.10192)	(0.03753)	(0.24839)	(0.15091)	(0.00018)	(0.01387)	(0.21123)
	[7.64639]	[-0.42554]	[-2.44178]	[-0.65717]	[-0.13125]	[-2.38748]	[-1.08080]	[-0.18645]
LHEXPTOTAL(-2)	0.082404	-0.013082	0.020200	-0.070967	-0.020132	8.01E-05	-0.005231	-0.045217
	(0.15247)	(0.14007)	(0.05157)	(0.34134)	(0.20738)	(0.00025)	(0.01906)	(0.29027)
	[0.54047]	[-0.09340]	[0.39169]	[-0.20791]	[-0.09708]	[0.32479]	[-0.27439]	[-0.15577]
LHEXPTOTAL(-3)	-0.056714	0.040448	0.003522	-0.016506	0.015438	-4.42E-05	0.005837	0.015736
	(0.15114)	(0.13884)	(0.05112)	(0.33836)	(0.20557)	(0.00024)	(0.01890)	(0.28774)
	[-0.37525]	[0.29132]	[0.06890]	[-0.04878]	[0.07510]	[-0.18073]	[0.30885]	[0.05469]
LHEXPTOTAL(-4)	-0.665144	0.106694	-0.087598	1.174222	0.966045	0.001175	0.023379	0.503488
	(0.17353)	(0.15941)	(0.05869)	(0.38848)	(0.23603)	(0.00028)	(0.02170)	(0.33036)
	[-3.83311]	[0.66930]	[-1.49247]	[3.02260]	[4.09294]	[4.18607]	[1.07751]	[1.52404]
LHEXPTOTAL(-5)	0.384588	-0.380560	-0.039971	-0.654169	-0.805277	-0.001460	0.011439	-0.341209
	(0.22057)	(0.20263)	(0.07461)	(0.49380)	(0.30002)	(0.00036)	(0.02758)	(0.41993)
	[1.74361]	[-1.87810]	[-0.53576]	[-1.32476]	[-2.68412]	[-4.09206]	[0.41476]	[-0.81254]
LHEXPTOTAL(-6)	0.176539	0.127079	-0.002163	-0.252520	0.144076	-0.000160	-0.037160	-0.146404
	(0.21123)	(0.19405)	(0.07145)	(0.47289)	(0.28731)	(0.00034)	(0.02641)	(0.40214)
	[0.83577]	[0.65489]	[-0.03027]	[-0.53400]	[0.50147]	[-0.46842]	[-1.40694]	[-0.36406]
LMCASE(-1)	0.096504	1.058085	0.029355	-0.095726	-0.015807	8.39E-05	-0.010780	-0.037862
	(0.03348)	(0.03076)	(0.01132)	(0.07495)	(0.04554)	(5.4E-05)	(0.00419)	(0.06374)
	[2.88249]	[34.4021]	[2.59229]	[-1.27716]	[-0.34710]	[1.54928]	[-2.57512]	[-0.59402]

LMCASE(-2)	-0.027667	-0.017720	-0.009212	-0.016265	-0.024691	-3.37E-05	0.000458	0.001350
	(0.04497)	(0.04132)	(0.01521)	(0.10069)	(0.06117)	(7.3E-05)	(0.00562)	(0.08562)
	[-0.61517]	[-0.42889]	[-0.60556]	[-0.16154]	[-0.40363]	[-0.46324]	[0.08149]	[0.01576]
LMCASE(-3)	-0.027079	-0.021454	-0.008879	0.008426	0.004895	-3.32E-05	0.003345	-0.007576
	(0.04345)	(0.03991)	(0.01469)	(0.09726)	(0.05909)	(7.0E-05)	(0.00543)	(0.08271)
	[-0.62330]	[-0.53755]	[-0.60425]	[0.08663]	[0.08284]	[-0.47200]	[0.61569]	[-0.09160]
LMCASE(-4)	-0.118891	-0.436955	-0.021087	0.172720	-0.051682	-0.000125	0.011627	-0.010211
	(0.04802)	(0.04411)	(0.01624)	(0.10750)	(0.06531)	(7.8E-05)	(0.00600)	(0.09142)
	[-2.47606]	[-9.90582]	[-1.29837]	[1.60675]	[-0.79132]	[-1.61095]	[1.93659]	[-0.11170]
LMCASE(-5)	0.220800	0.517129	0.056219	-0.374304	-0.006768	0.000195	-0.027432	-0.057331
	(0.06539)	(0.06007)	(0.02212)	(0.14638)	(0.08894)	(0.00011)	(0.00818)	(0.12448)
	[3.37686]	[8.60906]	[2.54199]	[-2.55702]	[-0.07610]	[1.84531]	[-3.35525]	[-0.46054]
LMCASE(-6)	-0.064604	-0.068213	-0.038849	0.201571	0.074276	-6.47E-05	0.009306	0.042422
	(0.05796)	(0.05325)	(0.01960)	(0.12976)	(0.07884)	(9.4E-05)	(0.00725)	(0.11035)
	[-1.11459]	[-1.28105]	[-1.98159]	[1.55339]	[0.94213]	[-0.68985]	[1.28399]	[0.38443]
LGDPC(-1)	0.271388	-0.357478	1.081034	0.890728	0.405448	0.000737	0.068984	0.043567
	(0.49947)	(0.45885)	(0.16894)	(1.11819)	(0.67937)	(0.00081)	(0.06245)	(0.95091)
	[0.54335]	[-0.77908]	[6.39890]	[0.79658]	[0.59680]	[0.91238]	[1.10457]	[0.04582]
LGDPC(-2)	-0.149772	-0.165632	-0.064474	1.144060	0.334814	0.000143	0.049228	0.475873
	(0.60500)	(0.55580)	(0.20464)	(1.35445)	(0.82292)	(0.00098)	(0.07565)	(1.15183)
	[-0.24755]	[-0.29801]	[-0.31507]	[0.84467]	[0.40686]	[0.14603]	[0.65074]	[0.41315]
LGDPC(-3)	0.179087	0.113023	0.028879	-0.959572	-0.360984	-0.000138	-0.060238	-0.382781
	(0.60180)	(0.55285)	(0.20355)	(1.34727)	(0.81855)	(0.00097)	(0.07525)	(1.14572)
	[0.29759]	[0.20444]	[0.14188]	[-0.71223]	[-0.44100]	[-0.14123]	[-0.80053]	[-0.33410]
LGDPC(-4)	-1.448412	9.383750	-0.739796	-0.823220	-5.783691	-0.001627	-0.048277	-2.493788
	(0.64499)	(0.59253)	(0.21816)	(1.44398)	(0.87731)	(0.00104)	(0.08065)	(1.22796)
	[-2.24563]	[15.8367]	[-3.39104]	[-0.57011]	[-6.59254]	[-1.55867]	[-0.59861]	[-2.03084]
LGDPC(-5)	1.510604	-9.129386	0.690994	0.205181	5.940542	0.001087	-0.005114	2.128274
	(0.83593)	(0.76794)	(0.28275)	(1.87145)	(1.13702)	(0.00135)	(0.10452)	(1.59148)
	[1.80709]	[-11.8881]	[2.44387]	[0.10964]	[5.22464]	[0.80367]	[-0.04892]	[1.33729]
LGDPC(-6)	-0.382301	-0.958203	-0.046741	2.645934	0.293398	0.001144	0.209661	0.690583
	(0.65235)	(0.59929)	(0.22065)	(1.46045)	(0.88732)	(0.00106)	(0.08157)	(1.24197)
	[-0.58604]	[-1.59889]	[-0.21183]	[1.81172]	[0.33066]	[1.08330]	[2.57034]	[0.55604]
LEDUEXP(-1)	-0.204029	-0.143734	-0.087584	1.260613	0.030172	-0.000228	0.015140	0.118067
	(0.10260)	(0.09425)	(0.03470)	(0.22969)	(0.13955)	(0.00017)	(0.01283)	(0.19533)
	[-1.98860]	[-1.52496]	[-2.52379]	[5.48821]	[0.21620]	[-1.37422]	[1.18018]	[0.60444]
LEDUEXP(-2)	0.177318	0.037405	0.110333	-0.159197	-0.216779	0.000422	-0.003155	0.048290
	(0.09122)	(0.08380)	(0.03085)	(0.20421)	(0.12407)	(0.00015)	(0.01141)	(0.17366)
	[1.94389]	[0.44636]	[3.57601]	[-0.77956]	[-1.74719]	[2.86016]	[-0.27662]	[0.27807]
LEDUEXP(-3)	0.030203	0.068107	-0.038132	0.118402	0.219883	-0.000152	-0.010524	-0.046722
	(0.09403)	(0.08638)	(0.03180)	(0.21051)	(0.12790)	(0.00015)	(0.01176)	(0.17902)
	[0.32121]	[0.78843]	[-1.19894]	[0.56245]	[1.71920]	[-1.00021]	[-0.89511]	[-0.26099]
LEDUEXP(-4)	0.213519	0.326882	0.018148	-1.512513	-0.635086	-0.000653	0.008669	-0.812399
	(0.13747)	(0.12629)	(0.04650)	(0.30777)	(0.18699)	(0.00022)	(0.01719)	(0.26173)
	[1.55316]	[2.58829]	[0.39028]	[-4.91442]	[-3.39636]	[-2.93603]	[0.50429]	[-3.10398]
LEDUEXP(-5)	-0.257005	-0.351060	-0.008551	1.260653	0.435182	0.000621	-0.013156	0.802126
	(0.10992)	(0.10098)	(0.03718)	(0.24608)	(0.14951)	(0.00018)	(0.01374)	(0.20927)
	[-2.33812]	[-3.47655]	[-0.23000]	[5.12289]	[2.91071]	[3.49307]	[-0.95719]	[3.83300]

LEDUEXP(-6)	0.089293	-0.096009	0.062780	-0.078922	-0.212905	0.000316	0.007888	0.011440
	(0.06847)	(0.06290)	(0.02316)	(0.15329)	(0.09313)	(0.00011)	(0.00856)	(0.13035)
	[1.30412]	[-1.52636]	[2.71083]	[-0.51486]	[-2.28607]	[2.85388]	[0.92133]	[0.08776]
LCO2(-1)	0.143588	0.121089	0.040468	-0.206769	0.977943	8.13E-05	-0.020503	-0.103869
	(0.09688)	(0.08900)	(0.03277)	(0.21690)	(0.13178)	(0.00016)	(0.01211)	(0.18445)
	[1.48205]	[1.36047]	[1.23490]	[-0.95329]	[7.42095]	[0.51863]	[-1.69247]	[-0.56312]
LCO2(-2)	-0.104211	-0.119219	-0.019138	0.140178	-0.150661	5.70E-05	0.013949	0.112271
	(0.10633)	(0.09768)	(0.03597)	(0.23805)	(0.14463)	(0.00017)	(0.01330)	(0.20244)
	[-0.98005]	[-1.22046]	[-0.53212]	[0.58886]	[-1.04169]	[0.33110]	[1.04913]	[0.55460]
LCO2(-3)	-0.047802	0.009467	-0.028955	-0.183212	0.073944	-0.000237	-0.004180	-0.128428
	(0.10047)	(0.09230)	(0.03398)	(0.22493)	(0.13666)	(0.00016)	(0.01256)	(0.19128)
	[-0.47578]	[0.10257]	[-0.85203]	[-0.81454]	[0.54109]	[-1.45645]	[-0.33270]	[-0.67142]
LCO2(-4)	0.024458	-0.312350	0.014974	-0.292445	-0.230647	-0.000246	-0.002782	0.267878
	(0.13287)	(0.12207)	(0.04494)	(0.29747)	(0.18073)	(0.00022)	(0.01661)	(0.25297)
	[0.18407]	[-2.55884]	[0.33317]	[-0.98310]	[-1.27617]	[-1.14400]	[-0.16742]	[1.05893]
LCO2(-5)	0.061554	0.356416	0.014004	0.341868	0.178754	0.000417	-0.004207	-0.223745
	(0.11612)	(0.10667)	(0.03928)	(0.25996)	(0.15794)	(0.00019)	(0.01452)	(0.22107)
	[0.53010]	[3.34117]	[0.35655]	[1.31508]	[1.13176]	[2.22197]	[-0.28976]	[-1.01210]
LCO2(-6)	-0.065361	-0.076421	-0.002549	0.084672	-0.189577	0.000107	0.007043	0.117050
	(0.06185)	(0.05682)	(0.02092)	(0.13848)	(0.08413)	(0.00010)	(0.00773)	(0.11776)
	[-1.05669]	[-1.34488]	[-0.12182]	[0.61145]	[-2.25330]	[1.07263]	[0.91058]	[0.99397]
LPOPDEN(-1)	306.9085	174.6988	135.6075	-376.9840	-173.6379	1.421012	-24.77330	-105.1600
	(121.258)	(111.396)	(41.0144)	(271.467)	(164.934)	(0.19621)	(15.1620)	(230.856)
	[2.53103]	[1.56827]	[3.30634]	[-1.38869]	[-1.05277]	[7.24227]	[-1.63391]	[-0.45552]
LPOPDEN(-2)	-212.3138	-97.25099	-103.4163	105.1631	103.3605	-0.386148	8.715771	-19.68161
	(119.519)	(109.798)	(40.4262)	(267.574)	(162.569)	(0.19340)	(14.9446)	(227.545)
	[-1.77639]	[-0.88572]	[-2.55815]	[0.39302]	[0.63580]	[-1.99666]	[0.58321]	[-0.08650]
LPOPDEN(-3)	-60.79509	-43.35069	9.399466	-53.97971	-128.8300	0.042313	8.701601	24.84487
	(108.254)	(99.4491)	(36.6158)	(242.353)	(147.245)	(0.17517)	(13.5359)	(206.097)
	[-0.56160]	[-0.43591]	[0.25671]	[-0.22273]	[-0.87493]	[0.24156]	[0.64285]	[0.12055]
LPOPDEN(-4)	-274.8872	-83.63909	-105.7567	166.5179	1085.232	-0.597162	-6.013223	597.9716
	(152.147)	(139.772)	(51.4621)	(340.619)	(206.948)	(0.24619)	(19.0242)	(289.662)
	[-1.80672]	[-0.59840]	[-2.05504]	[0.48887]	[5.24399]	[-2.42559]	[-0.31608]	[2.06437]
LPOPDEN(-5)	323.7738	52.58812	119.7837	31.80592	-1019.219	0.742220	14.58637	-543.0402
	(125.540)	(115.329)	(42.4626)	(281.052)	(170.757)	(0.20314)	(15.6973)	(239.007)
	[2.57905]	[0.45598]	[2.82092]	[0.11317]	[-5.96881]	[3.65376]	[0.92923]	[-2.27207]
LPOPDEN(-6)	-83.10877	-1.071373	-55.95483	124.5764	131.6304	-0.224507	-1.494723	45.49449
	(65.4576)	(60.1336)	(22.1404)	(146.543)	(89.0344)	(0.10592)	(8.18473)	(124.620)
	[-1.26966]	[-0.01782]	[-2.52728]	[0.85010]	[1.47842]	[-2.11962]	[-0.18262]	[0.36506]
LDEBT(-1)	0.424293	0.083919	-0.010427	2.885790	2.538635	0.000338	1.129642	0.165509
	(1.11720)	(1.02634)	(0.37788)	(2.50114)	(1.51960)	(0.00181)	(0.13969)	(2.12697)
	[0.37978]	[0.08177]	[-0.02759]	[1.15379]	[1.67059]	[0.18690]	[8.08657]	[0.07781]
LDEBT(-2)	-0.043125	0.146956	-0.037888	-2.884574	-1.562514	-0.000946	-0.153189	-0.819271
	(1.27485)	(1.17116)	(0.43121)	(2.85407)	(1.73403)	(0.00206)	(0.15941)	(2.42711)
	[-0.03383]	[0.12548]	[-0.08787]	[-1.01069]	[-0.90109]	[-0.45841]	[-0.96100]	[-0.33755]
LDEBT(-3)	0.920606	1.281076	0.074386	4.409809	2.437459	0.001612	-0.025366	1.522565
	(1.32458)	(1.21685)	(0.44803)	(2.96541)	(1.80168)	(0.00214)	(0.16562)	(2.52179)
	[0.69501]	[1.05278]	[0.16603]	[1.48708]	[1.35288]	[0.75205]	[-0.15315]	[0.60376]
LDEBT(-4)	3.612160	2.901974	0.544364	-15.54615	-11.97576	-0.002657	-0.862909	-2.848451
	(2.04651)	(1.88006)	(0.69221)	(4.58162)	(2.78363)	(0.00331)	(0.25589)	(3.89621)
	[1.76503]	[1.54356]	[0.78641]	[-3.39315]	[-4.30221]	[-0.80225]	[-3.37215]	[-0.73108]
LDEBT(-5)	-4.821186	-4.172704	-0.842216	15.33584	11.73468	0.001246	1.049353	2.405203
	(1.99925)	(1.83664)	(0.67623)	(4.47582)	(2.71935)	(0.00324)	(0.24998)	(3.80624)
	[-2.41150]	[-2.27192]	[-1.24547]	[3.42637]	[4.31525]	[0.38506]	[4.19769]	[0.63191]
LDEBT(-6)	0.396091	0.220380	0.229313	-3.657709	-1.754420	-0.000272	-0.139935	-1.211582
	(1.24987)	(1.14821)	(0.42275)	(2.79814)	(1.70005)	(0.00202)	(0.15628)	(2.37954)
	[0.31691]	[0.19193]	[0.54243]	[-1.30719]	[-1.03198]	[-0.13465]	[-0.89540]	[-0.50917]

LIMMRATE(-1)	-0.012253	0.105849	-0.008378	-0.227195	0.015234	-0.000171	-0.015868	0.921537
	(0.11078)	(0.10177)	(0.03747)	(0.24802)	(0.15069)	(0.00018)	(0.01385)	(0.21091)
	[-0.11060]	[1.04005]	[-0.22357]	[-0.91604]	[0.10110]	[-0.95420]	[-1.14548]	[4.36925]
LIMMRATE(-2)	-0.036599	-0.127366	-0.042450	-0.122031	0.064912	-0.000187	0.007353	-0.226129
	(0.11615)	(0.10670)	(0.03929)	(0.26003)	(0.15799)	(0.00019)	(0.01452)	(0.22113)
	[-0.31510]	[-1.19365]	[-1.08052]	[-0.46929]	[0.41087]	[-0.99248]	[0.50629]	[-1.02260]
LIMMRATE(-3)	-0.045497	0.033483	0.015596	-0.083298	-0.074795	-8.05E-06	0.000729	0.072835
	(0.12174)	(0.11183)	(0.04118)	(0.27254)	(0.16558)	(0.00020)	(0.01522)	(0.23176)
	[-0.37374]	[0.29939]	[0.37878]	[-0.30564]	[-0.45170]	[-0.04086]	[0.04786]	[0.31426]
LIMMRATE(-4)	0.167383	-0.463470	0.038397	1.053892	0.776488	0.000183	0.022344	0.180137
	(0.18308)	(0.16819)	(0.06193)	(0.40988)	(0.24903)	(0.00030)	(0.02289)	(0.34856)
	[0.91424]	[-2.75557]	[0.62005]	[2.57122]	[3.11806]	[0.61917]	[0.97605]	[0.51680]
LIMMRATE(-5)	0.060684	0.557379	0.026662	-1.124993	-0.708231	5.93E-05	-0.033996	-0.307964
	(0.15475)	(0.14217)	(0.05234)	(0.34646)	(0.21049)	(0.00025)	(0.01935)	(0.29463)
	[0.39213]	[3.92057]	[0.50936]	[-3.24714]	[-3.36460]	[0.23695]	[-1.75685]	[-1.04527]
LIMMRATE(-6)	-0.139789	-0.043891	-0.089266	-0.209304	0.124674	-0.000474	-0.003355	-0.238146
	(0.07543)	(0.06929)	(0.02551)	(0.16886)	(0.10259)	(0.00012)	(0.00943)	(0.14360)
	[-1.85330]	[-0.63342]	[-3.49891]	[-1.23950]	[1.21521]	[-3.88134]	[-0.35571]	[-1.65839]
C	-5.619911	-11.50747	1.718957	-1.226222	-16.09280	0.016627	0.866438	8.906548
	(3.12877)	(2.87429)	(1.05827)	(7.00453)	(4.25570)	(0.00506)	(0.39122)	(5.95666)
	[-1.79620]	[-4.00359]	[1.62430]	[-0.17506]	[-3.78147]	[3.28417]	[2.21472]	[1.49523]
D(LHEXPTOTAL(-7))	0.131246	0.091317	0.100504	0.385074	-0.008503	0.000558	0.017425	0.219194
	(0.19204)	(0.17642)	(0.06496)	(0.42993)	(0.26121)	(0.00031)	(0.02401)	(0.36561)
	[0.68344]	[0.51761]	[1.54729]	[0.89567]	[-0.03255]	[1.79450]	[0.72568]	[0.59953]
D(LHEXPTOTAL(-8))	-0.797110	0.776615	-0.025276	0.943473	-1.491708	0.001341	0.015242	-0.275494
	(0.18347)	(0.16854)	(0.06206)	(0.41073)	(0.24955)	(0.00030)	(0.02294)	(0.34929)
	[-4.34474]	[4.60780]	[-0.40731]	[2.29705]	[-5.97767]	[4.51823]	[0.66442]	[-0.78873]
D(LMCASE(-7))	-0.052499	-0.014732	0.003786	-0.243621	-0.113633	-8.28E-05	-0.000311	-0.066031
	(0.06126)	(0.05627)	(0.02072)	(0.13714)	(0.08332)	(9.9E-05)	(0.00766)	(0.11662)
	[-0.85704]	[-0.26178]	[0.18272]	[-1.77647]	[-1.36381]	[-0.83544]	[-0.04059]	[-0.56620]
D(LMCASE(-8))	-0.176241	-0.583882	-0.016641	0.200064	0.300687	0.000113	-0.008323	0.289470
	(0.06215)	(0.05709)	(0.02102)	(0.13913)	(0.08453)	(0.00010)	(0.00777)	(0.11832)
	[-2.83587]	[-10.2270]	[-0.79166]	[1.43795]	[3.55711]	[1.12058]	[-1.07107]	[2.44656]
D(LGDPC(-7))	-0.455626	0.252821	-0.195068	-3.461097	-0.770519	-0.002312	-0.148624	-1.111653
	(0.67004)	(0.61554)	(0.22663)	(1.50005)	(0.91138)	(0.00108)	(0.08378)	(1.27564)
	[-0.68000]	[0.41073]	[-0.86072]	[-2.30732]	[-0.84545]	[-2.13213]	[-1.77397]	[-0.87145]
D(LGDPC(-8))	1.319913	4.822534	-0.331572	-1.179884	1.980088	-0.002365	-0.120451	2.439329
	(0.62965)	(0.57844)	(0.21297)	(1.40963)	(0.85644)	(0.00102)	(0.07873)	(1.19875)
	[2.09626]	[8.33715]	[-1.55687]	[-0.83701]	[2.31199]	[-2.32129]	[-1.52990]	[2.03489]
D(LEDUEXP(-7))	-0.081474	0.072612	-0.054794	-0.078540	0.171779	-0.000342	-0.008210	-0.092060
	(0.07454)	(0.06848)	(0.02521)	(0.16688)	(0.10139)	(0.00012)	(0.00932)	(0.14192)
	[-1.09299]	[1.06035]	[-2.17323]	[-0.47063]	[1.69422]	[-2.83290]	[-0.88087]	[-0.64869]
D(LEDUEXP(-8))	0.169331	0.239425	-0.056942	-0.514843	0.619180	-0.000867	0.024187	0.035669
	(0.07269)	(0.06678)	(0.02459)	(0.16273)	(0.09887)	(0.00012)	(0.00909)	(0.13839)
	[2.32953]	[3.58545]	[-2.31599]	[-3.16375]	[6.26255]	[-7.37516]	[2.66111]	[0.25775]
D(LCO2(-7))	-0.020994	0.007305	-0.022788	-0.171019	0.135415	-0.000229	-0.001737	-0.155532
	(0.06249)	(0.05741)	(0.02114)	(0.13991)	(0.08500)	(0.00010)	(0.00781)	(0.11898)
	[-0.33594]	[0.12725]	[-1.07806]	[-1.22238]	[1.59308]	[-2.26357]	[-0.22233]	[-1.30725]
D(LCO2(-8))	0.040845	0.136051	0.043386	-0.295827	0.364462	-0.000460	0.005299	0.327787
	(0.06736)	(0.06188)	(0.02278)	(0.15080)	(0.09162)	(0.00011)	(0.00842)	(0.12824)
	[0.60636]	[2.19854]	[1.90421]	[-1.96165]	[3.97781]	[-4.22123]	[0.62911]	[2.55595]

D(LPOPDEN(-7))	77.59155	17.79826	48.64685	31.24673	-94.37406	0.253689	2.192559	34.20756
	(70.1114)	(64.4089)	(23.7145)	(156.962)	(95.3644)	(0.11345)	(8.76663)	(133.480)
	[1.10669]	[0.27633]	[2.05136]	[0.19907]	[-0.98962]	[2.23615]	[0.25010]	[0.25627]
D(LPOPDEN(-8))	-384.7100	302.8434	-41.66185	-255.8935	-266.7357	-0.026294	-35.95174	-206.3116
	(73.0366)	(67.0962)	(24.7039)	(163.511)	(99.3432)	(0.11818)	(9.13240)	(139.050)
	[-5.26736]	[4.51357]	[-1.68645]	[-1.56500]	[-2.68499]	[-0.22249]	[-3.93672]	[-1.48373]
D(LDEBT(-7))	1.340369	1.623240	0.086236	6.081738	2.760971	0.002488	-0.074832	2.404767
	(1.40759)	(1.29311)	(0.47610)	(3.15125)	(1.91459)	(0.00228)	(0.17600)	(2.67983)
	[0.95224]	[1.25530]	[0.18113]	[1.92994]	[1.44207]	[1.09234]	[-0.42517]	[0.89736]
D(LDEBT(-8))	3.928962	4.774550	-0.365788	-12.59460	-11.72044	-0.003318	-0.105532	-5.882270
	(1.74275)	(1.60101)	(0.58947)	(3.90159)	(2.37047)	(0.00282)	(0.21791)	(3.31791)
	[2.25446]	[2.98222]	[-0.62054]	[-3.22807]	[-4.94436]	[-1.17655]	[-0.48429]	[-1.77288]
D(LIMMRATE(-7))	0.023203	-0.025139	0.044433	0.193118	-0.108947	0.000286	0.011169	0.194216
	(0.07370)	(0.06770)	(0.02493)	(0.16499)	(0.10024)	(0.00012)	(0.00921)	(0.14031)
	[0.31484]	[-0.37131]	[1.78252]	[1.17049]	[-1.08685]	[2.39783]	[1.21209]	[1.38423]
D(LIMMRATE(-8))	-0.195484	-0.123341	0.075028	0.815947	-0.021341	0.000688	0.019154	0.453129
	(0.08006)	(0.07355)	(0.02708)	(0.17923)	(0.10889)	(0.00013)	(0.01001)	(0.15242)
	[-2.44178]	[-1.67705]	[2.77075]	[4.55252]	[-0.19598]	[5.31224]	[1.91342]	[2.97296]
R-squared	0.994818	0.999852	0.999830	0.999509	0.998984	1.000000	0.999970	0.996317
Adj. R-squared	0.983763	0.999536	0.999467	0.998463	0.996816	1.000000	0.999905	0.988459
Sum sq. resids	0.011570	0.009764	0.001324	0.057987	0.021405	3.03E-08	0.000181	0.041935
S.E. equation	0.019638	0.018041	0.006642	0.043965	0.026712	3.18E-05	0.002456	0.037388
F-statistic	89.98833	3162.993	2754.432	955.0149	460.8256	46138263	15430.03	126.7990
Log likelihood	293.3298	301.3890	396.3098	216.7676	264.1059	903.8462	490.8473	232.1622
Akaike AIC	-4.806943	-4.976609	-6.974943	-3.195107	-4.191702	-17.65992	-8.965207	-3.519203
Schwarz SC	-3.059553	-3.229220	-5.227554	-1.447718	-2.444313	-15.91253	-7.217817	-1.771814
Mean dependent	3.317147	15.09982	7.465994	4.355970	8.518199	5.021399	14.73144	3.671457
S.D. dependent	0.154116	0.837270	0.287677	1.121358	0.473384	0.178102	0.251687	0.348029

Determinant resid covariance (dof adj.)	6.83E-44
Determinant resid covariance	6.76E-48
Log likelihood	4080.758
Akaike information criterion	-74.96333
Schwarz criterion	-60.98421

Source: Eviews Software Output.

Appendix 4

Results of Determinants of Under-five Malaria Mortality in Nigeria.

Table 5a: Lag lenth selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: LFEMALELFP LFPMEDU LGDPC LHIVAIDS LIMMRATE LMALNTRN LPHYDE...
Exogenous variables: C
Date: 10/18/18 Time: 12:41
Sample: 1990Q1 2016Q4
Included observations: 100

Lag	LogL	LR	FPE	AIC	SC	HQ
0	852.3279	NA	6.40e-18	-16.88656	-16.67814	-16.80221
1	2889.851	3708.293	4.64e-35	-56.35703	-54.48131	-55.59789
2	3188.163	495.1979*	4.38e-37*	-61.04327*	-57.50024*	-59.60934*
3	3222.793	51.94376	8.36e-37	-60.45585	-55.24551	-58.34713
4	3247.067	32.52741	2.08e-36	-59.66134	-52.78369	-56.87783

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 5b: VAR Estimation results

Vector Autoregression Estimates
Date: 10/18/18 Time: 12:55
Sample (adjusted): 1991Q3 2015Q4
Included observations: 98 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LU5M	LFEMALELFP	LFPMEDU	LGDPC	LHIVAIDS	LIMMRATE	LMALNTRN	LPHYDEN
LU5M(-1)	1.628956	-15.46999	-0.004649	6.500547	0.053134	42.08525	-3.932439	48.63736
	(0.63705)	(86.1299)	(1.31469)	(7.48849)	(0.05657)	(30.2450)	(3.71598)	(29.4319)
	[2.55703]	[-0.17961]	[-0.00354]	[0.86807]	[0.93932]	[1.39148]	[-1.05825]	[1.65254]
LU5M(-2)	-0.636501	15.44803	-0.078266	-6.904612	-0.056243	-42.89173	3.393404	-45.62364
	(0.63724)	(86.1554)	(1.31508)	(7.49071)	(0.05658)	(30.2539)	(3.71708)	(29.4407)
	[-0.99884]	[0.17930]	[-0.05951]	[-0.92176]	[-0.99399]	[-1.41772]	[0.91292]	[-1.54968]
LFEMALELFP(-1)	-0.005338	1.014577	1.21E-05	-0.046886	-0.000299	-0.335309	0.032387	-0.342193
	(0.00481)	(0.64969)	(0.00992)	(0.05649)	(0.00043)	(0.22814)	(0.02803)	(0.22201)
	[-1.11087]	[1.56163]	[0.00122]	[-0.83002]	[-0.70021]	[-1.46973]	[1.15542]	[-1.54134]
LFEMALELFP(-2)	-0.003427	-1.215246	0.001787	0.057060	0.000483	0.316125	-0.022922	0.344465
	(0.00501)	(0.67709)	(0.01034)	(0.05887)	(0.00044)	(0.23776)	(0.02921)	(0.23137)
	[-0.68437]	[-1.79482]	[0.17294]	[0.96928]	[1.08601]	[1.32958]	[-0.78466]	[1.48880]
LFPMEDU(-1)	-0.000676	1.335980	1.438732	0.025231	-0.005023	2.023531	-0.553251	1.837485
	(0.06076)	(8.21518)	(0.12540)	(0.71426)	(0.00540)	(2.88480)	(0.35444)	(2.80725)
	[-0.01112]	[0.16262]	[11.4734]	[0.03532]	[-0.93092]	[0.70144]	[-1.56094]	[0.65455]
LFPMEDU(-2)	0.012274	0.365981	-0.546644	0.607259	0.003839	-0.273485	0.235483	1.496104
	(0.05905)	(7.98330)	(0.12186)	(0.69410)	(0.00524)	(2.80338)	(0.34443)	(2.72802)
	[0.20787]	[0.04584]	[-4.48593]	[0.87489]	[0.73227]	[-0.09756]	[0.68369]	[0.54842]
LGDPC(-1)	-0.002689	-0.233419	0.003278	1.230431	0.000403	0.185917	-0.053330	0.001608
	(0.01033)	(1.39712)	(0.02133)	(0.12147)	(0.00092)	(0.49061)	(0.06028)	(0.47742)
	[-0.26026]	[-0.16707]	[0.15369]	[10.1294]	[0.43961]	[0.37895]	[-0.88475]	[0.00337]
LGDPC(-2)	0.000891	0.100434	-0.014532	-0.486821	-0.000311	-0.204247	-0.003943	0.067041
	(0.00909)	(1.22868)	(0.01875)	(0.10683)	(0.00081)	(0.43146)	(0.05301)	(0.41986)
	[0.09800]	[0.08174]	[-0.77485]	[-4.55712]	[-0.38554]	[-0.47339]	[-0.07438]	[0.15967]
LHIVAIDS(-1)	0.654351	66.41872	-1.687471	9.956478	1.459869	-79.94323	2.535450	9.795425
	(1.53102)	(206.995)	(3.15959)	(17.9970)	(0.13595)	(72.6876)	(8.93060)	(70.7336)
	[0.42739]	[0.32087]	[-0.53408]	[0.55323]	[10.7387]	[-1.09982]	[0.28391]	[0.13848]
LHIVAIDS(-2)	-0.662618	-66.30551	1.600712	-10.11280	-0.463408	79.55836	-3.227145	-5.332633
	(1.51830)	(205.275)	(3.13333)	(17.8475)	(0.13482)	(72.0835)	(8.85638)	(70.1458)
	[-0.43642]	[-0.32301]	[0.51087]	[-0.56662]	[-3.43736]	[1.10370]	[-0.36439]	[-0.07602]

LIMMRATE(-1)	-0.000593 (0.00245) [-0.24208]	-0.028059 (0.33113) [-0.08474]	-0.003621 (0.00505) [-0.71637]	-0.001724 (0.02879) [-0.05990]	-0.000432 (0.00022) [-1.98727]	1.295167 (0.11628) [11.1385]	0.015732 (0.01429) [1.10118]	-0.182408 (0.11315) [-1.61205]
LIMMRATE(-2)	5.11E-05 (0.00245) [0.02085]	-0.002777 (0.33167) [-0.00837]	0.003226 (0.00506) [0.63721]	0.003968 (0.02884) [0.13762]	0.000336 (0.00022) [1.54089]	-0.472025 (0.11647) [-4.05290]	-0.014629 (0.01431) [-1.02234]	0.173612 (0.11334) [1.53185]
LMALNTRN(-1)	-0.001206 (0.02140) [-0.05636]	-0.025983 (2.89304) [-0.00898]	-0.073260 (0.04416) [-1.65898]	-0.124452 (0.25153) [-0.49478]	0.000314 (0.00190) [0.16503]	-0.784650 (1.01591) [-0.77236]	1.587808 (0.12482) [12.7211]	0.835455 (0.98860) [0.84509]
LMALNTRN(-2)	0.000624 (0.02045) [0.03051]	-0.007432 (2.76515) [-0.00269]	0.054486 (0.04221) [1.29092]	0.033251 (0.24041) [0.13831]	-0.001115 (0.00182) [-0.61385]	0.417916 (0.97100) [0.43040]	-0.588426 (0.11930) [-4.93235]	-1.015907 (0.94489) [-1.07515]
LPHYDEN(-1)	0.000538 (0.00292) [0.18383]	-0.013149 (0.39540) [-0.03325]	0.002424 (0.00604) [0.40157]	0.011387 (0.03438) [0.33123]	0.000136 (0.00026) [0.52430]	-0.287669 (0.13885) [-2.07182]	0.046683 (0.01706) [2.73651]	1.348859 (0.13512) [9.98299]
LPHYDEN(-2)	-0.000302 (0.00290) [-0.10411]	-0.013161 (0.39257) [-0.03352]	-0.000954 (0.00599) [-0.15917]	-0.033683 (0.03413) [-0.98684]	-0.000405 (0.00026) [-1.57005]	0.056105 (0.13785) [0.40699]	-0.001866 (0.01694) [-0.11017]	-0.737695 (0.13415) [-5.49910]
C	0.078621 (0.33979) [0.23138]	-2.092088 (45.9401) [-0.04554]	1.441189 (0.70123) [2.05523]	2.262899 (3.99422) [0.56654]	0.043443 (0.03017) [1.43987]	2.347770 (16.1321) [0.14553]	7.818263 (1.98204) [3.94456]	-50.19938 (15.6984) [-3.19773]
D(LU5M(3))	0.232171 (0.85373) [0.27195]	-3.139545 (115.425) [-0.02720]	-0.691208 (1.76186) [-0.39232]	6.073250 (10.0356) [0.60517]	0.046728 (0.07581) [0.61642]	46.44623 (40.5323) [1.14591]	3.694933 (4.97991) [0.74197]	48.72362 (39.4427) [1.23530]
D(LU5M(4))	-0.040810 (0.80464) [-0.05072]	-1.848053 (108.788) [-0.01699]	0.887339 (1.66054) [0.53437]	-9.018018 (9.45847) [-0.95343]	-0.137625 (0.07145) [-1.92626]	-90.45513 (38.2015) [-2.36784]	-3.044435 (4.69354) [-0.64864]	-74.56175 (37.1745) [-2.00572]
D(LFEMALELFP(3))	-0.001808 (0.00634) [-0.28540]	0.068281 (0.85668) [0.07970]	0.006538 (0.01308) [0.49996]	-0.049856 (0.07448) [-0.66936]	-0.000432 (0.00056) [-0.76737]	-0.391655 (0.30083) [-1.30193]	-0.028382 (0.03696) [-0.76791]	-0.375589 (0.29274) [-1.28301]
D(LFEMALELFP(4))	0.000588 (0.00609) [0.09642]	-0.006546 (0.82384) [-0.00795]	-0.007611 (0.01258) [-0.60525]	0.059091 (0.07163) [0.82497]	0.001144 (0.00054) [2.11484]	0.713465 (0.28930) [2.46621]	0.026267 (0.03554) [0.73900]	0.544074 (0.28152) [1.93263]
D(LFPMEDU(3))	0.011379 (0.05042) [0.22569]	1.150148 (6.81677) [0.16872]	0.145555 (0.10405) [1.39888]	0.819853 (0.59268) [1.38330]	0.000168 (0.00448) [0.03758]	0.188619 (2.39375) [0.07880]	-0.626807 (0.29410) [-2.13125]	3.738932 (2.32940) [1.60511]
D(LFPMEDU(4))	-0.003934 (0.04157) [-0.09464]	0.994376 (5.61983) [0.17694]	-0.274586 (0.08578) [-3.20099]	-0.569079 (0.48861) [-1.16469]	0.004043 (0.00369) [1.09543]	7.975528 (1.97344) [4.04144]	-0.168369 (0.24246) [-0.69442]	4.158881 (1.92039) [2.16565]

LIMMRATE(-1)	-0.000593	-0.028059	-0.003621	-0.001724	-0.000432	1.295167	0.015732	-0.182408
	(0.00245)	(0.33113)	(0.00505)	(0.02879)	(0.00022)	(0.11628)	(0.01429)	(0.11315)
	[-0.24208]	[-0.08474]	[-0.71637]	[-0.05990]	[-1.98727]	[11.1385]	[1.10118]	[-1.61205]
LIMMRATE(-2)	5.11E-05	-0.002777	0.003226	0.003968	0.000336	-0.472025	-0.014629	0.173612
	(0.00245)	(0.33167)	(0.00506)	(0.02884)	(0.00022)	(0.11647)	(0.01431)	(0.11334)
	[0.02085]	[-0.00837]	[0.63721]	[0.13762]	[1.54089]	[-4.05290]	[-1.02234]	[1.53185]
LMALNTRN(-1)	-0.001206	-0.025983	-0.073260	-0.124452	0.000314	-0.784650	1.587808	0.835455
	(0.02140)	(2.89304)	(0.04416)	(0.25153)	(0.00190)	(1.01591)	(0.12482)	(0.98860)
	[-0.05636]	[-0.00898]	[-1.65898]	[-0.49478]	[0.16503]	[-0.77236]	[12.7211]	[0.84509]
LMALNTRN(-2)	0.000624	-0.007432	0.054486	0.033251	-0.001115	0.417916	-0.588426	-1.015907
	(0.02045)	(2.76515)	(0.04221)	(0.24041)	(0.00182)	(0.97100)	(0.11930)	(0.94489)
	[0.03051]	[-0.00269]	[1.29092]	[0.13831]	[-0.61385]	[0.43040]	[-4.93235]	[-1.07515]
LPHYDEN(-1)	0.000538	-0.013149	0.002424	0.011387	0.000136	-0.287669	0.046683	1.348859
	(0.00292)	(0.39540)	(0.00604)	(0.03438)	(0.00026)	(0.13885)	(0.01706)	(0.13512)
	[0.18383]	[-0.03325]	[0.40157]	[0.33123]	[0.52430]	[-2.07182]	[2.73651]	[9.98299]
LPHYDEN(-2)	-0.000302	-0.013161	-0.000954	-0.033683	-0.000405	0.056105	-0.001866	-0.737695
	(0.00290)	(0.39257)	(0.00599)	(0.03413)	(0.00026)	(0.13785)	(0.01694)	(0.13415)
	[-0.10411]	[-0.03352]	[-0.15917]	[-0.98684]	[-1.57005]	[0.40699]	[-0.11017]	[-5.49910]
C	0.078621	-2.092088	1.441189	2.262899	0.043443	2.347770	7.818263	-50.19938
	(0.33979)	(45.9401)	(0.70123)	(3.99422)	(0.03017)	(16.1321)	(1.98204)	(15.6984)
	[0.23138]	[-0.04554]	[2.05523]	[0.56654]	[1.43987]	[0.14553]	[3.94456]	[-3.19773]
D(LU5M(3))	0.232171	-3.139545	-0.691208	6.073250	0.046728	46.44623	3.694933	48.72362
	(0.85373)	(115.425)	(1.76186)	(10.0356)	(0.07581)	(40.5323)	(4.97991)	(39.4427)
	[0.27195]	[-0.02720]	[-0.39232]	[0.60517]	[0.61642]	[1.14591]	[0.74197]	[1.23530]
D(LU5M(4))	-0.040810	-1.848053	0.887339	-9.018018	-0.137625	-90.45513	-3.044435	-74.56175
	(0.80464)	(108.788)	(1.66054)	(9.45847)	(0.07145)	(38.2015)	(4.69354)	(37.1745)
	[-0.05072]	[-0.01699]	[0.53437]	[-0.95343]	[-1.92626]	[-2.36784]	[-0.64864]	[-2.00572]
D(LFEMALELFP(3))	-0.001808	0.068281	0.006538	-0.049856	-0.000432	-0.391655	-0.028382	-0.375589
	(0.00634)	(0.85668)	(0.01308)	(0.07448)	(0.00056)	(0.30083)	(0.03696)	(0.29274)
	[-0.28540]	[0.07970]	[0.49996]	[-0.66936]	[-0.76737]	[-1.30193]	[-0.76791]	[-1.28301]
D(LFEMALELFP(4))	0.000588	-0.006546	-0.007611	0.059091	0.001144	0.713465	0.026267	0.544074
	(0.00609)	(0.82384)	(0.01258)	(0.07163)	(0.00054)	(0.28930)	(0.03554)	(0.28152)
	[0.09642]	[-0.00795]	[-0.60525]	[0.82497]	[2.11484]	[2.46621]	[0.73900]	[1.93263]
D(LFPMEDU(3))	0.011379	1.150148	0.145555	0.819853	0.000168	0.188619	-0.626807	3.738932
	(0.05042)	(6.81677)	(0.10405)	(0.59268)	(0.00448)	(2.39375)	(0.29410)	(2.32940)
	[0.22569]	[0.16872]	[1.39888]	[1.38330]	[0.03758]	[0.07880]	[-2.13125]	[1.60511]
D(LFPMEDU(4))	-0.003934	0.994376	-0.274586	-0.569079	0.004043	7.975528	-0.168369	4.158881
	(0.04157)	(5.61983)	(0.08578)	(0.48861)	(0.00369)	(1.97344)	(0.24246)	(1.92039)
	[-0.09464]	[0.17694]	[-3.20099]	[-1.16469]	[1.09543]	[4.04144]	[-0.69442]	[2.16565]

D(LGDPC(3))	0.000674	-0.049441	-0.002843	0.269379	0.002021	-0.148552	-0.021197	0.707129
	(0.00984)	(1.33015)	(0.02030)	(0.11565)	(0.00087)	(0.46709)	(0.05739)	(0.45453)
	[0.06854]	[-0.03717]	[-0.14004]	[2.32929]	[2.31384]	[-0.31804]	[-0.36937]	[1.55573]
D(LGDPC(4))	-0.001024	0.117722	0.024280	-0.531800	-0.001412	0.528484	-0.086929	-0.173380
	(0.00764)	(1.03295)	(0.01577)	(0.08981)	(0.00068)	(0.36273)	(0.04457)	(0.35298)
	[-0.13397]	[0.11397]	[1.53993]	[-5.92146]	[-2.08137]	[1.45698]	[-1.95058]	[-0.49120]
D(LHIVAIDS(3))	0.400007	51.80935	5.742363	-9.342745	0.380864	-42.20698	0.859639	69.81464
	(1.95043)	(263.700)	(4.02514)	(22.9272)	(0.17319)	(92.5998)	(11.3771)	(90.1106)
	[0.20509]	[0.19647]	[1.42663]	[-0.40750]	[2.19916]	[-0.45580]	[0.07556]	[0.77477]
D(LHIVAIDS(4))	-0.333956	-31.07411	-12.39660	31.53115	-0.685636	-144.7116	-1.697539	-170.4865
	(1.26397)	(170.889)	(2.60846)	(14.8578)	(0.11223)	(60.0087)	(7.37283)	(58.3955)
	[-0.26421]	[-0.18184]	[-4.75246]	[2.12219]	[-6.10908]	[-2.41151]	[-0.23024]	[-2.91951]
D(LIMMRATE(3))	-2.43E-05	-0.058925	0.009727	0.024366	-0.000327	0.317536	-0.000831	-0.071407
	(0.00296)	(0.40077)	(0.00612)	(0.03484)	(0.00026)	(0.14073)	(0.01729)	(0.13695)
	[-0.00820]	[-0.14703]	[1.59008]	[0.69928]	[-1.24106]	[2.25630]	[-0.04803]	[-0.52141]
D(LIMMRATE(4))	-0.001768	-0.043271	-0.022645	-0.045724	9.32E-05	-0.619947	0.002698	-0.099880
	(0.00219)	(0.29548)	(0.00451)	(0.02569)	(0.00019)	(0.10376)	(0.01275)	(0.10097)
	[-0.80890]	[-0.14644]	[-5.02071]	[-1.77981]	[0.48042]	[-5.97478]	[0.21165]	[-0.98920]
D(LMALNTRN(3))	-0.014586	-0.470491	0.009282	-0.497165	-0.006094	-1.044002	0.180906	-3.174097
	(0.03233)	(4.37143)	(0.06673)	(0.38007)	(0.00287)	(1.53505)	(0.18860)	(1.49379)
	[-0.45110]	[-0.10763]	[0.13910]	[-1.30809]	[-2.12271]	[-0.68011]	[0.95920]	[-2.12487]
D(LMALNTRN(4))	0.005323	-0.620586	-0.113807	-0.732952	0.002578	-0.328551	0.143809	1.146295
	(0.02975)	(4.02210)	(0.06139)	(0.34970)	(0.00264)	(1.41238)	(0.17353)	(1.37442)
	[0.17894]	[-0.15429]	[-1.85372]	[-2.09596]	[0.97589]	[-0.23262]	[0.82873]	[0.83402]
D(LPHYDEN(3))	-0.002606	-0.025531	-0.002626	-0.098214	-0.001104	-0.205484	0.029536	-0.518900
	(0.00610)	(0.82416)	(0.01258)	(0.07166)	(0.00054)	(0.28941)	(0.03556)	(0.28163)
	[-0.42754]	[-0.03098]	[-0.20871]	[-1.37063]	[-2.03998]	[-0.71001]	[0.83064]	[-1.84250]
D(LPHYDEN(4))	0.004083	-0.017431	0.006143	-0.027482	0.000572	-0.397932	0.093234	-0.300658
	(0.00503)	(0.68010)	(0.01038)	(0.05913)	(0.00045)	(0.23882)	(0.02934)	(0.23240)
	[0.81167]	[-0.02563]	[0.59172]	[-0.46478]	[1.28019]	[-1.66624]	[3.17749]	[-1.29371]

R-squared	0.999991	0.650056	0.996737	0.999243	1.000000	0.990755	0.999876	0.997837
Adj. R-squared	0.999987	0.477776	0.995130	0.998870	1.000000	0.986204	0.999815	0.996773
Sum sq. resids	4.26E-05	0.779021	0.000182	0.005889	3.36E-07	0.096061	0.001450	0.090966
S.E. equation	0.000810	0.109476	0.001671	0.009518	7.19E-05	0.038443	0.004723	0.037410
F-statistic	225723.5	3.773252	620.4055	2681.436	19590985	217.6836	16390.15	937.2063
Log likelihood	578.7062	97.84355	507.7046	337.2075	816.0072	200.4031	405.8785	203.0736
Akaike AIC	-11.13686	-1.323338	-9.687848	-6.208317	-15.97974	-3.416390	-7.609764	-3.470891
Schwarz SC	-10.26641	-0.452889	-8.817400	-5.337869	-15.10929	-2.545942	-6.739316	-2.600442
Mean dependent	5.088633	3.695159	3.815225	7.431445	4.986107	3.650245	2.167231	-1.416025
S.D. dependent	0.220962	0.151492	0.023946	0.283201	0.182784	0.327293	0.347332	0.658506

Determinant resid covariance (dof adj.)	7.47E-40
Determinant resid covariance	2.80E-41
Log likelihood	3463.058
Akaike information criterion	-65.28691
Schwarz criterion	-58.32332

Appendix 5

Results of Impact of Public Health Expenditure on Under-Five Mortality in Nigeria.

Table 6a: Cointegration Results

Date: 03/10/18 Time: 14:18
Sample (adjusted): 1991Q2 2016Q4
Included observations: 103 after adjustments
Trend assumption: Linear deterministic trend
Series: D(LU5M) D(LHHEXP) D(LFEMALELFP) D(LINFLR) D(LGDPC)
Exogenous series: D(LHEXPTOTAL) D(LMCASE) D(LIMMRATE)
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.680078	254.7277	69.81889	0.0000
At most 1 *	0.333868	137.3410	47.85613	0.0000
At most 2 *	0.285039	95.49543	29.79707	0.0000
At most 3 *	0.261956	60.93605	15.49471	0.0000
At most 4 *	0.250134	29.64966	3.841466	0.0000

Trace test indicates 5 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.680078	117.3867	33.87687	0.0000
At most 1 *	0.333868	41.84555	27.58434	0.0004
At most 2 *	0.285039	34.55938	21.13162	0.0004
At most 3 *	0.261956	31.28640	14.26460	0.0000
At most 4 *	0.250134	29.64966	3.841466	0.0000

Max-eigenvalue test indicates 5 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

D(LU5M)	D(LHHEXP)	D(LFEMALELFP)	D(LINFLR)	D(LGDPC)
203.6408	-1.411953	-1.284853	-0.768873	13.08631
-29.73749	13.49275	-0.583664	0.293177	-46.92428
56.23636	11.49743	0.249211	0.401144	50.29016
2.820491	4.267444	1.067064	-6.556045	-3.110584
28.46326	0.254765	3.655841	0.463419	2.042473

Unrestricted Adjustment Coefficients (alpha):

D(LU5M,2)	-0.013162	-0.001466	0.000167	0.000248	-0.002020
D(LHHEXP,2)	0.006949	-0.039302	-0.038273	-0.004691	-0.000553
D(LFEMALELFP,2)	0.096144	0.011970	0.009987	-0.019970	-0.254365
D(LINFLR,2)	0.003938	-0.029651	-0.018049	0.146371	-0.044520
D(LGDPC,2)	0.011463	0.010735	-0.011267	-0.000297	0.004003

1 Cointegrating Equation(s): Log likelihood 555.6097

Normalized cointegrating coefficients (standard error in parentheses)

D(LU5M)	D(LHHEXP)	D(LFEMALELFP)	D(LINFLR)	D(LGDPC)
1.000000	-0.006934	-0.006309	-0.003776	0.064262
	(0.00657)	(0.00145)	(0.00237)	(0.02236)

Adjustment coefficients (standard error in parentheses)

D(LU5M,2)	-2.680297
	(0.22199)
D(LHHEXP,2)	1.415068
	(2.15704)
D(LFEMALELFP,2)	19.57891
	(11.1817)
D(LINFLR,2)	0.801907
	(6.63766)
D(LGDPC,2)	2.334384
	(0.65729)

2 Cointegrating Equation(s): Log likelihood 576.5325

Normalized cointegrating coefficients (standard error in parentheses)

D(LU5M)	D(LHHEXP)	D(LFEMALELFP)	D(LINFLR)	D(LGDPC)
1.000000	0.000000	-0.006712	-0.003681	0.040772
		(0.00150)	(0.00243)	(0.02316)
0.000000	1.000000	-0.058050	0.013615	-3.387882
		(0.04575)	(0.07412)	(0.70557)

Adjustment coefficients (standard error in parentheses)

D(LU5M,2)	-2.636716	-0.001190
	(0.22202)	(0.01464)
D(LHHEXP,2)	2.583822	-0.540108
	(2.00215)	(0.13198)
D(LFEMALELFP,2)	19.22295	0.025760
	(11.2972)	(0.74472)
D(LINFLR,2)	1.683653	-0.405633
	(6.67644)	(0.44011)
D(LGDPC,2)	2.015143	0.128663
	(0.62111)	(0.04094)

3 Cointegrating Equation(s): Log likelihood 593.8122

Normalized cointegrating coefficients (standard error in parentheses)

D(LU5M)	D(LHHEXP)	D(LFEMALELFP)	D(LINFLR)	D(LGDPC)
1.000000	0.000000	0.000000	-0.001339	0.491740
			(0.00702)	(0.06673)
0.000000	1.000000	0.000000	0.033874	0.512481
			(0.05941)	(0.56472)
0.000000	0.000000	1.000000	0.348988	67.18927
			(1.08176)	(10.2826)

Adjustment coefficients (standard error in parentheses)

D(LU5M,2)	-2.627326	0.000730	0.017808
	(0.23013)	(0.01918)	(0.00155)
D(LHHEXP,2)	0.431509	-0.980145	0.004473
	(1.88422)	(0.15706)	(0.01266)
D(LFEMALELFP,2)	19.78459	0.140586	-0.128029
	(11.7092)	(0.97600)	(0.07865)
D(LINFLR,2)	0.668656	-0.613147	0.007749
	(6.90903)	(0.57589)	(0.04641)
D(LGDPC,2)	1.381503	-0.000883	-0.023802
	(0.59069)	(0.04924)	(0.00397)

4 Cointegrating Equation(s): Log likelihood 609.4554

Normalized cointegrating coefficients (standard error in parentheses)

D(LU5M)	D(LHHEXP)	D(LFEMALELFP)	D(LINFLR)	D(LGDPC)
1.000000	0.000000	0.000000	0.000000	0.506584
				(0.06838)
0.000000	1.000000	0.000000	0.000000	0.136903
				(0.53849)
0.000000	0.000000	1.000000	0.000000	63.31987
				(9.63845)
0.000000	0.000000	0.000000	1.000000	11.08748
				(2.28468)

Adjustment coefficients (standard error in parentheses)

D(LU5M,2)	-2.626627	0.001787	0.018073	0.008132
	(0.23008)	(0.01972)	(0.00193)	(0.00714)
D(LHHEXP,2)	0.418278	-1.000163	-0.000532	-0.001464
	(1.88136)	(0.16126)	(0.01575)	(0.05837)
D(LFEMALELFP,2)	19.72826	0.055366	-0.149338	0.064515
	(11.7014)	(1.00296)	(0.09799)	(0.36304)
D(LINFLR,2)	1.081494	0.011482	0.163936	-0.978575
	(6.05473)	(0.51897)	(0.05070)	(0.18785)
D(LGDPC,2)	1.380666	-0.002149	-0.024119	-0.008241
	(0.59071)	(0.05063)	(0.00495)	(0.01833)

Table 6b: VEC MODEL

Vector Error Correction Estimates
Date: 03/10/18 Time: 14:23
Sample (adjusted): 1991Q2 2016Q4
Included observations: 103 after adjustments
Standard errors in ( ) & t-statistics in [ ]

CointegratingEq:	CointEq1	CointEq2	CointEq3	CointEq4
D(LU5M(-1))	1.000000	0.000000	0.000000	0.000000
D(LHHEXP(-1))	0.000000	1.000000	0.000000	0.000000
D(LFEMALELFP(-1))	0.000000	0.000000	1.000000	0.000000
D(LINFLR(-1))	0.000000	0.000000	0.000000	1.000000
D(LGDPC(-1))	0.506584	0.136903	63.31987	11.08748
	(0.06958)	(0.54791)	(9.80706)	(2.32465)
	[7.28094]	[0.24986]	[6.45656]	[4.76953]
C	0.003612	-0.002466	-0.404375	-0.069912

Error Correction:	D(LU5M,2)	D(LHHEXP,2)	D(LFEMALELFP,2)	D(LINFLR,2)	D(LGDPC,2)
CointEq1	-2.626627	0.418278	19.72826	1.081494	1.380666
	(0.23411)	(1.91427)	(11.9061)	(6.16065)	(0.60104)
	[-11.2197]	[0.21851]	[1.65699]	[0.17555]	[2.29713]
CointEq2	0.001787	-1.000163	0.055366	0.011482	-0.002149
	(0.02007)	(0.16408)	(1.02050)	(0.52804)	(0.05152)
	[0.08907]	[-6.09570]	[0.05425]	[0.02175]	[-0.04172]
CointEq3	0.018073	-0.000532	-0.149338	0.163936	-0.024119
	(0.00196)	(0.01603)	(0.09970)	(0.05159)	(0.00503)
	[9.21883]	[-0.03322]	[-1.49787]	[3.17776]	[-4.79214]
CointEq4	0.008132	-0.001464	0.064515	-0.978575	-0.008241
	(0.00726)	(0.05939)	(0.36939)	(0.19113)	(0.01865)
	[1.11966]	[-0.02465]	[0.17465]	[-5.11982]	[-0.44197]
D(LU5M(-1),2)	1.084418	-0.278852	-13.15217	-0.720996	-0.920444
	(0.17241)	(1.40975)	(8.76819)	(4.53698)	(0.44263)
	[6.28984]	[-0.19780]	[-1.49999]	[-0.15892]	[-2.07948]
D(LU5M(-2),2)	0.542209	-0.139426	-6.576087	-0.360498	-0.460222
	(0.10703)	(0.87517)	(5.44328)	(2.81655)	(0.27479)
	[5.06593]	[-0.15931]	[-1.20811]	[-0.12799]	[-1.67484]
D(LHHEXP(-1),2)	-0.001191	0.000109	-0.036911	-0.007655	0.001433
	(0.01638)	(0.13397)	(0.83326)	(0.43116)	(0.04206)
	[-0.07272]	[0.00081]	[-0.04430]	[-0.01775]	[0.03406]
D(LHHEXP(-2),2)	-0.000596	5.44E-05	-0.018455	-0.003827	0.000716
	(0.01159)	(0.09473)	(0.58922)	(0.30488)	(0.02974)
	[-0.05142]	[0.00057]	[-0.03132]	[-0.01255]	[0.02408]

D(LFEMALELFP(-1),2)	-0.012048	0.000355	-0.567108	-0.109291	0.016079
	(0.00242)	(0.01978)	(0.12306)	(0.06367)	(0.00621)
	[-4.97944]	[0.01794]	[-4.60857]	[-1.71643]	[2.58842]
D(LFEMALELFP(-2),2)	-0.006024	0.000177	-0.283554	-0.054645	0.008040
	(0.00214)	(0.01749)	(0.10876)	(0.05628)	(0.00549)
	[-2.81691]	[0.01015]	[-2.60710]	[-0.97100]	[1.46429]
D(LINFLR(-1),2)	-0.005422	0.000976	-0.043010	-0.014283	0.005494
	(0.00592)	(0.04844)	(0.30130)	(0.15590)	(0.01521)
	[-0.91512]	[0.02014]	[-0.14275]	[-0.09162]	[0.36123]
D(LINFLR(-2),2)	-0.002711	0.000488	-0.021505	-0.007142	0.002747
	(0.00418)	(0.03422)	(0.21284)	(0.11013)	(0.01074)
	[-0.64775]	[0.01426]	[-0.10104]	[-0.06485]	[0.25568]
D(LGDPC(-1),2)	0.063897	-0.016683	-0.840565	-0.053272	-0.053697
	(0.06260)	(0.51186)	(3.18362)	(1.64732)	(0.16071)
	[1.02074]	[-0.03259]	[-0.26403]	[-0.03234]	[-0.33412]
D(LGDPC(-2),2)	0.031949	-0.008342	-0.420282	-0.026636	-0.026848
	(0.04413)	(0.36085)	(2.24435)	(1.16131)	(0.11330)
	[0.72396]	[-0.02312]	[-0.18726]	[-0.02294]	[-0.23697]
C	0.000122	-0.000175	0.000266	-0.008003	-1.12E-05
	(0.00110)	(0.00900)	(0.05595)	(0.02895)	(0.00282)
	[0.11126]	[-0.01945]	[0.00475]	[-0.27645]	[-0.00397]
D(LHEXPTOTAL)	0.000655	-0.434638	-0.051918	-0.151575	0.158320
	(0.01581)	(0.12930)	(0.80418)	(0.41611)	(0.04060)
	[0.04145]	[-3.36157]	[-0.06456]	[-0.36427]	[3.89988]
D(LMCASE)	-0.001315	-0.048689	-0.025981	0.038747	-0.006790
	(0.00388)	(0.03173)	(0.19734)	(0.10211)	(0.00996)
	[-0.33878]	[-1.53460]	[-0.13166]	[0.37947]	[-0.68163]
D(LIMMRATE)	-0.017521	0.338923	0.005354	0.406139	0.056031
	(0.01079)	(0.08822)	(0.54867)	(0.28390)	(0.02770)
	[-1.62406]	[3.84196]	[0.00976]	[1.43055]	[2.02294]
R-squared	0.761997	0.628563	0.357446	0.511369	0.629165
Adj. R-squared	0.714397	0.554275	0.228936	0.413643	0.554998
Sum sq. resids	0.010540	0.704725	27.26167	7.299035	0.069473
S.E. equation	0.011136	0.091054	0.566326	0.293038	0.028589
F-statistic	16.00815	8.461220	2.781452	5.232672	8.483075
Log likelihood	326.9949	110.5602	-77.69443	-9.830849	229.8788
Akaike AIC	-5.999901	-1.797286	1.858144	0.540405	-4.114151
Schwarz SC	-5.539463	-1.336848	2.318582	1.000843	-3.653712
Mean dependent	1.37E-05	0.000474	-0.000138	-0.005471	0.000301
S.D. dependent	0.020837	0.136385	0.644943	0.382686	0.042857

Determinant resid covariance (dof adj.)	1.30E-11
Determinant resid covariance	4.99E-12
Log likelihood	609.4554
Akaike information criterion	-9.698163
Schwarz criterion	-6.884375

Appendix 6.

Results: Response of Under-five mortality to health expenditure shocks.

Table 7a: Lag lenth selection criterion

VAR Lag Order Selection Criteria
Endogenous variables: LU5M LRECEXP LCAPEXP LIMMRATE LMCASE LPOPDEN
Exogenous variables: C
Date: 03/06/19   Time: 09:45
Sample: 1990Q1 2016Q4
Included observations: 100

Lag	LogL	LR	FPE	AIC	SC	HQ
0	81.66849	NA	8.87e-09	-1.513370	-1.357060	-1.450108
1	753.9548	1250.452	2.64e-14	-14.23910	-13.14492	-13.79626
2	766.9999	22.69846	4.21e-14	-13.78000	-11.74796	-12.95760
3	793.6455	43.16600	5.18e-14	-13.59291	-10.62302	-12.39094
4	1198.537	607.3379	3.36e-17	-20.97075	-17.06299	-19.38921
5	1300.425	140.6054	9.56e-18*	-22.28851*	-17.44289*	-20.32740*
6	1311.357	13.77371	1.73e-17	-21.78714	-16.00366	-19.44646
7	1330.467	21.78578	2.79e-17	-21.44935	-14.72801	-18.72910
8	1389.275	59.98413*	2.15e-17	-21.90551	-14.24630	-18.80569

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 7b: VAR Results

Vector Autoregression Estimates
Date: 03/06/19 Time: 09:51
Sample (adjusted): 1991Q2 2015Q1
Included observations: 96 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LU5M	LRECEXP	LCAPEXP	LIMMRATE	LMCASE	LPOPDEN
LU5M(-1)	0.830106	-100.0746	50.61835	8.451506	-38.09995	0.024656
	(0.12240)	(52.6148)	(39.6561)	(16.8995)	(50.7922)	(0.04134)
	[6.78166]	[-1.90202]	[1.27643]	[0.50010]	[-0.75011]	[0.59639]
LU5M(-2)	-0.021989	6.711885	4.868688	-0.659898	-9.506256	0.000444
	(0.03145)	(13.5172)	(10.1880)	(4.34164)	(13.0490)	(0.01062)
	[-0.69926]	[0.49654]	[0.47788]	[-0.15199]	[-0.72850]	[0.04181]
LU5M(-3)	-8.43E-10	2.68E-07	-4.75E-08	-5.13E-08	-2.08E-09	5.94E-10
	(0.01979)	(8.50779)	(6.41237)	(2.73264)	(8.21308)	(0.00668)
	[-4.3e-08]	[3.1e-08]	[-7.4e-09]	[-1.9e-08]	[-2.5e-10]	[8.9e-08]
LU5M(-4)	0.925524	6.820188	18.23632	-4.570189	-4.371024	-0.011135
	(0.01979)	(8.50779)	(6.41237)	(2.73264)	(8.21308)	(0.00668)
	[46.7607]	[0.80164]	[2.84393]	[-1.67244]	[-0.53220]	[-1.66571]
LU5M(-5)	-0.768531	101.4681	-59.21106	-6.883646	39.04685	-0.010719
	(0.12749)	(54.7994)	(41.3026)	(17.6012)	(52.9011)	(0.04306)
	[-6.02832]	[1.85163]	[-1.43359]	[-0.39109]	[0.73811]	[-0.24894]
LRECEXP(-1)	3.18E-05	0.820678	-0.044086	-0.009067	0.069789	1.38E-05
	(0.00035)	(0.15242)	(0.11488)	(0.04896)	(0.14714)	(0.00012)
	[0.08977]	[5.38429]	[-0.38376]	[-0.18521]	[0.47430]	[0.11510]
LRECEXP(-2)	-6.87E-06	0.020954	0.035165	0.011712	-0.046088	1.12E-05
	(0.00036)	(0.15545)	(0.11716)	(0.04993)	(0.15007)	(0.00012)
	[-0.01900]	[0.13479]	[0.30013]	[0.23456]	[-0.30712]	[0.09130]
LRECEXP(-3)	6.80E-13	2.51E-10	-9.62E-11	-4.90E-11	4.33E-11	7.68E-13
	(0.00033)	(0.14298)	(0.10777)	(0.04593)	(0.13803)	(0.00011)
	[2.0e-09]	[1.8e-09]	[-8.9e-10]	[-1.1e-09]	[3.1e-10]	[6.8e-09]
LRECEXP(-4)	-0.000101	-0.550032	0.017424	0.123562	-0.102831	-2.21E-05
	(0.00033)	(0.14298)	(0.10777)	(0.04593)	(0.13803)	(0.00011)
	[-0.30513]	[-3.84681]	[0.16168]	[2.69049]	[-0.74499]	[-0.19673]
LRECEXP(-5)	7.58E-05	0.332070	-0.009543	-0.103921	0.129036	2.27E-05
	(0.00033)	(0.13971)	(0.10530)	(0.04488)	(0.13488)	(0.00011)
	[0.23336]	[2.37677]	[-0.09062]	[-2.31577]	[0.95671]	[0.20669]

LCAPEXP(-1)	0.000101	-0.444064	0.695494	0.048914	-0.011565	-5.60E-05
	(0.00073)	(0.31239)	(0.23545)	(0.10034)	(0.30156)	(0.00025)
	[0.13914]	[-1.42152]	[2.95393]	[0.48750]	[-0.03835]	[-0.22834]
LCAPEXP(-2)	-9.46E-05	-0.061061	0.019822	0.003304	0.104389	0.000115
	(0.00057)	(0.24582)	(0.18528)	(0.07896)	(0.23731)	(0.00019)
	[-0.16546]	[-0.24840]	[0.10699]	[0.04185]	[0.43989]	[0.59579]
LCAPEXP(-3)	1.05E-11	-2.72E-09	3.98E-10	5.29E-10	1.24E-10	-6.50E-12
	(0.00047)	(0.20392)	(0.15369)	(0.06550)	(0.19685)	(0.00016)
	[2.2e-08]	[-1.3e-08]	[2.6e-09]	[8.1e-09]	[6.3e-10]	[-4.1e-08]
LCAPEXP(-4)	-0.001204	0.519764	-0.242363	-0.042386	0.399290	-3.76E-05
	(0.00047)	(0.20392)	(0.15369)	(0.06550)	(0.19685)	(0.00016)
	[-2.53762]	[2.54889]	[-1.57692]	[-0.64714]	[2.02836]	[-0.23458]
LCAPEXP(-5)	0.000627	-0.798732	0.214687	0.064285	-0.453373	-2.53E-05
	(0.00060)	(0.26003)	(0.19599)	(0.08352)	(0.25103)	(0.00020)
	[1.03568]	[-3.07163]	[1.09540]	[0.76968]	[-1.80607]	[-0.12379]
LIMMRATE(-1)	-0.000299	0.363747	0.132775	0.744914	0.043533	0.000193
	(0.00136)	(0.58252)	(0.43905)	(0.18710)	(0.56234)	(0.00046)
	[-0.22066]	[0.62443]	[0.30241]	[3.98132]	[0.07741]	[0.42193]
LIMMRATE(-2)	7.82E-05	-0.106087	-0.025224	0.080190	-0.060877	-8.70E-05
	(0.00144)	(0.61823)	(0.46596)	(0.19857)	(0.59681)	(0.00049)
	[0.05436]	[-0.17160]	[-0.05413]	[0.40383]	[-0.10200]	[-0.17909]
LIMMRATE(-3)	-1.92E-11	6.78E-09	-1.28E-09	-1.31E-09	-9.99E-11	1.49E-11
	(0.00131)	(0.56489)	(0.42576)	(0.18144)	(0.54532)	(0.00044)
	[-1.5e-08]	[1.2e-08]	[-3.0e-09]	[-7.2e-09]	[-1.8e-10]	[3.4e-08]
LIMMRATE(-4)	0.000457	0.289231	0.237984	-0.066167	-0.611672	-0.000695
	(0.00131)	(0.56489)	(0.42576)	(0.18144)	(0.54532)	(0.00044)
	[0.34747]	[0.51201]	[0.55896]	[-0.36468]	[-1.12167]	[-1.56522]
LIMMRATE(-5)	-0.000566	-0.082832	-0.085865	-0.088928	0.604192	0.000591
	(0.00141)	(0.60783)	(0.45813)	(0.19523)	(0.58678)	(0.00048)
	[-0.39997]	[-0.13627]	[-0.18743]	[-0.45550]	[1.02967]	[1.23769]
LMCASE(-1)	0.000139	-0.047608	-0.004788	0.000117	0.761359	-2.00E-05
	(0.00040)	(0.17039)	(0.12843)	(0.05473)	(0.16449)	(0.00013)
	[0.35162]	[-0.27940]	[-0.03728]	[0.00214]	[4.62856]	[-0.14972]
LMCASE(-2)	-8.05E-05	-0.043518	0.026384	0.003651	0.086086	-6.29E-07
	(0.00046)	(0.19863)	(0.14971)	(0.06380)	(0.19175)	(0.00016)
	[-0.17415]	[-0.21909]	[0.17624]	[0.05723]	[0.44894]	[-0.00403]
LMCASE(-3)	2.40E-12	-5.84E-10	1.96E-10	1.15E-10	5.49E-12	-1.46E-12
	(0.00039)	(0.16710)	(0.12594)	(0.05367)	(0.16131)	(0.00013)
	[6.2e-09]	[-3.5e-09]	[1.6e-09]	[2.1e-09]	[3.4e-11]	[-1.1e-08]
LMCASE(-4)	-0.000675	0.068808	0.185197	-0.017852	0.034613	0.000109
	(0.00039)	(0.16710)	(0.12594)	(0.05367)	(0.16131)	(0.00013)
	[-1.73678]	[0.41179]	[1.47050]	[-0.33263]	[0.21458]	[0.83165]
LMCASE(-5)	0.000644	-0.003693	-0.092772	0.024484	-0.198119	-4.84E-05
	(0.00033)	(0.14291)	(0.10771)	(0.04590)	(0.13795)	(0.00011)
	[1.93747]	[-0.02584]	[-0.86132]	[0.53341]	[-1.43611]	[-0.43088]

LPOPDEN(-1)	-0.118174	138.2927	131.9589	-18.74393	82.87726	0.727454
	(0.74313)	(319.428)	(240.755)	(102.598)	(308.363)	(0.25099)
	[-0.15902]	[0.43294]	[0.54811]	[-0.18269]	[0.26877]	[2.89836]
LPOPDEN(-2)	0.216233	-199.1984	-132.2306	48.20300	114.6733	-0.291110
	(0.52946)	(227.584)	(171.531)	(73.0983)	(219.700)	(0.17882)
	[0.40841]	[-0.87528]	[-0.77088]	[0.65943]	[0.52195]	[-1.62793]
LPOPDEN(-3)	-1.22E-09	3.40E-07	-5.37E-08	-6.52E-08	-9.19E-09	7.41E-10
	(0.02341)	(10.0616)	(7.58351)	(3.23173)	(9.71310)	(0.00791)
	[-5.2e-08]	[3.4e-08]	[-7.1e-09]	[-2.0e-08]	[-9.5e-10]	[9.4e-08]
LPOPDEN(-4)	-0.115344	17.41964	29.53615	-4.660162	-4.297206	0.990369
	(0.02341)	(10.0616)	(7.58351)	(3.23173)	(9.71310)	(0.00791)
	[-4.92761]	[1.73129]	[3.89479]	[-1.44200]	[-0.44241]	[125.270]
LPOPDEN(-5)	0.096184	30.49769	-190.1234	-16.94126	-56.39875	-0.631997
	(0.52558)	(225.918)	(170.276)	(72.5634)	(218.093)	(0.17751)
	[0.18300]	[0.13499]	[-1.11656]	[-0.23347]	[-0.25860]	[-3.56027]
C	0.198148	-128.0275	-217.5493	31.69075	137.9152	-0.038662
	(0.24648)	(105.946)	(79.8521)	(34.0291)	(102.276)	(0.08325)
	[0.80392]	[-1.20842]	[-2.72440]	[0.93128]	[1.34846]	[-0.46443]
LU5M(6)	0.030778	0.411188	-0.820402	-0.136207	0.720564	0.003215
	(0.02345)	(10.0818)	(7.59874)	(3.23822)	(9.73260)	(0.00792)
	[1.31223]	[0.04079]	[-0.10797]	[-0.04206]	[0.07404]	[0.40586]
LU5M(7)	-0.013955	-6.884564	4.284893	1.315541	1.533248	-0.003307
	(0.02999)	(12.8896)	(9.71498)	(4.14006)	(12.4431)	(0.01013)
	[-0.46536]	[-0.53412]	[0.44106]	[0.31776]	[0.12322]	[-0.32654]
LRECEXP(6)	-2.65E-05	-0.186105	0.012426	0.050561	0.018512	1.19E-05
	(0.00037)	(0.15977)	(0.12042)	(0.05132)	(0.15423)	(0.00013)
	[-0.07123]	[-1.16485]	[0.10319]	[0.98529]	[0.12003]	[0.09450]
LRECEXP(7)	-0.000334	-0.330403	0.263538	0.041399	-0.055995	8.62E-05
	(0.00058)	(0.24896)	(0.18764)	(0.07996)	(0.24034)	(0.00020)
	[-0.57612]	[-1.32714]	[1.40447]	[0.51771]	[-0.23299]	[0.44059]
LCAPEXP(6)	-7.78E-07	-0.096264	-0.196175	0.021613	0.324141	-0.000124
	(0.00053)	(0.22711)	(0.17118)	(0.07295)	(0.21925)	(0.00018)
	[-0.00147]	[-0.42385]	[-1.14603]	[0.29628]	[1.47842]	[-0.69694]
LCAPEXP(7)	0.000178	0.027426	0.019399	0.018952	0.021121	4.09E-06
	(0.00057)	(0.24678)	(0.18600)	(0.07926)	(0.23823)	(0.00019)
	[0.30977]	[0.11113]	[0.10430]	[0.23909]	[0.08866]	[0.02109]

LIMMRATE(6)	-4.78E-05	0.032848	0.179408	0.140907	-0.237368	-8.29E-06
	(0.00123)	(0.52924)	(0.39889)	(0.16999)	(0.51091)	(0.00042)
	[-0.03879]	[0.06207]	[0.44977]	[0.82892]	[-0.46460]	[-0.01993]
LIMMRATE(7)	-0.000824	-0.260038	0.140989	-0.079042	0.170674	7.41E-05
	(0.00152)	(0.65422)	(0.49309)	(0.21013)	(0.63156)	(0.00051)
	[-0.54114]	[-0.39748]	[0.28593]	[-0.37616]	[0.27024]	[0.14418]
LMCASE(6)	-0.000304	-0.052399	0.095609	0.004298	0.130833	8.05E-05
	(0.00040)	(0.17227)	(0.12984)	(0.05533)	(0.16630)	(0.00014)
	[-0.75730]	[-0.30417]	[0.73636]	[0.07769]	[0.78673]	[0.59462]
LMCASE(7)	-3.65E-06	-0.198887	-0.054773	0.015834	-0.026360	-4.98E-05
	(0.00044)	(0.19127)	(0.14416)	(0.06144)	(0.18465)	(0.00015)
	[-0.00820]	[-1.03981]	[-0.37993]	[0.25773]	[-0.14276]	[-0.33117]
LPOPDEN(6)	-0.203051	209.3644	136.5615	-49.90395	-127.0951	0.293662
	(0.53550)	(230.182)	(173.490)	(73.9330)	(222.209)	(0.18086)
	[-0.37918]	[0.90956]	[0.78714]	[-0.67499]	[-0.57196]	[1.62366]
LPOPDEN(7)	0.105770	-177.2276	46.94330	38.11838	-25.46942	-0.084157
	(0.65844)	(283.025)	(213.318)	(90.9058)	(273.221)	(0.22239)
	[0.16064]	[-0.62619]	[0.22006]	[0.41932]	[-0.09322]	[-0.37843]
R-squared	0.999993	0.983426	0.989419	0.935913	0.924538	0.999999
Adj. R-squared	0.999987	0.970291	0.981034	0.885128	0.864739	0.999998
Sum sq. resids	3.16E-05	5.838500	3.316688	0.602329	5.441016	3.60E-06
S.E. equation	0.000772	0.331904	0.250158	0.106605	0.320407	0.000261
F-statistic	171781.4	74.87355	118.0016	18.42874	15.46058	1064802.
Log likelihood	580.2642	-1.824132	25.32021	107.2043	1.560256	684.4684
Akaike AIC	-11.19300	0.933836	0.368329	-1.337590	0.863328	-13.36392
Schwarz SC	-10.04439	2.082450	1.516943	-0.188976	2.011942	-12.21531
Mean dependent	5.103916	3.056809	9.107443	3.634692	14.97879	4.973157
S.D. dependent	0.212792	1.925613	1.816482	0.314537	0.871195	0.178933

Determinant resid covariance (dof adj.)	1.18E-19
Determinant resid covariance	3.34E-21
Log likelihood	1445.880
Akaike information criterion	-24.74749
Schwarz criterion	-17.85581