**TITLE PAGE**

**IMPACT OF HEALTHCARE DELIVERY ON AGRICULTURAL SECTOR OUTPUT IN NIGERIA**

**BY**

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**U14/MSS/ECO/093**

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**SUPERVISOR: OLUCHUKWU ANOWOR**

**JULY, 2018**

**CERTIFICATION PAGE**

I, Ezeonwuneme Ogochukwu Eucharia, an undergraduate of the department of Economics, Godfrey Okoye University with the registration number U14/MSS/ECO/093 do hereby affirm that the work embodied in this research: The Impact of Healthcare on Agricultural output is original and has not been submitted in part or full in any other diploma or degree of this or any other university.

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**APPROVAL PAGE**

This project has been approved to have satisfied the requirements for the award of Bachelor of Science Degree in the department of Economics, Godfrey Okoye University, Ugwuomu-Nike, Enugu State.

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**External Examiner Date**

**DEDICATION**

This research work is dedicated to Mr. & Mrs . Emmanuel Ezeonwuneme and Mr. Izuchukwu Ezeonwuneme for their support in achieving this stage of my academic pursuit.

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**ABSTRACT**

*This research work is an empirical effort attempting to examine the impact of healthcare delivery on agricultural sector output using the ordinary least squares (OLS) with annual secondary data from 1980 to 2016 sourced from Central Bank of Nigeria Statistical Bulletin and Index Mundi Database. The co integration and regression analysis of the variables were used to analyze the data .The result of this study shows the independent variables (life expectancy and mortality rate) have significant impact on the agricultural sector output in Nigeria which means that agricultural output is dependent on healthcare. From this study the government are advised to grant free medical care to large scale farmers to sustain their capacity in engaging in the activities of the agricultural sector; they should also set up agencies that will ensure accessibility of good health care.*

**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of the Study**

Better health care is a primary human need. According to the World Health Organization (WHO, 2005), fifty percent of economic development differentials between developed and developing nation is attributable to ill-health and low life expectancy. Provision of health is seen as a key element of a policy to promote broad-based national development. The burden of diseases such as HIV/AIDS is known to slow the human productivity of developing countries. Therefore, every country primarily aims to devote huge public fund to health sector so as to empower its human capital. Hence, the importance of health as a form of human capital cannot be over emphasized. Good health and productive agriculture are important in the economy of any nation; good health enhances work effectiveness and the productivity of an individual through increase in physical and mental capabilities. Disease significantly reduces the productivity of agricultural labor in developing countries due to the loss of labor and know-how of productive adults (World Bank, 2008).

On the basis of economic analysis, there appears to be an inextricable link between health care and human labor productivity channeled to the agricultural sector. Over the years in Nigeria, there have been some financial commitments by the government in the area of health sector which is believed to also affect human productivity exhumed in the agricultural sector. The financial commitments of government to the health sector are both the recurrent and capital expenditure on health. The capital expenditure of government decrease from N7.3million in 1970 to N4.88 million in 1972 before it rose again to N126.75 in 1974. It sharply dropped to N79.2 million in 1982. From 1982 to 1987, capital expenditure on health declined from N72.9m in 1982 to an all-time low of N17.2m in 1987. This development is occasioned by the fact government was more preoccupied in the business of paying workers’ salaries with less attention being paid to capital expenditure. In 1988 there was a significant rise to N297.96m. By 1991, the statistic dropped to N137.3m but plummeted to N33.72m in 1992. The figure rose steadily from N586.2 million in 1993 to N17,717.42m, N33,396.97m and N34,647.9m in 2003, 2005 and 2007 respectively the capital expenditure on health stood at N64,922.9m in 2008, N79,321.09m in 2011 and increased to N82.98m in 2015.

The recurrent expenditure on health also follows a similar trend. It rose gradually from N12.48 m in 1970 to N59.47m in 1977 but fell to N40.48m in the successive year. The pattern of health expenditure at this period is a reflection of both the product of the disposition of government policy towards health issue and the determination of the Federal Government to improve the health care system with the wind fall of oil revenue. From 1984 to 1986, recurrent expenditure rose from N101.55m to N134.12m when the recurrent expenditure as a percentage of total expenditure stood at 77.4 percent. The value of recurrent health expenditure reduced significantly in 1987 to N41.31m before it rose steadily from N422.80 in 1988 to N24,522.27m in 2001. This figure rose again from N40,621.42 in 2002 to N44,551.63, N58,686.56 and N72,290.07 in 2005, 2006 and 2007 respectively. Recurrent expenditure on health stood at N18,200.0 million in 2008 and N21,542.9m in 2011, N179.99m in 2013 and N257.72m in 2015.

On the other hand, the agricultural output in Nigeria in 2011 totaled in monetary value as N14,037.83m, and N15,816.00, N16,816.555m, N18.018.61 and N19,936.97m in 2012 to 2015 respectively. Health problems apart from affecting the state of welfare of affected households, affects agriculture and economic growth negatively through the reduction of available labor hours for economic activities, premature loss of human resources and high cost of diseases treatment which adds to the economic burden of the rural households. Research focusing on agriculture has revealed the negative impact of ill health especially on the welfare of agricultural household affects overall economic development. Against this background, this study is aimed at carrying out an empirical analysis of the impact of healthcare on agricultural output in Nigeria from 1980-2016.

**1.2 Statement of the Problem**

Many programs like the River Basin Development Authorities, Green Revolution Scheme have been initiated by the government in order to cut down the issue of food scarcity but to no avail. Agricultural production decreases as a result of several factors such as disease, climate change which invariably affects human health and thereby deepens poverty in Nigeria. Majority (over 70%) of Nigerians depends on agriculture for their means of livelihood and there has been a case of food insecurity which has led to malnutrition and again affects human health. Poor health as a result of ailment and diseases diminish economic opportunities for a large number of the farming household that form majority in the study area and this in turn affects the poor negatively who are stuck in the vicious cycle of poverty. In spite of huge government spending, coupled with bilateral and multilateral assistance in the health sector, the patterns of health status in Nigeria mirror many other Sub-Saharan African nations but are worse than would be expected given Nigeria’s GDP per capital. Poor human resources and policy management have led to unprecedented brain drain in the health sector as health professionals in search for better conditions of service abroad often vote with their feet in droves.

The Nigerian health system is in comatose; health care financing is worse hit especially in the poor continent where health care faces serious problem. Effects of ill health on farm households include three broad impacts: absenteeism from work due to morbidity (and eventual death); diversion of family b time to caring of the sick; and the loss of savings and assets in the course of dealing with diseases and its consequences. Against these problems listed above this research work tends to be an aid in proffering solutions.

* 1. **Research Questions**

In the course of this study, the following research questions will be addressed:

1. To what extent has health care affected the level of agricultural sector output in Nigeria?
2. How has life expectancy influenced agricultural sector output in Nigeria?
3. What extent has infant mortality affected agricultural sector output in Nigeria?
4. What direction of causality exists between health care delivery and agricultural sector output in Nigeria?

**1.4 Objectives of the Study**

The broad objective of this study is to determine the impact of healthcare delivery on agricultural output. In line with this, the specific objectives of the study are:

1. To evaluate the effect of life expectancy on agricultural sector output in Nigeria.
2. To analyze the impact of infant mortality on agricultural sector output in Nigeria.
3. To examine the causal relationship between healthcare delivery and agricultural sector output.

**1.5 Research Hypotheses**

The following hypotheses will be tested in the course of this study:

Ho: Healthcare delivery has no significant impact on agricultural sector output in Nigeria.

H1**:** Healthcare delivery has significant impact on agricultural sector output in Nigeria.

Ho: Life expectancy has no significant impact on agricultural sector output in Nigeria.

H1: Life expectancy has significant impact on agricultural sector output in Nigeria.

Ho: Infant mortality has no significant impact on agricultural sector output in Nigeria.

Hi: Infant mortality has significant impact on agricultural sector output in Nigeria.

Ho: There is no causal relationship between healthcare delivery and agricultural sector output in Nigeria.

Hi: There is a causal relationship between healthcare delivery and agricultural sector output in Nigeria.

* 1. **Significance of the Study**

This research work apart from achieving its objective will be significance in the following ways:

Firstly;the federal government will find this study highly relevant as it will provide a picture of the impact of health care budgetary allocation on agricultural output in Nigeria. This research will also find its relevance in the coffers of health and agricultural authorities given that the subject under study is purely on health and agricultural matters.

Secondly;this investigation will also be highly significant to subsequent researchers as this research will provide them with relevant literatures on the concept of health care and agricultural output.

Thirdly;this research has the ingredient of expanding the knowledge of research students on the concept of under study.

Finally, this research is considered relevant given that it will be an addition to the existing stock of knowledge and hence creates a capacity building input to the education sector.

* 1. **Scope and Limitations of the Study**

The focus of this study is to carry out an empirical analysis on the impact of health care on agricultural output in Nigeria covering the period 1980-2016. The research while being conducted was threatened by some factors which posed as limitations to the smoothness of the research. Out of all the factors, the most significant ones are access to research material, statistical data and financial constraints.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 CONCEPTUAL LITERATURE**

**2.1.1 Concept of Healthcare**

Healthcare could be said to be the process of maintaining health through the prevention and treatment of diseases and illness for both physical and mental aspects of human beings. Access to human health varies across countries, communities, and individuals, which sometimes is influenced by social and economic conditions. Healthcare systems are established to meet the health needs of the populace. A well-functioning healthcare system requires a robust financing mechanism; a well-trained and adequately paid workforce; reliable information on which to base decisions and policies; and well maintained health facilities and logistics to deliver quality medicines and technologies. (WHO, 2009). Healthcare contributes to a significant part of a country’s economy that is why it is treated with great concern.

**2.1.2The Healthcare Financing**

As it is known, the health sector in any nation is the bases of growth and development. But in Nigeria, the provision of sound healthcare services with an expected financing has remained a mirage for several years. As such, Nigeria’s health sector is grossly in shambles, there are few hospitals and health institutions especially in rural areas, few drugs, inadequate and substandard equipment in spite of advanced technology, inadequate infrastructural support which includes diagnostic laboratories, electricity, water and some other facilities resulting in misdiagnosis. According to the Federal Ministry of Health, FMoH. (2004), delivery of health care has become a personal affair and dependent on ability to pay for basic laboratory and physician services. These have exacerbated the disease burden. Medical record keeping is rudimentary and diseases surveillance is very poor. Health care financing is worse hit especially in the poor continent/nations like in Nigeria where health care faces serious problem of acceptability with out-of-pocket expenditure accounting for over 70% of total private health expenditure is enough to dent the little progress of the health system made. Hence, the increasing out-of-pocket expenditure due to high disease burden on most poverty-stricken households which has kept them in the vicious cycle of the poverty trap coupled with a very low per capita health spending.

Health financing entails the collection of funds from different sources which includes the government, households, businesses, and donor agencies pooling them to share financial risk across larger population groups and using them to pay for services from public and private health care providers. The sole aims of health financing are to make funding available, ensure appropriate choice and acquisition of cost-effective interventions, give appropriate financial incentives to health providers and ensure that all people have access to effective health services (Soyibo et al, 2005).

**2.1.3 National Health Policy (NHP)**

The National Health policy (NHP) advocates the establishment and appointment of Local Government Health Committees (LGHCs) in each LGA for the purpose of ensuring the delivery of health services to the communities and to enhance community participation. The establishment of the State Hospital Management Board (SHMB) arose following the need to promote efficiency, effectiveness and transparency in the management of state-owned hospital. The SHMB function under the general supervision of and the policies established by the State Ministry of Health (SMoH), and is responsible for management of hospitals which comes under the jurisdiction of the SMoH (FMoH, 1988).

* + 1. **Health Pricing Policy**

Since government cannot shoulder the burden of providing certain health care services alone as a result of financial constraints, and to ensure an uninterrupted provision of adequate, regular and high quality services, minimal fees which are in fact less than the cost of providing such services are charged. For instance, the right pricing policies arise from the experience of the down-turn of the Nigerian economy during the last two decades resulted in a decline in the funding of many vital sectors of the economy including health. Such services includes laboratory and ancillary services, surgical operation fees, private/special admission facilities, private ambulance use, mortuary services, hospital bed and feeding services, specific ante-natal care and so on (Aregbeyen, 2001).

**2.1.5 Primary Health Care (PHC) Scheme**

This concept of PHC clearly articulates the need for multi-sectorial linkages and community participation, not only to bring about individual health care but more importantly, to cater for the health of communities on a catchment area basis. The Primary Health Care (PHC) Scheme implies the adoption of the PHC system which was a major development in health policy reform in the country like Nigeria. Consequently, the national health system has since been based on primary health care (Aregbeyen, 2001, Berman, 1995).

**2.1.6 Life Expectancy**

Life expectancy at birth shows the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups; children and adolescents, adults and elders. Life expectancy could be defined as the average number of years a newborn is expected to live if the current mortality rate applies. It varies by geographical areas and depends on some variables like lifestyle, access to healthcare, diet, economical status and the relevant mortality and morbidity rate. Life expectancy is also a statistical measure of the average time an organism is expected to live, based on the year of their birth, their current age and other demographic factors which includes gender (Chris, 2007).

**2.1.7 Mortality Rate**

Mortality is a word derived from the latin word “mors” which means death. Mortality rate is the measure of the number of deaths ( in general or due to a specific cause) in a particular population at a particular time. There are also types of mortality rate which includes:

* Infant mortality rate: the number of children dying under a year of age divided by the number of live births that year.
* Maternal mortality rate: the number of maternal death related to child bearing divided by the number of live birth in that year.

Mortality rate helps to determine if an economy is an increasing or decreasing population which is an important asset in determining human capital which helps in productivity leading to increased output.

**2.1.8 Concept of Agriculture**

Agriculture has been given several definitions by different scholars according to their own understanding but a layman can simply define agriculture as the cultivation of crops and rearing of animals for man’s use. Some of the definitions of agriculture given by scholars include: Agriculture is the production of food and livestock and the purposeful tendering of plants and livestock. (Ahmed, 1995) Agriculture is the systematic raising of useful plants and livestock under the management of mans. ( Rimando, T.J 2004). Agriculture is a deliberate effort to modify a portion of earth’s surface through the cultivation of crops and the risings of livestock for sustenance and economic gain.(Rubenstien, J.M. 2003). Agriculture is the growing of both plants and animals for human needs. ( Abellanoarsa, A.L and H.M.Pava 1987). The level of agricultural productivity is been measured by the level of output produced.

**2.2 Theoretical Review**

In an attempt to satisfy the objectives of this study certain theories were reviewed.

**2.2.1 Human Capital Theory**

Gary Becker and Jacob Mincer in this theory states that human capital arises out of any activity that would raise individual’s productivity. Also it states that human capital being the aggregate stock of knowledge and skill is important in the creation of measurable economic value. The theory of the classicist’s human capital framework is rooted from the field of macroeconomic development theory. The theory posits that there are different kinds of capitals that include schooling, a computer training course, and expenditures on medical care. Consequently, it is in keeping with the capital concept as traditionally defined to say that expenditures on education, training, and medical care, etc., are investment in capital. These are not simply costs but investment with valuable returns that can be calculated. Unlike in the past when economic strength depends on tangible physical assets like lands, factories and equipment; development in human capital is deemed necessary because it leads to greater economic output.

**2.2.2 Endogenous Growth Theory**

This theory believes that improvements in productivity can be attributed directly to a faster pace of innovation and extra investment in human capital. This theory also known as the new theory explains the long run growth rate of an economy on the basis of endogenous factors. This theory which was developed by Kenneth .J. Arrow, Paul .M. Romer and Rober .E. Lucas emphasizes technical progress resulting from the rate of investment, the stock of human capital and size of capital stock. Also this theory states that investment in capital; innovation and knowledge are significant contributors to economic growth. More specifically this theory notes that human capital of a nation will lead to economic growth which makes healthcare an important sector because human capital depends on the health status of a particular individual. They stress the need for government and private sector institutions to encourage innovation and provide incentives for individual and business to be inventive. There is also central role of the accumulation of knowledge as a determinant of growth, that is; knowledge industries such as telecommunication, electronics, software or biotechnology are becoming increasingly important in developed countries.

**2.2.3 Mellor’s Theory of Agricultural Development**

In 1966 Mellor posited that “the faster agriculture grows, the faster its relative size declines. Others have dubbed this “Mellor’s Law.” Mellor’s observation stems from the possibility that technological changes can overcome the effects of a growing population, and following Engel’s Law, as per capita income increases, the percentage of income spent on food will decline leading to a relative decline in the size of the agricultural sector. Where agriculture represents a large share of total output, structural transformation requires increases in agricultural productivity. In the process, agriculture becomes relatively less important while paving the way for the development of the nonagricultural sector. Nearly 40 years later, leaders in the international development community still hold that this notion “captures the essence of agricultural growth and its causal relationship to the structural transformation and aggregate growth of an economy.” Mellor further notes that the relationship described in the above statement “can be illustrated by comparing the agricultural and nonagricultural growth rates of countries in each of the world’s three major geographical regions.

**2.2.4 Structural Change Theory of Agriculture**

Both Rostov and the agricultural development stage theorists have emphasized the importance of structural changes during the early stages of economic development. Tenure reform, fiscal policy reform, and others have identified as important factors in reducing the political power of those who have a vested interest in the *status quo,* and releasing the productive energies of the peasants and the emerging middle class. With these reforms agricultural prosperity is expected to stimulate industrial development by providing the mass purchasing power needed to sustain an expanding urban-industrial sector. Since initiation of steps leading to exchange decontrol in the Philippines in 1961, the agricultural and commodity sectors have experienced sustained increases in prices, output, and income. At the same time the sectors producing primarily for domestic consumption have, with the exception of the domestic agriculture and construction industries, failed to share in this growth.

**2.3 Empirical Literature**

Some related studies that have been carried out on the concept under study will be reviewed in this section.

Gyimah and Wilson (2013) with least squares regression carried out a research on the health care on economic growth and identified positive link between investment in health and growth in both Sub-Saharan African and OECD countries. Thus, the need for health care and human development cannot be overemphasized especially in the developing countries like Nigeria. The health position of the individual is likely important in determining the efficiency of labour and performance of the education sector. Indeed, every human being needs a good healthcare for him/her to function effectively in social and economic activities of his/her surroundings.

Mayer (2001) used the probability of adult survival by gender and age group as a measure of health status came with result that health status affects economic growth in Latin America generally, and specifically in Brazil and Mexico. However, he further claimed that the growth impact is higher for improvements in health of female compared with health of male. Using 2SLS technique, Bloom, et al., (2010) found that life expectancy and schooling have a positive and significant effect on GDP. Improvements in health increase the output not only through labour productivity, but also through the Capital accumulation. The study also found that improvement of one year in a population’s life expectancy resulted into an increase of 4% in output.

Malik (2006) used Ordinary Least Squares (OLS) method in measuring health status where infant mortality rate, life expectancy rate were used as proxies, and per capita as indicator of economic growth; and he also discovered that there was no significant relationship between health status and economic growth. This was very uncommon among other findings. However, using 2SLS; the study observed highly significant effect of health indicators on economic growth.

Dauda (2010) in her empirical study of the role of human capital in economic development, using Co-integration tests and Error Correction Mechanism (ECM) discovered that there was a feedback mechanism between human capital formation and economic development in Nigeria. She emphasized the need for the Nigeria government to strengthen educational sector. Though, her study recognized the health component of the human capital but major health parameters like infant mortality rate, maternal mortality rate, life expectancy and health expenditure were not included in the model but focused more on the educational variables such as school enrolment at both level, labour force and real gross capital formation which this study deems as a gap in the recent pragmatic approach to the study of human capital formation in the parlance of health economics.

Bakare and Sanmi (2011) examined health care expenditures and economic growth in Nigeria using ordinary least squares multiple regression analytical method and employed data covering 1970 to 2008. Their study showed a significant and positive relationship between health care expenditures and economic growth in Nigeria and concluded that Nigerian Government should pay attention to health sector not only by increasing its budgetary allocation but also ensuring appropriate implementation and adequate monitoring of the budget.

Odior (2011) investigated the potential impact of increase in government expenditure on health care in Nigeria using computable general equilibrium (CGE) model and discovered that government health expenditure is significant in explaining economic growth in Nigeria and concluded that more resources should be channeled to health sector to provide quality of health to its citizens.

Owolabi and Okwu (2010) observed in their study that human resource development is an important variable in economic growth bracket in Nigeria and they recommended among other things that government should boost revenue allocation to the health and education sector of the economy for steady and sustainable growth.

Investigating the relationship between health care expenditures and health outcomes by Baldacci (2004) using a panel data set for one hundred and twenty developing countries form 1975-2000. He discovered that spending on health within a period affects growth within the same period while lagged health expenditures appear to have no affect on growth. He inferred from this result that the direct effect of health expenditure on growth is a flow and not a stock effect. Other studies such Greiner (2005), Strauss and Martins (2005) and Agenor (2013), all conducted researches in respect of other countries and affirmed that health expenditure is positively related to economic growth. What differ from one country to another is the extent and magnitude of its contributions.

In a related studies, Anyawu et al (2013) examining the linkage between African countries’ (group into different geographical locations) per capita total as well as government health expenditures to infant mortality and under-five mortality between 1999 and 2004 albeit with mixed results. Their result reveals that Health expenditures have a statistically significant effect on infant mortality and under-five mortality and that total health expenditures are certainly important for African countries depending on each region peculiarities. They conclude that both infant and under-five mortality are positively and significantly associated with Sub-Saharan Africa while reverse is true for North Africa.

Bidani and Ravallion (2011) in their study applied a cross-section regression analysis, disaggregating health outcomes indicator as an additional explanatory variable. Their results suggested that per capita health spending was positively related to the life expectancy of the poor, but it had no significant link to the life expectancy of the rich. As a robustness check, a similar result was found when a different poverty cut off point was used. From the results, it is evident that public health spending had a larger impact on life expectancy and infant for those living on less than $1 a day as compared to the results focused on poor people defined using the $2 a day as poverty line.

Chaabouni and Abednnadher (2010) examined the determinants of health expenditures in Tunisia during the period 1961-2008, in an attempt investigated the chain of causality using the Autoregressive Distributed Lag (ARDL) approach by Pesaran et al. (2011). On the one hand the results of the bounds test showed that there is a stable long-run relationship between per capita health expenditure, GDP, population ageing and medical density among others. On the other hand, results of the causality test showed that there is a bi-directional causal flow from health expenditures to income, both in the short and in the long run. They recommended that policies aiming at encouraging health expenses are required to build up a healthier and productive society to support the Tunisian’s economic growth and development.

Rahman, Bassey and Edu (2011) examined healthcare expenditure in Nigeria; as to whether the level of government spending for the period between 1980 and 2003 has any impact on economic development of the nation. Their finding is that life expectancy as well as literacy rate were negatively correlated with healthcare expenditure both in the short and long run, and that income elasticity of healthcare expenditure was below unit both in the short and long run.. Their recommendation is that government needs to increase funding of health sector and reduce the inequality in the budgeting distribution of health expenditure in order to improve the health status of Nigerians.

The above view was shared by Olayinka et al. (2013), drawing from their result in a paper on health expenditure and health status in northern and southern Nigeria. They concluded that in the light of low income of majority of the people, especially in the north, stewardship role of the government has to increase in terms of funding healthcare, if the health status of the populace is to improve. However they are apt to note that without government being directly involved in the provision of healthcare services, attempt should be made to subsidise the private sector and increase regulatory capacities (institutional quality) to improve the overall availability and accessibility of health services to the citizenry.

Confirming the above, Imoughele, (2013) empirically examines the determinants of public health expenditure in Nigeria. Using the error correction techniques and time series data from 1986 to 2010, the results show that demand for health in Nigeria is price Inelastic. Further in their studies, they concluded that total population of children that falls within the age of 14 Years and below and health expenditure share in gross domestic product (proxy for government developmental policy on health) are the major determinants of health expenditure in Nigeria. To this end, the study recommended that to make government health expenditure to have a robust effect on Nigerians health status and meet WHO recommended budgetary allocation to the sector, Government Budgetary allocation to health sector should be increased to the prescribe of 15% of its annual budgetary allocation to the health sector.

**2.4 Gap in Literature**

An impressive amount of research and studies have been carried out on the concept of health budgetary allocation. However, an obvious weakness discovered in the above reviewed studies is that majority of the studies are focused on Health Expenditure and Economic Growth nexus. Hence, many of the studies were mainly focused on analyzing health care budgetary allocation and its impact or relationship with economic growth. This research in a bid to add to literature is thus aimed at empirically estimating the impact of health care delivery on agricultural sector output in Nigeria.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

**3.1 Research Design**

The investigation employed the expo-facto design. This is because the researcher had no control over the data and variables used in the investigation.This study makes use of econometric procedure in estimating the impact of health care on agricultural output in Nigeria. It is also pertinent to note that the research design will adopt the quantitative approach based on the fact that it will give room for statistical and econometric estimations for the actualization of the research objectives.

In researches that involves times series and secondary data, the appropriate methodology is the linear regression with the application of Ordinary least squares (OLS) technique. The primary justification for adopting the linear regression is based on the fact that it gives room for conventional econometric tests and the data is secondary in nature.

**3.2 Theoretical Framework**

The theory upon which this study is anchored is the human capital theory. This theory asserts that improvement in human capital which includes improvement in health and education is a generator of growth. In the context of this study, improvement in human capital has the tendency of improving agricultural production due to fortified human capital development.

**3.3 Model Specification**

In this research, the independent variables are infant mortality and life expectancy while the dependent variable will be the value of agricultural output. The model is given by:



Where:

AGRICO = Agricultural Output

MR = Mortality Rate

LE = Life Expectancy

U = Stochastic Error Term

Where:  The Parameters of the independent variables to be estimated.

* 1. **METHOD OF EVALUATION**

**PRELIMINARY TEST**

**Stationary (unit root) Test**

To avoid the emergence of spurious regression due to a non-stationary series, the stationary test will be conducted using the Augmented Dickey Fuller test.

* **Decision Rule:** If the ADF test statistic is greater than the MacKinnon critical value at 5% (all in absolute term), the variable is said to be stationary. Otherwise it is non-stationary.

**Economic Criterion Test (A priori Test)**

The a priori test of the analysis will be based on the regression coefficient based on the coefficient of the algebraic signs of the parameters. It is a test that will be based on evaluating the conformity of the relationship between the variables on economic theory.

|  |  |
| --- | --- |
| **VARIABLES** | **APRIOR SIGN** |
| **LE** | **+VE** |
| **MR** | **-VE** |

**3.5 STATISTICAL TEST OF SIGNIFICANCE [First Order Tests]**

**3.5.1 Test for Goodness of Fit**

This test involves the test of the goodness of fit. To evaluate the working hypothesis of this study. R2 the co-efficient of determination is used to test the explanatory power of the variable. r2 lies between zero and one (0 < R2 < 1). The closer R2 is to 1 the greater the proportion of the variation in the dependent variables attributed to the independent variables.

**3.5.2 T-Test of Significance**

To test for the statistical significance of individual regression co-efficient, t-statistic is used. A two-tailed test will be conducted at 5% level of significance. 8The null hypothesis Ho will be tested against the alternative hypothesis H1.

**Decision Rule (T-Test)**

If t0.025 < t\* Ho will be rejected and the H1 accepted. Otherwise, the alternative hypothesis H1 will be rejected and the null hypothesis Ho be accepted.

**3.5.3 F-TEST of Significance**

To Test the statistical significance of the entire regression, the f-ratio is used. The test will be conducted at 5% level of significance.

**Decision Rule (F-Test)**

If f\* > (f0.05), we say the regression is statistically significance but if otherwise, it implies that it is statistically insignificant

Note: t\* = computed t – value

t0.025 = tabulated t – value

f\* = Computed f-value

f0.05= tabulated f – value

**3.6 Econometrics Test of Significance [Second Order Tests]**

**3.6.1 Autocorrelation Test**

To evaluate the reliability of the expected numerical estimates, the Durbin – Watson (D-W) statistics at 5% will be used to test for the presence of autocorrelation problem. The region of autocorrelation remains:

du < d\* < (4-du)

Where:

du = Upper Durbin – Watson

d\* = Computed Durbin-Watson

**Decision Rule (Autocorrelation Test)**

If the computed value of Durbin-Watson lies within the region, it means there is no presence of autocorrelation problem. But if the Durbin-Watson computed value lies outside the regions there is the presence of autocorrelation problem and a remedial measure like the use of first difference equation will be adopted.

**3.7 DIAGNOSTIC TEST**

**3.7.1 Normality Test:** The normality test will be carried out to ascertain if the residuals of the model are normally distributed. The basis of the decision will be based on the value of the Jaque-Berra [JB]. If the JB statistics yields a value close to or equal to zero, we accept the null hypothesis of normal distribution, but if otherwise we reject the normal distribution hypothesized value.

**3.7.2 Heteroscedasticity Test:** The primary essence of this test is to evaluate if the variance of the residuals are constant overtime. It is thus based on ascertaining if the series possess the Homoscedasticity property. The basis of judging the heteroscedastic status of the residuals is based on comparing the values between the Computed Chi-Square [X2] and the tabulated version. If the computed X2 exceeds the tabulated X2, we conclude that there is the presence of heteroscedasticity in the residuals but if otherwise, we conclude there is the presence of homoscedasticity in the residual series.

**3.7.3 Unit Root/Stationarity Test**

To avoid the emergence of spurious regression due to a non-stationary series, the stationarity test will be conducted using the Augmented Dickey Fuller test.

**3.8 Data Required and Sources**

The data required in this research is time series data on infant mortality, life expectancy and value of agricultural output, and they will be sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and Index Mundi Statistical Database.

**CHAPTER FOUR**

**PRESENTATION AND ANALYSIS OF RESULTS**

**4.1 Unit Root Test**

To avoid estimating parameters with unreliable estimates, it becomes necessary to carry out a unit-root test on the variables. The table below displays the summary results of the unit-root test using Augmented Dickey-Fuller (ADF) statistic.

**Table 4.1:** *Unit Root Test*

|  |  |  |  |
| --- | --- | --- | --- |
| **VARIABLE** | **ADF STATISTIC** | **CRITICAL-VALUE @5%** | **ORDER OF INTEGRATION** |
| MORTALITYR | -9.568080 | -3.544284 | I(1) |
| LIFE-EXP | -4.393518 | -3.544284 | I(1) |
| AGRICOUTP | -5.798633 | -3.544284 | I(1) |

**Source:** *Author’s Computation Using E-views Software*

The table above shows that mortality rate, life expectancy and agricultural output were stationary at the first difference which means they are respectively integrated at order one.

**4.2 Regression Analysis**

**Below is a summary table of the regression analysis. Main output is located in appendix I.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Coefficients** | **Std.Error** | **t-statistics** |
| Mortality Rate | -0.7880113 | 0.1064021 | -7.405974 |
| Life Expectancy | 0.7977910 | 0.1711937 | 4.660165 |

Durbin-Watson = 1.210683 R-Squared (R2) = 0.947279 F-statistics =643.9337

The regression analysis above shows the impact and contribution of healthcare variables (mortality rate and life expectancy) on agricultural output in Nigeria. The numerical coefficient of mortality rate yielded a negative value at the magnitude of -0.7880113. This entails that on the average, a 1% increase in mortality rate will lead a loss of agricultural output potential at the magnitude of -0.7880113 units. This conforms to economic a priori expectation because loss in manpower is also loss in agricultural product potential.

On the other hand, the regression result also the numerical parameter of life expectancy yielded a positive parameter at the magnitude of 0.7977910. This entails that a direct relationship exists between life expectancy and agricultural output in Nigeria. It connotes that over the years analyzed, life expectancy has contributed positively to agricultural output in Nigeria.

The R-Squares (R2) which yielded 0.947279 entails that the explanatory power of the independent variables (life expectancy and mortality rate) on the dependent variable (agricultural output) are high. It further means that the variation in agricultural output is accounted for by the changes in healthcare variables by 94%. This entails healthcare variables have much influence over agricultural output in Nigeria.

**4.3 Normality Test**



The normality test was carried out to ascertain if the residuals are normally distributed. This is aided by the Jarque-Berra (JB) Statistic. The Normality table shows that the JB statistic yielded 7.602048. This entails that the residuals are not optimally distributed as the JB is expected to yield a value close or equal to zero. However, this is attributed to the longevity and length of data as a larger sample size has the tendency of yielding a normally distributed residuals.

**4.4 Statistical Test of Significance**

The table below displays the computed and tabulated values of the t and f statistics.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Computed t\*** | **Tabulated t0.025** | **Decision** |
| MortalityR | -7.405974 | 1.68 | Significant |
| LifeExp | 4.660165 | 1.68 | Significant |

|  |  |  |
| --- | --- | --- |
| **Statistics** | **Computed F\*** | **Tabulated F0.05** |
| F-Stat | 643.9337 | 2.84 |

**4.5 Autocorrelation Test**

This test whether the error is correlated with one another. To do that, we apply the Durbin Watson the test with the hypothesis as below

|  |  |  |
| --- | --- | --- |
| Null Hypothesis | Decision | If |
| No positive autocorrelation  No positive autocorrelation  No negative correlation  No negative correlation  No autocorrelation positive or negative | Reject  No decision  Reject  No decision  Do not reject | 0<d<dL  dL ≤ d≤ dU  4-dL<d<4  4-dU≤d≤4-dL  dU<d<4-dU |

From the Durbin Watson table, dL= 1.364 and dU= 1.724 and the estimated d-statistic=1.210683. Since 0<d<dL =0<1.210683<1.364 lies in the indecisive zone, we apply the modified d test in which we reject the null hypothesis of no positive autocorrelation. Therefore we reject the null hypothesis.

* 1. **GRANGER – CAUSALITY**

From the result of the Granger-Causality carried out, there is a uni- directional causality that suggests that Agricultural output granger cause life expectancy. This implies that increase in output of Agricultural sector causes over time increase in life expectancy.

**4.7 Test of Hypotheses**

Since the computed t-statistics is greater than the tabulated t-statistics for hypotheses one, we accept that life expectancy has significant impact on agricultural output in Nigeria.

Since the computed t-statistics is greater than the tabulated t-statistics for hypotheses two, we accept that infant mortality has significant impact on agricultural output in Nigeria.

We accept the alternative hypothesis that there is a causal relationship between healthcare delivery and agricultural output in Nigeria because the probability values for the test yielded values less than 0.05.

**4.9 Implications of the Results**

So far, this analysis has been to carry out an empirical analysis of the impact of health care on agricultural output in Nigeria. The result shows that healthcare delivery has significant impact on agricultural output in Nigeria. This implies that if the healthcare system in Nigeria can be taken as a policy priority, a tremendous increase in the agricultural sector is unarguably expected. Having captured the heath care with life expectancy and infant mortality rate, the numerical coefficients of life expectancy yielded positive value while mortality rate yielded a negative value. The implication of these signs is that for the period analyzed, life expectancy of the study area has been a positive contributor to the agricultural sector in the study area whereas mortality rate is otherwise. This calls for immediate policy action.

**CHAPTER FIVE**

**SUMMARY, CONCULSION AND RECOMMENDATION**

**5.0 Summary of Findings**

The main essence of this study is to carry out an empirical analysis of the impact of healthcare delivery on agricultural output in Nigeria from 1980-2016. To actualize this main purpose, health care was proxied with mortality rate and life expectancy. Secondary data was utilized and the methodology that was adopted to estimate the structural parameters is the multiple linear regressions with the application of Ordinary Least Squares (OLS) technique. Findings from the analysis are specified thus:

1. Life expectancy has significant impact on agricultural sector output in Nigeria.
2. Infant mortality has significant impact on agricultural sector output in Nigeria.
3. There is a causal relationship between healthcare and agricultural sector output in Nigeria.

**5.2 Conclusion of the Study**

This research has been able to evaluate the impact of health care on agricultural output in Nigeria covering the period 1980-2016. Based on the findings of the study, one can draw an objective conclusion that the agricultural sector is highly dependent on the health sector i.e. the health status of the concerned population. The federal government of Nigeria has not been able to prioritize the health sector and hence there is no adequate man-power to propel the agricultural sector. There is need for immediate policy action.

**5.3 Recommendations**

In the light of the findings of this study, the following recommendations are proffered:

1. The Federal Government should explore ways towards improving access to primary health care. Extending the reach of primary health care and improving its performance requires action on several fronts’ simultaneously-including new delivery models to increase access, a greater role for nonprofit and private organizations in service delivery, and the introduction of performance incentives to improve it. This will invariably boost the agricultural sector.
2. Large scale farmers should be granted specialized free medical services so as to sustain their capacity to keep their engagement in the agricultural sector. This will go a long way in increasing and sustaining the human capacity of our large scale farmers.
3. Committees or agencies should be set in order to monitor and evaluate the performance and track the use of resources, health policies and reforms continuously to enable technical efficiency in the delivery of their services. Implementation of health financing policies and actions need to be monitored and evaluated at regular intervals.

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**TIME SERIES DATA ON AGRICULTURAL OUTPUT, MORTALITY RATE AND LIFE EXPECTANCY.**

|  |  |  |  |
| --- | --- | --- | --- |
| **YEAR** | **AGRIC** | **MORTALI** | **LIFEEXP** |
| 1980 | 2246.324 | 214.5000 | 46.63000 |
| 1981 | 2364.370 | 211.5000 | 46.93000 |
| 1982 | 2425.960 | 209.6000 | 47.15000 |
| 1983 | 2409.080 | 208.9000 | 47.31000 |
| 1984 | 2303.510 | 209.1000 | 47.39000 |
| 1985 | 2731.060 | 209.9000 | 47.40000 |
| 1986 | 2986.840 | 211.0000 | 47.38000 |
| 1987 | 2891.670 | 211.9000 | 47.33000 |
| 1988 | 3174.570 | 212.6000 | 47.27000 |
| 1989 | 3325.950 | 212.9000 | 47.23000 |
| 1990 | 3464.720 | 212.9000 | 47.19000 |
| 1991 | 3590.840 | 212.5000 | 47.16000 |
| 1992 | 3674.790 | 211.9000 | 47.13000 |
| 1993 | 3743.670 | 211.2000 | 47.09000 |
| 1994 | 3839.680 | 210.1000 | 47.05000 |
| 1995 | 3977.380 | 208.3000 | 47.01000 |
| 1996 | 4133.550 | 205.7000 | 46.99000 |
| 1997 | 4305.680 | 202.1000 | 46.98000 |
| 1998 | 4475.240 | 197.7000 | 47.00000 |
| 1999 | 4703.640 | 197.8000 | 47.07000 |
| 2000 | 4840.970 | 187.4000 | 47.19000 |
| 2001 | 5024.540 | 181.7000 | 47.40000 |
| 2002 | 7817.080 | 175.9000 | 47.69000 |
| 2003 | 8364.830 | 169.9000 | 48.07000 |
| 2004 | 8888.570 | 164.0000 | 48.52000 |
| 2005 | 9516.990 | 157.9000 | 49.02000 |
| 2006 | 10222.47 | 151.9000 | 49.56000 |
| 2007 | 10958.47 | 146.0000 | 50.09000 |
| 2008 | 11645.37 | 140.3000 | 50.61000 |
| 2009 | 12330.33 | 134.8000 | 51.10000 |
| 2010 | 13048.89 | 129.6000 | 51.56000 |
| 2011 | 13429.38 | 124.6000 | 52.00000 |
| 2012 | 14329.71 | 120.0000 | 52.43000 |
| 2013 | 14750.52 | 115.6000 | 52.86000 |
| 2014 | 15380.39 | 111.6000 | 53.30000 |
| 2015 | 15952.22 | 108.0000 | 53.76000 |
| 2016 | 15999.43 | 104.3000 | 53.79000 |

**Source:** *CBN statistical bulletin and Index Mundi Statistical Database.*

**Appendix I**

**Unit-Root Results**

**AGRIC. OUTPUT (1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(AGRI\_O) has a unit root | | | |  |
| Exogenous: Constant, Linear Trend | | | |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=9) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -5.798633 | 0.0002 |
| Test critical values: | 1% level |  | -4.243644 |  |
|  | 5% level |  | -3.544284 |  |
|  | 10% level |  | -3.204699 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(AGRI\_O,2) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 11:38 | | |  |  |
| Sample (adjusted): 1982 2016 | | |  |  |
| Included observations: 35 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(AGRI\_O(-1)) | -1.025317 | 0.176820 | -5.798633 | 0.0000 |
| C | -40.80064 | 161.5681 | -0.252529 | 0.8022 |
| @TREND("1980") | 24.08718 | 8.578723 | 2.807782 | 0.0084 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.512377 | Mean dependent var | | 15.34543 |
| Adjusted R-squared | 0.481900 | S.D. dependent var | | 622.0767 |
| S.E. of regression | 447.7655 | Akaike info criterion | | 15.12823 |
| Sum squared resid | 6415807. | Schwarz criterion | | 15.26155 |
| Log likelihood | -261.7441 | Hannan-Quinn criter. | | 15.17425 |
| F-statistic | 16.81221 | Durbin-Watson stat | | 2.000238 |
| Prob(F-statistic) | 0.000010 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**MORTALITY RATE (1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(MORT\_R) has a unit root | | | |  |
| Exogenous: Constant, Linear Trend | | | |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=9) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -9.568080 | 0.0000 |
| Test critical values: | 1% level |  | -4.243644 |  |
|  | 5% level |  | -3.544284 |  |
|  | 10% level |  | -3.204699 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(MORT\_R,2) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 11:40 | | |  |  |
| Sample (adjusted): 1982 2016 | | |  |  |
| Included observations: 35 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(MORT\_R(-1)) | -1.481390 | 0.154826 | -9.568080 | 0.0000 |
| C | 1.332790 | 3.201212 | 0.416339 | 0.6799 |
| @TREND("1980") | -0.308445 | 0.152031 | -2.028831 | 0.0509 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.740992 | Mean dependent var | | -0.020000 |
| Adjusted R-squared | 0.724805 | S.D. dependent var | | 16.92963 |
| S.E. of regression | 8.881126 | Akaike info criterion | | 7.287550 |
| Sum squared resid | 2523.981 | Schwarz criterion | | 7.420866 |
| Log likelihood | -124.5321 | Hannan-Quinn criter. | | 7.333571 |
| F-statistic | 45.77427 | Durbin-Watson stat | | 2.277156 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**LIFE EXPECTANCY (1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: LIFE\_EXP has a unit root | | | |  |
| Exogenous: Constant, Linear Trend | | | |  |
| Lag Length: 1 (Automatic - based on SIC, maxlag=9) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -4.393518 | 0.0069 |
| Test critical values: | 1% level |  | -4.243644 |  |
|  | 5% level |  | -3.544284 |  |
|  | 10% level |  | -3.204699 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(LIFE\_EXP) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 12:52 | | |  |  |
| Sample (adjusted): 1982 2016 | | |  |  |
| Included observations: 35 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| LIFE\_EXP(-1) | -0.047012 | 0.010700 | -4.393518 | 0.0001 |
| D(LIFE\_EXP(-1)) | 1.031327 | 0.085951 | 11.99904 | 0.0000 |
| C | 2.130127 | 0.488939 | 4.356633 | 0.0001 |
| @TREND("1980") | 0.007413 | 0.002165 | 3.424263 | 0.0018 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.917594 | Mean dependent var | | 0.196000 |
| Adjusted R-squared | 0.909620 | S.D. dependent var | | 0.227625 |
| S.E. of regression | 0.068432 | Akaike info criterion | | -2.418755 |
| Sum squared resid | 0.145169 | Schwarz criterion | | -2.241001 |
| Log likelihood | 46.32822 | Hannan-Quinn criter. | | -2.357395 |
| F-statistic | 115.0626 | Durbin-Watson stat | | 1.392977 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**CO-INTEGRATION ANALYSIS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: ERROR has a unit root | | | |  |
| Exogenous: None | | |  |  |
| Lag Length: 1 (Fixed) | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -3.036807 | 0.0034 |
| Test critical values: | 1% level |  | -2.632688 |  |
|  | 5% level |  | -1.950687 |  |
|  | 10% level |  | -1.611059 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(ERROR) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 15:49 | | |  |  |
| Sample (adjusted): 1982 2016 | | |  |  |
| Included observations: 35 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| ERROR(-1) | -0.584330 | 0.192416 | -3.036807 | 0.0046 |
| D(ERROR(-1)) | -0.058538 | 0.173924 | -0.336574 | 0.7386 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.317257 | Mean dependent var | | 9.218376 |
| Adjusted R-squared | 0.296568 | S.D. dependent var | | 859.5540 |
| S.E. of regression | 720.9152 | Akaike info criterion | | 16.05437 |
| Sum squared resid | 17150718 | Schwarz criterion | | 16.14324 |
| Log likelihood | -278.9514 | Hannan-Quinn criter. | | 16.08505 |
| Durbin-Watson stat | 2.037819 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**REGRESSION ANALYSIS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: AGRI\_O | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 11:49 | | |  |  |
| Sample: 1980 2016 | | |  |  |
| Included observations: 37 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | -17669.49 | 10159.45 | -1.739217 | 0.0910 |
| LIFE\_EXP | 0.7977910 | 0.1711937 | 4.660165 | 0.0000 |
| MORT\_R | -0.7880113 | 0.1064021 | -7.405974 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.947279 | Mean dependent var | | 7023.785 |
| Adjusted R-squared | 0.972766 | S.D. dependent var | | 4746.017 |
| S.E. of regression | 783.2251 | Akaike info criterion | | 16.24232 |
| Sum squared resid | 20857015 | Schwarz criterion | | 16.37294 |
| Log likelihood | -297.4830 | Hannan-Quinn criter. | | 16.28837 |
| F-statistic | 643.9337 | Durbin-Watson stat | | 1.210683 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**HETEROSKEDASTICITY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Heteroskedasticity Test: White | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 37.30720 | Prob. F(5,31) | | 0.0000 |
| Obs\*R-squared | 31.72731 | Prob. Chi-Square(5) | | 0.0000 |
| Scaled explained SS | 47.43663 | Prob. Chi-Square(5) | | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID^2 | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 07/21/18 Time: 12:01 | | |  |  |
| Sample: 1980 2016 | | |  |  |
| Included observations: 37 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 1.76E+09 | 7.64E+08 | 2.306510 | 0.0279 |
| LIFE\_EXP^2 | 528636.8 | 193744.1 | 2.728531 | 0.0104 |
| LIFE\_EXP\*MORT\_R | 56904.23 | 29074.53 | 1.957185 | 0.0594 |
| LIFE\_EXP | -61190220 | 24252373 | -2.523061 | 0.0170 |
| MORT\_R^2 | 1237.022 | 1296.283 | 0.954284 | 0.3473 |
| MORT\_R | -3189050. | 1886372. | -1.690573 | 0.1010 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.857495 | Mean dependent var | | 563703.1 |
| Adjusted R-squared | 0.834510 | S.D. dependent var | | 1075420. |
| S.E. of regression | 437485.7 | Akaike info criterion | | 28.96287 |
| Sum squared resid | 5.93E+12 | Schwarz criterion | | 29.22410 |
| Log likelihood | -529.8131 | Hannan-Quinn criter. | | 29.05497 |
| F-statistic | 37.30720 | Durbin-Watson stat | | 0.685774 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**NORMALITY TEST**



**GRANGER CAUSALITY**

|  |  |  |  |
| --- | --- | --- | --- |
| Pairwise Granger Causality Tests | | | |
| Date: 07/21/18 Time: 16:35 | | | |
| Sample: 1980 2016 | | |  |
| Lags: 2 | |  |  |
|  |  |  |  |
|  |  |  |  |
| Null Hypothesis: | Obs | F-Statistic | Prob. |
|  |  |  |  |
|  |  |  |  |
| LIFE\_EXP does not Granger Cause AGRI\_O | 35 | 1.65422 | 0.2082 |
| AGRI\_O does not Granger Cause LIFE\_EXP | | 6.21363 | 0.0055 |
|  |  |  |  |
|  |  |  |  |
| MORT\_R does not Granger Cause AGRI\_O | 35 | 3.03957 | 0.0628 |
| AGRI\_O does not Granger Cause MORT\_R | | 2.75020 | 0.0800 |
|  |  |  |  |
|  |  |  |  |
| MORT\_R does not Granger Cause LIFE\_EXP | 35 | 1.38817 | 0.2651 |
| LIFE\_EXP does not Granger Cause MORT\_R | | 1.11774 | 0.3403 |
|  |  |  |  |
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