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# Foreign Direct Investment and the Performance of Health Outcomes in Nigeria

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**Abstract**

This work evolved out of the need to provide the nexus between FDI and health using MMR as a proxy for health outcomes in Nigeria. Attention on the health sector is very germane to any economy, reason why the health outcomes has become one of the main macro-economic goal of many countries. This study aims at ascertaining significant effect on the health status of a nation. The data used for the analysis were gotten from WDI (2016) covering the period of 36 years (1980 to 2016).Based on the feature of endogeneity of the variables, the VAR/VECM framework were employed via Eviews 9.0 to check how the short run equilibrium is adjusted into the long run. The granger causality test was employed using the Wald and block test including other supplementary diagnostic test like the impulse response, CUSUM squares and Inverse root of AR. The result reveals that FDI significantly affects Health outcomes in Nigeria on the other hand, PCI was found to have a bidirectional relationship with MMR. It was found that there was a vicious cycle among FDI and MMR i.e. a rise in FDI affects the level of per capita income leading to increased health care access which leads to improved health indices, which attracts FDI into the nation. The study reveals that FDI has a significant impact on health, therefore, there is need for policies and programs that drives increased FDI inflows into a nation to improve the level of maternal health and other health outcomes. Thus, government, non-government and private organizations should adopt policies that attract FDI inflows and tailor down towards individual specific goals, which will affect the lives of the populace.

**Keywords**: FDI, Health, Econometrics

**JEL Classification**: F21, I10, C100

**Paper Classification**: Research Paper

## Introduction

Foreign direct investment has been the subject of immense importance over the last few decades, as strong wind of globalization began to blow into most developing countries, Nigeria inclusive. Thus, researchers like Blomstrom, Lipsey and Zejan (1996), Alfaro, Chanda, Kalemliozcan, Sayek (2004) and Izilein & Mohammed (2017) among others alluded to the fact

that welcoming continuous FDI inflows into an economy has the tendency to increase the level of national development since, such flows tends to complement the available domestic capital availability, widen trade access, yield encouraging institutional and technological externalities for domestic firms, and help gather and raise mental stock. It is pertinent to note that for recipient economy, countries or multinational firms that tend to receive these investment, it help provide a means and channel for original technologies, stock, means of production, outputs, managerial technologies, managerial skills, and as such can yield a strong foundation for the growth of an economy to thrive (Raul, 2012).

Scholars like Marcella, Bloom and Canning (2006) and Jakob Madsen (2016) asserted on the increasing literature on health as an important part of Human capital that has the capacity of raising labour yield, output and speeds up the growth of an economy via the multiplier effect. Thus, increasing levels of human capital in the labour force are likely, ceteris paribus to make a country attract more foreigners for investment. Conversely, increasing levels of absenteeism or labour spill over as a result of causality and mortality has the tendency of raising the cost of production and thus, hinder FDI. Thus, a great burden of contaminable diseases hinder FDI flows into a given geographical location if, investor's expectation for its personal health or that of their worker might be compromised. This was supported by Quarmrul, Ashley and David (2009) and Nwankwo (2013) on the ground that it attracts foreign investors.

From the forgoing, it is seen that over the years, governing bodies situated in both emerged and emerging economies tend to fight for foreign direct investment (FDI) to flow into her economy. This has been the reason why there has been an intense fight for FDI inflows, as FDI is greatly believed to drive the domestic countries' economic growth and development.

Attention on the health sector is very germane to any economy hence, the reason why the health outcomes has become one of the main macro-economic goal of many countries as it tries to achieve positive indices such as, reduction in the rate of her maternal deaths and deaths of her infants to the barest minimum among others. The idea that the health status of a nation may have a negative impact on FDI is not to be doubted, for the clear fact that an economy with a work force that is perceived to be healthy would yield more result in terms of output when compared, with its counterpart with work force who are believed to be sick. As a result, one would believe that the state of health of labour in recipient economies have a great effect on FDI flows. Thus, it is however fascinating that although, there is relatively an already fact in terms of literature empiricism on the factors affecting FDI flows to an emerging economy in general, African countries and Nigeria inclusive, studied how the state of health of labour in recipient economy impacts and affects FDI flows has been few though, it has been seen to be contemporary.

There has been little literature/work done on FDI and health in Nigeria. Most work done looks at the relationship between FDI and economic growth, employment generation, power sector among others, but little has been done on FDI and health, the only work done by Rodlphe and Celine (2008) relates FDI and infant mortality rate in developed countries using a panel analysis.

However, there remains a gap in literature as it affects empiricism validation in terms of theory and data as regards the relationship between FDI and Health in Nigeria. The only existing literature known to the authors is the work of Rodolphe and Celine (2008) which looked at FDI and Health in Sub- Sahara African Countries (SSA) while Abolghasem (2017) did the same study for selected developed countries thus leaving a gap as regard FDI and its impact on Health in Nigeria using maternal mortality rate (MMR) as a case study, establishing both short-term and long-term FDI effects with requisite econometric methods.

Therefore, it can be asserted that the issue of FDI as it tends to affect the health sector in isolation is one of the most unresolved field of study in international economics. However, this work looks at FDI and its impact on health taking MMR as a case study thus, improving on the scant existing literature available.

## Literature Review

The role of FDI in process of growth of an economy has of course been the subject of great deal for over past three decades as most countries begin to welcome the dividends of industrialization and globalization. For two decades past, emerging and emerged economies have continuously given serious efforts in terms of time, energy, focus and setting up institutions towards the attraction of increased FDI flows and believing that these flows have the potency of driving expansion and growth in their host countries. The theoretical precedence is direct and of course easy to understand. FDI is seen as a full body of technological know-how, capital stocks among others. Alfaro et al. (2004), alluded noted that, welcoming increased FDI flows to an economy is expected to yield an increased level of economic growth and development since such flows compliment the home capital stock, widens the market base, yield positive tech-know-how spill over benefit for the domestic firms, and aid in the accumulation and improvement of human capital ( Yasir Khan, 2018).

Several scholars have tried to conceptually clarify the term FDI, however, the most accepted conceptually clarification of FDI is referred to as the IMF/OECD (2011) benchmark definition which posits that foreign direct investment (FDI) is a foreign investment in which a domestic businessman living in the domestic economy that receives the investment possesses a long term 'influence' in the running of a firm in the recipient country. This conceptual clarification is viewed generally in acceptance because it was given by the joint efforts of two foreign organizations with the aim of giving base to domestic statistical department for the gathering of FDI data. Therefore, based on the above conceptual clarification, the existence of such long-term influence is shown when voting or quest for management by the foreign firm yields up to 10% (minimum) of the sum of voting shares of rights of the multinational firm.

However, empiricism in terms of fact on the growth effect of FDI flows in third-world economies is not straight forward hence vague, mixed, dicey and inconclusive. The outputs largely differ depending on a large determinant among which are country specific, the time horizon covered, the data employed, among others. Borensztein, De Gregorio (1998), and Loungani (2002) both debunked the existing available doubts casted on theoretical literatures on the growth-driving impact of FDI flows (Laura Alfaro & Jasmina Chauvin, 2017) noting that FDI has the potency to drive economic growth. However, argument persisted that the inflows of FDI may not yield the desired needs in terms of the development of many third-world countries and then would deter instead of promoting the growth as a result of crowding out home saving, spurring dependent countries, and negatively impacting on the social-economic and cultural beliefs of the recipient economy. The possibility of a negative impact because of FDI flows are more obvious and more pronounced if these inflows are bedeviled by a high level of fluctuations (Laura Alfaro & Jasmina Chauvin 2017).

## Theoretical Review

Foreign direct investment (FDI) is obscured to be a measure of international gain of assets for productive purpose, such as plants, mines and capital. Growth in multinational investment can be utilized as a measure of raising globalization for economies (Azam & Ather, 2015)). Studies

form over half a decade have shown that the traditional clarification of FDI has metamorphosed greatly. This believe of a transition in the traditional clarification, therefore, needs to be placed in the right context to keep its meaning. Most importantly, it has been seen that over two out of three of every FDI is still made in the form of fixtures and fitting, plants and machinery, equipment and structures/buildings. However, great international firms and partners still cover and harness the all-increasing FDI in terms of its percentage. Thus, many governmental bodies, especially from emerging and emerged countries among which is Nigeria, pay great deal of attention to FDI because, it believes that such flows into (Inward FDI) and out (Outward FDI) of the respective countries will definitely have a significant impact on the health status of the nation hence, ultimately their productivity (Aseidu, 2009).

**Principles of Foreign Direct Investment**

David (2008) alluded to the fact that countries who receive investment should implement a code of conduct that covers the following 3 principles.

***Principle 1***: The law covering the review of investment should be directed and focused on domestic security not considering economic factors.

One of the basic guidelines of foreign trade and investment policies over the past 50 years covering the world is that any barriers to trade should be among others the least that are needed to be put into consideration in the achievement of governmental aim and objective. The above principle needs to be applied to modern day new multinational investment regimes being deliberated and implemented. Thus, governmental barriers on multinational investments should be directed to those issues that the institution cannot directly hinder, which includes anticompetitive effects or threats to the domestic security.

***Principle 2***: This investment review policy should give a sense of direction to both parties in an investment process by making sure that the policies will be enacted within a specified time horizon. With the belief of price rise, only scant determinants are more necessary for foreign investors than the turnover with which a transaction can undertake. This is because investors would never be happy with uncertainty, and the more time taken in a transaction for it to be closed, the more the uncertainty as compared to levels of certainty.

***Principle 3***: This investment review policy should make sure that confidence is built between both parties in consideration. Thus, serious secrecy inherent in an investment review mechanism process is pertinent to raise assurance that the statistics and the necessary information given to governmental bodies will be shielded from the populace and its rivals. It is very important to note that both parties build confidence in the institutions and the regulatory framework thereby builds faith, in as much as the secrecy of the business deal and ownership/patent information is never compromised for any reason.

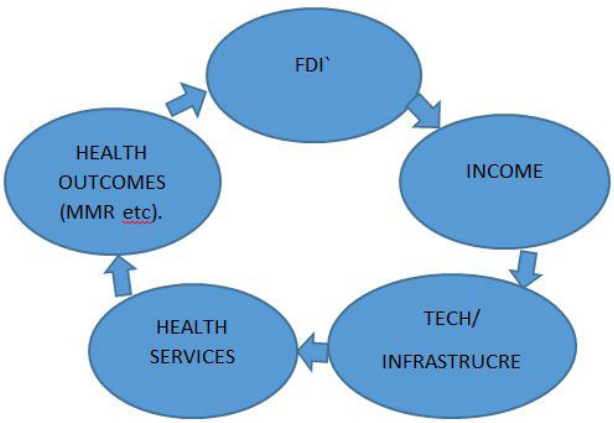
From the foregoing, the first principle by David, asserts that the government is to only place restrictions on problems that the perfect market cannot prevent, then government should open up the borders for the free flow of beneficial FDI which is expected not to cause any form of threats to national security hence, this will affect the inflow of improved technology and ultimately impact positively on maternal health, infant mortality, life expectancy among others in the recipient country. On the other hand, higher FDI inflows yield higher personal income as a result of reduction in poverty rate in the recipient country for the populace to have increase access to quality health care services, high calorie intake which is a prerequisite for improved health outcomes. From the second principle, it has been seen that delay in time which leads to

uncertainty, forces FDI inflows out of a country, therefore, to achieve an improvement in health outcomes, Nigeria should encourage prompt transaction that will reduce uncertainty in the health sector which leads to maternal and infant death and low life expectancy. Finally, the third Principle holds that a nation that lacks confidentiality cannot attract FDI which has its antecedent consequences on Health outcomes as noted above.

**Potential links between FDI and health**

It has been observed that FDI is expected to yield a positive impact on the populace, specifically on the health sector by raising the level of demand for all medical/health-related services and goods, and by raising the rate at which such related goods and services are supplied to the populace. Going by the OECD (2002),the impact of FDI on the level of productivity and its factor of production is generally immense, especially to the recipient economy and income per capita growth in the recipient countries, above what the home investment would normally trigger. FDI-induced capital profits are expected to drive greater private and public spending on balanced diet with high calorie intake, drinkable water, accesses to academics and medical services. In continuation, FDI looks to drive domestic economics as it tends to drive medical output with availability of increased medical goods and services that is available to the populace at an affordable price. Since FDI is known as a principal pulling strength of globalization which has been connected to rise in income differences among skilled and unskilled labours in industrialized and emerging economies, Dierk Herzer, Korbinian Nagel & Peter Nunnenkamp (2015) supports that foreign industries specifically yield more and higher output, greater, and more efficient skill-intensive than its home-based competitors. This has been the reason for developing countries to welcome FDI into its health sector to improve its health indicators. Thus, from the forgoing, it is seen that the nexus between FDI and health outcomes yields incentive-based externality that spills over to several sector of the economy giving rise to a notion known as the vicious cycle of FDI and health.

**Figure 1. Vicious cycle of FDI and Health outcomes**




*Source: Researcher*

Figure 1 shows the vicious cycle of FDI and Health outcomes. According to Grossman (1972) health capital model, it posits that an individual is assumed to maximize utility subject to his wealth/income and time constraint. Thus according to the researcher above, an economy which attracts high inflow of FDI has the tendency to increase the per capita income of its citizens which could be the result of increase in employment opportunities which has the possibility of having a

spillover effect on the level of infrastructure and technology. Therefore, because of this spillover effect, there will be technological advancement which will lead to improved health services. Thus, with the increase in income level, the populace will be able to access the improved health care services thereby impacting positively on health outcomes. From the analysis above, let's note that what attracts FDI into an economy is the level of human capital in an economy. With an improvement in health outcomes, foreign investors therefore will have a conducive environment for investment to thrive as supported by David (2008), hence the vicious cycle of FDI and health outcomes.

## Methodology

The underlying framework for analyzing the nexus between FDI and Health in this research follows the Grossman (1972) & Sede and Ohemeng (2015) health capital model. Drawing from the model presented by Grossman, the economic agent is believed to optimize satisfaction constrained on the available Wealth/income and time. Grossman (1999) presented the optimization problem of the consumer as an inter-temporal issue where the individual optimizes his or her satisfaction through time and he specified it as:

$$U_t = f\ (H_t, Z_t) \qquad 3.1$$

Where t = 0,1, 2,…n, $H_t$ is the stock of health. $Z_t$ is the vector consumption goods

N.B: This utility is maximized subject to the income constraint of the individual overtime. The equation can be represented as:

$$\sum_{t=0}^{n} \left( \frac{PmMt + PxXt}{(1+r)t} = \frac{Wt\Omega}{(1+r)t} \right) + Ao \qquad 3.2$$

Where r is the discount rate. Pm & Px represents prices of health inputs and other goods while Mt is a vector of health services.

N.B: these medical inputs, other goods and medical services cannot be acquired without incomes which is the role and importance of FDI inflows into an economy which can be represented as Wt classically known as hourly wage rate of the individual.

The Ω is the amount of time available to the individual.

The left-hand side of the equation represents the discounted life-time income plus the initial wealth. Cases where this is low, it therefore yields low stock of health hence ill health, leading to low productivity then poor economic growth and development in such country, vice versa.

Model Specification and Methodology

The investigation between the relationship between health and FDI follows the theoretical framework above. In this study, the analysis begins with a functional specification as

$$V_t = f(\text{MMR,FDI,GFCF,LEB,IMR,PCI}) \qquad 3.3$$

Where; $V_t$ = vector of variables in the determination of direction of causality between FDI and health outcomes. MMR = Maternal Mortality Rate. FDI = Foreign Direct Investment. GFCF = Gross Fixed Capital Formation. LEXB = Life Expectancy at Birth. IMR = Infant Mortality Rate. PCI = Per Capita Income t, = time factor. The model can be specified econometrically as

$$\boldsymbol{MMR_t} = \beta_1 \boldsymbol{FDI_t} + \beta_2 \boldsymbol{LEXB_t} + \beta_3 \boldsymbol{IMR_t} + \beta_4 \boldsymbol{GFCF_t} + \beta_5 \boldsymbol{PCI_t} + \varepsilon_t$$

From the forgoing we proceed to specify a VAR model as

$$V_t = \sum^{k}_{t=0} A_i \; V_{t-1} + E_t \qquad 3.30$$

Where $V_t$ = (MMR,FDI,GFCF,LEB,IMR,PCI).

$A_i$ = six by six matrices containing coefficients of all variables in the model.

$V_t$ = vector of variables in the determination of direction of causality between FDI and health.

$V_{t-1}$ = vector of lagged variables. $E_t$ = vector of normally and independently distributed error term.

The study employed the VAR estimation technique. Where all the variables were viewed as endogenous variables. Furthermore, the error correction version of the technique was estimated (VECM). The Granger Causality test was also carried out to establish the direction of causality between FDI and Health outcomes in Nigeria. Also, the impulse response function testing was applied to check for the effect of deviational shocks on the respective variables of concern. The data employed for this work is gotten from the world development indicators (2016). The work employs data for the time horizon 1981 to 2016 due to data constraint mainly on health indicators.

## Results and Discussion

The descriptive statistics as presented in the appendix 1, is used to reveal the statistical behavior of the data used for the analysis. In other words, it is used tfr reliability and the nature of the data used so as to ascertain its potency for policy implications. The summary of descriptive statistics for the variables, shows that the average Values of MMR, FDI, GFCF, LEXB, IMR and PCI are 1161.703, 2.844174, 13.08438, 47.6801, 107.4378 and 112536.7 respectively. Where the deaths are per 1000, FDI and GFCF are percentage of GDP, and PCI is a proxy for Income level. Their respective maximum values are 1610 deaths per 1000, 10.83256 for FDI, 35.22126 for GFCF, 53.4 for LEXB per 1000 live birth, 127.00 per 1000 deaths and 539655.4 for PCI.

The Standard deviation which is used as measure of quantifying the amount of variation or dispersion of a given data set shows that level of variation is systematically low as shown by the various standard deviation values of 256.0406, 2.326778, 6.627441, 2.512020, 20.74558 and 170848.6 respectively.

Skewness of a given data set reveals the extent to which a distribution differs from a normal distribution. The Jarque-bera statistics is a test of goodness of fit to know whether the sample data has the skewness and kurtosis matching a normal distribution. The null hypothesis is a joint hypothesis of the skewness being equal to zero. George and Mallery (2010) asserts that for the normal distribution of data, the values should be near to zero lying between -3 and +3 for the probability values; but for an asymmetry distribution, the value should lie between -2 and +2 (as cited in Javier 2015). Also, if the probability value is less than the Jarque Bera chi-square, then the null hypothesis of the regression which states that the variables are not normally distributed is rejected. From the result, it is clear that the hypothesis that all the variables are not normally distributed can be rejected since all the probabilities are less than the Jarque Bera chi-square distribution.

Just like the skewness, kurtosis is a measure of the 'peakedness or tailedness' of a real valued random distribution from its mean. Conclusively, the skewness coefficient indicates normal curves for all the variables with the values ranging from -3 to +3. Deducing from the table above, all the variables indicate a normal curve as their values range from -3 to +3.

**Unit Roots Test Results**

Usually in economic analysis of macroeconomic phenomena, researchers are often faced with the problem of deriving stationarity in the time series variables incorporated in the study of interest given the poor data collation technique in most African Countries, Nigeria inclusive. Thus, this prompts the relevance of conducting the unit root test using both ADF and PP test to rationalize the stochastic process in time series analysis (Sede and Ohemeng, 2015). Appendix 2 shows that the ADF and PP test statistic are greater than their respective 95% critical value at first differencing. FDI is seen to be stationary at levels 1(0) while the others were after the first differencing, ADF and PP test proved all variables to be stationary. A lag selection criteria table was derived from the VAR estimate as the system suggested an optimum lag of 2.

**Result of Johansen Co-Integration Test**

From Table 3a & 3b, it is obscured that the trace statistics and Max Eigen statistics showed the presence of six co-integrating equation. This means that we can reject the null hypothesis of no co-integrating relationship among the variable at 5% significance level this supports the presence of a long run relationship between the variables as they are likely to converge at equilibrium in the long run.

**Vector Error Correction Methodology (VECM) Estimates**

This tells what rate it will take for the model to correct the previous disequilibrium in the system. In other words, it shows the speed of adjustment of the co-integrated variables.

The VECM result can be stated below as

$$ECT_{t-1} = \beta_0 + \beta_1 MMR_{t-1} + \beta_2 FDI_{t-1} + \beta_3 LEXB_{t-1} + \beta_4 IMR_{t-1} + \beta_4 GFCF_{t-1} + \beta_5 PCI_{t-1} + \varepsilon_{t-1}$$

$$ECT_{t-1} = 4.744943 - 1.69246MMR_{t-1} - 0.270201FDI_{t-1} - 791.8653LEXB_{t-1} - 15.94591IMR_{t-1} + 3.333123GFCF_{t-1} - 0.000559PCI_{t-1} - 0.147748.$$

The VECM result was estimated to analyze the systematic disequilibrium, adjustment process and the short run effect among the variables. From the estimate above, the impact of each variable on the other variables will be assessed. The coefficient of ECT is the speed of adjustment, because it measures the speed at which the dependent variable returns back to equilibrium after a change in the independent variable. The main aim of VECM is to analyze the adjustment of the MMR (the Target variable) to changes in the variables shown by the coefficient of ECMt-1. Thus, from the error correction modelling, it is observed that the Error Correction Term (ECTt-1) is negative and statistically significant hence conforms to economic theory of negativity and statistical significance. Thus, given the value of the ECT at -0.14778 and its t-value of -2.80730 it reveals that the system has a self-equilibrating mechanism and has the ability of converging back to equilibrium after some period of deviational shock with the speed of 14.7748% annually.

The short run estimate of 1 period lag of MMR places the coefficient at -1.169246 with a t-value of 2.53357 which shows that it conforms to a-priori and it is statistically significant even at 5% significance level. Hence a 1unit change in MMR in its past period will lead to a 1.169246 unit decrease in the current year.

The short run estimate of 1 period lag of FDI places the coefficient at -0.270201 with a t-value of 0.15265 which shows that it conforms to a-priori expectation and it is statistically significant even

at 10% significance level. Hence a 1unit change in FDI in its past period will lead to a 1.169246 unit decrease in the current year. Judging from the above we can say that FDI granger causes MMR.

The short run estimate of 1 period lag of LEXB places the coefficient at -791.8653 with a t-value of 2.12535 which shows that it does conform to a-priori expectation and it is statistically significant even at 5% significance level. Hence a 1-unit change in LEXB in its past period will lead to a 791.8653-unit change in the current year. Judging from the above, we can say that LEXB granger causes MMR. The short run estimate of 1 period lag of IMR places the coefficient at -15.94591 with a t-value of 0.62362 which shows that it does not conform to a-priori expectation though it is statistically significant even at 5% significance level. Hence, a 1unit change in IMR in its past period will lead to a 15.94591unit change in the current year.

The short run estimate of 1 period lag of PCI places the coefficient at -0.000559 with a t-value of 3.44475 which shows that it does conform to a-priori expectation and it is statistically significant even at 1% significant level. Hence a 1unit change in PCI in its past period will lead to a 791.8653unit change in the current year. Judging from the above we can say that PCI granger causes MMR.

The estimated model above puts the coefficient of determination at 0.716744, showing that 71.67 per cent variation in maternal mortality is jointly predicted by the explanatory variables while the remaining 28.33 per cent is due to the Gaussian white noise. Thus, the model has a commendable goodness of fit. Its adjusted counterpart ($\overline{R}^2$) puts the explained variation in MMR by the explanatory variables at 52.294 per cent. The $\overline{R}^2$ shows that the estimated short run Vector Model has a relatively high predictive ability.

The F-Statistics of 3.698 exceeds the critical value at both 1 per cent and 5 per cent thus, implying that the overall model is statistically significant and a hypothesized linear relationship between maternal mortality rate on one hand and on the other hand the regressors, has been validated.

**Co-integrating Equation (Long Run Model)**

The ECM relates to the last period deviation from long run equilibrium (the error) influences the short-run dynamics of the dependent variable.

The output shows the speed of adjustment. In other words, it tells at what rate it corrects the previous disequilibrium in the system. The long run coefficient according to theory must be negative and statistically significant for it to correct for deviations in the system.

The coefficient of 1 period lag value of FDI is 2.628176 with a t-value of 2.40182 which reveals that FDI is significant in affecting MMR in the long run as supported by the p-value. Thus, FDI has a 1 period delayed effect of 2.628176 on maternal mortality rate in Nigeria.

The coefficient of the 1 period lag of life expectancy is -1074.399 with a t-value of 7.66239. From the result, the coefficient conforms to a-priori expectation and is statistically significant even at 1% statistical significance as supported by the p-value. Therefore, it connotes that the system corrects its previous disequilibrium at the speed of 10.74399% annually. Also, the significance and negativity of the coefficient shows the validity of the long run equilibrium relationship between life expectancy and maternal mortality rate in Nigeria.

The coefficient of Infant Mortality Rate (IMR) is significant as supported by the p-value but not negative thus there is no long run relationship between IMR and MMR.

The coefficient of the 1 period lag of Per Capita Income (PCI) is -0.00899 with t-value of 0.04196 which reveals that the coefficient conforms to a-priori expectation and is statistically significant in affecting MMR as supported by the p-value. Thus, this means that the system corrects for its previous disequilibrium at the speed of 0.0000899% which of course is seen to be very slow. However, PCI has 1 period delayed effect of 0.00899 on MMR.

**The VEC granger causality/block exogeneity WALD test, CUSUM Squares, Impulse Response Functions and Inverse Roots of AR Characteristic Polynomial.**

The VEC granger causality test shows that in the MMR equation, there is a unidirectional causality between FDI, GFCF, LEXB, IMR and MMR at 5% significance. However, only PCI is seen to be significant in granger causing MMR. Also, in the FDI equation, there is a one-way causality running from FDI to all the variables reason being that all the variables are not statistically significant in affecting FDI at 5% significance. The block exogeneity test shows that only one variable is statistically significant in affecting MMR which is PCI because the p value of the joint test for the variable is less than 0.05.

As seen in appendix 4, it reveals the CUSUM test, which is used for reliability test. It reveals that the model is dynamically stable at 5% significance level as supported by the inverse roots of AR characteristic polynomial, therefore can be used for effective policy implication to drive health outcomes so as to improve the health indices in the economy. The tables can be seen in the appendix. The impulse response function describes the reaction of one variable to the innovation in another variable in the system, while holding all other shocks equal to zero. The Monte Carlo simulations with the 5% error band were used to generate the impulse response function in the study. The impulse response function indicates that the shock from any of the variables to MMR has a profound effect that last for some period before returning to the equilibrium as shown in the graphs. Thus, a positive shock to MMR, i.e. positive increase in FDI, IMR, GFCF, LEXB and PCI affects maternal mortality rate over time. (see appendix).

**White Test**

The white test was conducted to ascertain the presence or absence of hetero-skedasticity in the VECM Model estimate. However, based on economic theory, we expect the output to be characterized with the problem of non-constant variance (Hetero-skedasticity). The null hypothesis of the white test states that there is no presence of hetro-skedasticity in the estimated model. However, the result as shown in the appendix 8 reveals that we accept the null hypothesis which states that there is no presence of hetero-skedasticity because the p-value of both the Pagan, Scaled and C.D test a component of the white test are all less than 0.05 pointing that the model is statistically significant in revealing that there is no hetero-skedasticity in the estimated model.

## Conclusion

The study sought to investigate the nexus between FDI and health in Nigeria. Answering the question as to the relationship between the variables was brought to light via the Vector Error Correction Model. Maternal mortality rate (MMR), a proxy for health outcomes which was found to have a significant impact on FDI, being that adverse health challenges on an individual or a nation affects FDI inflows. Infant mortality and life expectancy were also identified as a part of health and were found to be statistically significant in affecting FDI inflow. Therefore, a nation with positive health indices encourages investors into such nations thereby guarantee greater FDI inflows.

Since the study reveals that FDI has a significant impact on health, there is need for policies and programs that drives increased FDI inflows into a nation to improve the level of maternal health and other health outcomes. Given the importance of health to a nation to boost her economic growth and development, the study recommends that greater attention be given to health in terms of increased health expectancy, decreased maternal mortality, decreased infant mortality which are necessary to enhance productivity.

Despite several economic policy efforts toward improving health outcomes, the outcome can be seen not to commensurate with its cost. Having ascertained the robustness, the relevant statistical features of the model through the relevant diagnostic test, the study therefore concludes that FDI impacts significantly and positively on health. It is believed that if the recommendations propounded in the study are implemented, there will be significant improvement in health outcomes especially the high rate of maternal death, infant death, increased life expectancy and increased FDI flows in the nation as proven econometrically. However, existing policies on health stated previously should be tailored down to individual specific goals which will affect the lives of the populace, but this needs commitment on the part of both governmental and private organizations.

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# Appendix

**Table 1: Summary of Descriptive Statistics**

| | MMR | FDI | GFCF | LEXB | IMR | PCI |
|---|---|---|---|---|---|---|
| Mean | 1161.703 | 2.844174 | 13.08438 | 47.68014 | 107.4378 | 112536.7 |
| Median | 1220.000 | 2.534126 | 12.08816 | 46.10193 | 117.8000 | 24005.62 |
| Maximum | 1610.000 | 10.83256 | 35.22126 | 53.40000 | 127.0000 | 539655.4 |
| Minimum | 810.0000 | -1.150856 | 5.458996 | 45.32756 | 66.90000 | 651.0254 |
| Std. Dev. | 256.0406 | 2.326778 | 6.627441 | 2.512020 | 20.74558 | 170848.6 |
| Skewness | -0.039902 | 1.558135 | 1.798439 | 1.059474 | -0.695162 | 1.491870 |
| Kurtosis | 1.681260 | 5.990344 | 6.251408 | 2.602026 | 1.937642 | 3.682213 |
| Jarque-Bera | 2.690894 | 28.75716 | 36.24333 | 7.166162 | 4.719975 | 14.44252 |
| Probability | 0.260423 | 0.000001 | 0.000000 | 0.027790 | 0.094421 | 0.000731 |
| Sum | 42983.00 | 105.2344 | 484.1220 | 1764.165 | 3975.200 | 4163858. |
| Sum Sq. Dev. | 2360044. | 194.9003 | 1581.227 | 227.1688 | 15493.65 | 1.05E+12 |
| Observations | 37 | 37 | 37 | 37 | 37 | 37 |

*Source: Authors computation using Eviews 9.*

**Table 2**

| Variables | ADF Test Statistics | 95% Critical Value of ADF | Order of Integration | Status | PP Test Statistics | 95% Critical Value of ADF | Order of Integration | Status |
|---|---|---|---|---|---|---|---|---|
| MMR | -5.296871 | -2.948404 | I(1) | Stationary | -5.382135 | -2.948404 | I(1) | Stationary |
| FDI | -3.676588 | -2.945842 | I(0) | Stationary | -3.646984 | -2.945842 | I(0) | Stationary |
| GFCF | -3.510487 | -2.954021 | I(1) | Stationary | -5.382135 | -2.948404 | I(1) | Stationary |
| LEXB | -4.140657 | -2.963972 | I(1) | Stationary | -4.467521 | 3.548490 | I(1) | Stationary |
| IMR | -2.916632 | -2.954021 | I(1) | Stationary | -3.838718 | -2.951125 | I(2) | Stationary |
| PCI | -4.802363 | -2.948404 | I(1) | Stationary | -4.909795 | -2.948404 | I(1) | Stationary |

*Author's computation*

**Table 3a&b**

| Hypothesized (Null) number of co-integrating equations (r) | Eigen values | Trace Statistics | 0.05 Critical values | Probability values |
|---|---|---|---|---|
| r = 0* | 0.955266 | 307.0370 | 95.75366 | 0.0000 |
| r ≤ 1 | 0.914160 | 201.3981 | 69.81889 | 0.0000 |
| r ≤ 2 | 0.690017 | 117.9188 | 47.85613 | 0.0000 |
| r ≤ 3 | 0.638362 | 78.09670 | 29.79707 | 0.0000 |
| r ≤ 4 | 0.590681 | 43.51491 | 15.49471 | 0.0000 |
| r ≤ 5 | 0.320630 | 13.14406 | 3.841466 | 0.0003 |
| **Hypothesized (Null) number of co-integrating equations (r)** | **Eigen values** | **Max. Eigen Statistics** | **0.05 Critical values** | **Probability values** |
| r = 0* | 0.955266 | 105.6389 | 40.07757 | 0.0000 |
| r ≤ 1 | 0.914160 | 83.47928 | 33.87687 | 0.0000 |
| r ≤ 2 | 0.690017 | 39.82211 | 27.58434 | 0.0008 |
| r ≤ 3 | 0.638362 | 34.58180 | 21.13162 | 0.0004 |
| r ≤ 4 | 0.590681 | 30.37084 | 14.26460 | 0.0001 |
| r ≤ 5 | 0.320630 | 13.14406 | 3.841466 | 0.0003 |

**Table 4. VECM**

Vector Error Correction Estimates
Date: 1/02/19 Time: 02:03
Sample (adjusted): 1984 2016
Included observations: 33 after adjustments
Standard errors in ( ) & t-statistics in [ ]

| Cointegrating Eq: | CointEq1 |
|---|---|
| | |
| D(MMR(-1)) | 1.000000 |
| | |
| FDI(-1) | 2.628176<br>(1.09424)<br>[ 2.40182] |

| | | | | | | |
|---|---|---|---|---|---|---|
| D(GFCF(-1)) | -44.13797<br>(5.76034)<br>[-7.66239] | | | | | |
| D(LEXB(-1)) | -1074.399<br>(188.087)<br>[ -5.71224] | | | | | |
| D(IMR(-1)) | 157.0455<br>(20.1266)<br>[ 7.80288] | | | | | |
| D(PCI(-1)) | -0.000899<br>(0.00037)<br>[ -0.04196] | | | | | |
| C | 9.374993 | | | | | |
| **Error Correction:** | **D(MMR,2)** | **D(FDI)** | **D(GFCF,2)** | **D(LEXB,2)** | **D(IMR,2)** | **D(PCI,2)** |
| CointEq1 | -0.147748 | 0.002410 | 0.015876 | -5.20E-05 | -0.000780 | -107.5689 |
| | (0.05263) | (0.00658) | (0.00737) | (1.5E-05) | (0.00048) | (61.3265) |
| | [ -2.80730] | [ 0.36600] | [ 2.15301] | [-3.48834] | [-1.61884] | [-1.75404] |
| D(MMR(-1),2) | -1.169246 | 0.008796 | -0.012030 | -1.03E-07 | 0.001080 | 1258.363 |
| | (0.21130) | (0.02644) | (0.02960) | (6.0E-05) | (0.00193) | (246.215) |
| | [-5.53357] | [ 0.33272] | [-0.40637] | [-0.00173] | [ 0.55833] | [ 5.11082] |
| D(MMR(-2),2) | -0.227944 | 0.013767 | -0.016130 | -4.33E-05 | -0.001837 | 315.5259 |
| | (0.23081) | (0.02888) | (0.03234) | (6.5E-05) | (0.00211) | (268.944) |
| | [-0.98760] | [ 0.47678] | [-0.49882] | [-0.66268] | [-0.86955] | [ 1.17320] |
| D(FDI(-1)) | -0.270201 | -0.280682 | 0.005199 | 0.000188 | -0.013513 | 709.4677 |
| | (1.71307) | (0.21432) | (0.24001) | (0.00048) | (0.01568) | (1996.14) |
| | [-0.15773] | [-1.30964] | [ 0.02166] | [ 0.38713] | [-0.86165] | [ 0.35542] |
| D(FDI(-2)) | -0.253730 | -0.101910 | -0.232441 | -0.000274 | 0.002735 | 1801.149 |
| | (1.66215) | (0.20795) | (0.23288) | (0.00047) | (0.01522) | (1936.80) |
| | [-0.15265] | [-0.49008] | [-0.99814] | [-0.58278] | [ 0.17975] | [ 0.92996] |
| D(GFCF(-1),2) | 3.333123 | 0.080073 | 0.237817 | -0.000912 | -0.017136 | -3216.959 |
| | (1.66501) | (0.20831) | (0.23328) | (0.00047) | (0.01524) | (1940.13) |
| | [ 2.00186] | [ 0.38440] | [ 1.01947] | [-1.93442] | [-1.12424] | [-1.65811] |
| D(GFCF(-2),2) | 1.593486 | -0.076132 | -0.190029 | -0.000618 | -0.014093 | -3781.559 |
| | (1.18964) | (0.14883) | (0.16668) | (0.00034) | (0.01089) | (1386.22) |
| | [ 1.33946] | [-0.51153] | [-1.14011] | [-1.83453] | [-1.29401] | [-2.72797] |
| D(LEXB(-1),2) | -791.8653 | 19.76538 | 22.52737 | 1.536498 | -3.620859 | -208852.4 |
| | (372.581) | (46.6129) | (52.2006) | (0.10545) | (3.41081) | (434146.) |
| | [-2.12535] | [ 0.42403] | [ 0.43155] | [ 14.5711] | [-1.06158] | [-0.48107] |
| D(LEXB(-2),2) | 682.7706 | -18.72715 | -14.58664 | -0.741979 | 3.726853 | 202600.0 |
| | (320.717) | (40.1243) | (44.9342) | (0.09077) | (2.93602) | (373712.) |
| | [ 2.12889] | [-0.46673] | [-0.32462] | [-8.17431] | [ 1.26936] | [ 0.54213] |
| D(IMR(-1),2) | -15.94591 | 6.407561 | -5.843305 | 0.001543 | 0.460339 | 11411.20 |
| | (25.5698) | (3.19899) | (3.58246) | (0.00724) | (0.23408) | (29794.9) |
| | [-0.62362] | [ 2.00300] | [-1.63109] | [ 0.21328] | [ 1.96659] | [ 0.38299] |

| | | | | | | |
|---|---|---|---|---|---|---|
| D(IMR(-2),2) | 0.971689 | -7.029193 | -1.652464 | 0.008616 | 0.671584 | 29912.96 |
| | (31.3194) | (3.91831) | (4.38801) | (0.00886) | (0.28671) | (36494.6) |
| | [ 0.03103] | [-1.79394] | [-0.37659] | [ 0.97204] | [ 2.34234] | [ 0.81966] |
| D(PCI(-1),2) | -0.000559 | -1.16E-05 | -3.23E-06 | 7.20E-08 | 9.86E-07 | -0.282308 |
| | (0.00016) | (2.0E-05) | (2.3E-05) | (4.6E-08) | (1.5E-06) | (0.18893) |
| | [-3.44475] | [-0.57062] | [-0.14204] | [ 1.56870] | [ 0.66403] | [-1.49423] |
| D(PCI(-2),2) | -0.000455 | 1.02E-05 | -8.69E-06 | 2.41E-08 | -6.36E-08 | 0.162651 |
| | (0.00014) | (1.8E-05) | (2.0E-05) | (4.0E-08) | (1.3E-06) | (0.16411) |
| | [-3.23006] | [ 0.58162] | [-0.44016] | [ 0.60538] | [-0.04933] | [ 0.99113] |
| C | 4.744943 | -0.060772 | -0.124078 | 0.001465 | -0.014402 | 1260.042 |
| | (3.88646) | (0.48623) | (0.54451) | (0.00110) | (0.03558) | (4528.66) |
| | [ 1.22089] | [-0.12499] | [-0.22787] | [ 1.33218] | [-0.40479] | [ 0.27824] |
| R-squared | 0.716744 | 0.365804 | 0.484406 | 0.987510 | 0.680208 | 0.822629 |
| Adj. R-squared | 0.522937 | -0.068119 | 0.131631 | 0.978965 | 0.461403 | 0.701270 |
| Sum sq. resids | 7564.688 | 118.4028 | 148.4910 | 0.000606 | 0.633964 | 1.03E+10 |
| S.E. equation | 19.95348 | 2.496342 | 2.795588 | 0.005647 | 0.182665 | 23250.57 |
| F-statistic | 3.698239 | 0.843016 | 1.373129 | 115.5592 | 3.108739 | 6.778476 |
| Log likelihood | -136.4982 | -67.90512 | -71.64125 | 133.1115 | 18.38751 | -369.5006 |
| Akaike AIC | 9.121101 | 4.963946 | 5.190378 | -7.218880 | -0.265910 | 23.24246 |
| Schwarz SC | 9.755983 | 5.598828 | 5.825260 | -6.583998 | 0.368972 | 23.87734 |
| Mean dependent | 1.545455 | 0.002059 | 0.203626 | 0.008075 | -0.051515 | 852.2046 |
| S.D. dependent | 28.88889 | 2.415429 | 2.999998 | 0.038937 | 0.248899 | 42539.68 |
| Determinant resid covariance (dof adj.)<br>Determinant resid covariance<br>Log likelihood<br>Akaike information criterion<br>Schwarz criterion | | | 2219046.<br>80835.88<br>-467.4027<br>33.78198<br>37.86337 | | | |

**Table 5. Cusum Cusum Squares**

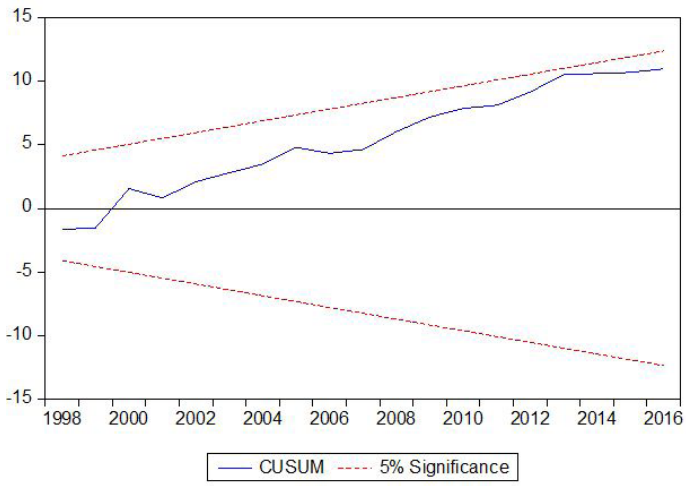

**Table 6 Inverse Roots of AR Characteristic Polynomial**

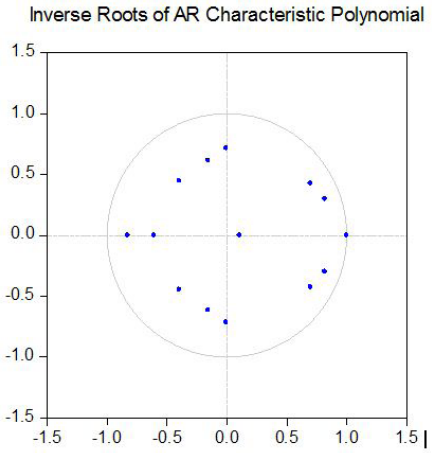


**Table 7. VEC Granger Causality/Block Exogeneity Wald Tests Results**

| **Dependent variable: D(MMR,2)** | | | |
|---|---|---|---|
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(FDI) | 0.035096 | 2 | 0.9826 |
| D(GFCF,2) | 4.701119 | 2 | 0.0953 |
| D(LEXB,2) | 4.664035 | 2 | 0.0971 |
| D(IMR,2) | 0.449224 | 2 | 0.7988 |
| D(PCI,2) | 15.87217 | 2 | 0.0004 |
| All | 20.36084 | 10 | 0.0260 |
| **Dependent variable: D(FDI)** | | | |
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(MMR,2) | 0.232181 | 2 | 0.8904 |
| D(GFCF,2) | 0.554893 | 2 | 0.7577 |
| D(LEXB,2) | 0.219729 | 2 | 0.8960 |
| D(IMR,2) | 5.152525 | 2 | 0.0761 |
| D(PCI,2) | 1.119384 | 2 | 0.5714 |
| All | 6.187542 | 10 | 0.7993 |
| **Dependent variable: D(GFCF,2)** | | | |
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(MMR,2) | 0.269672 | 2 | 0.8739 |
| D(FDI) | 1.176870 | 2 | 0.5552 |
| D(LEXB,2) | 0.243063 | 2 | 0.8856 |
| D(IMR,2) | 3.969162 | 2 | 0.1374 |
| D(PCI,2) | 0.195384 | 2 | 0.9069 |
| All | 6.657872 | 10 | 0.7573 |
| **Dependent variable: D(LEXB,2)** | | | |
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(MMR,2) | 0.658068 | 2 | 0.7196 |
| D(FDI) | 0.764455 | 2 | 0.6823 |

| | | | |
|---|---|---|---|
| D(GFCF,2) | 5.606741 | 2 | 0.0606 |
| D(IMR,2) | 1.393156 | 2 | 0.4983 |
| D(PCI,2) | 2.462139 | 2 | 0.2920 |
| All | 9.223346 | 10 | 0.5110 |
| **Dependent variable: D(IMR,2)** | | | |
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(MMR,2) | 2.449329 | 2 | 0.2939 |
| D(FDI) | 1.034523 | 2 | 0.5962 |
| D(GFCF,2) | 2.325067 | 2 | 0.3127 |
| D(LEXB,2) | 1.761487 | 2 | 0.4145 |
| D(PCI,2) | 0.563320 | 2 | 0.7545 |
| All | 7.763610 | 10 | 0.6519 |
| **Dependent variable: D(PCI,2)** | | | |
| **Excluded** | **Chi-sq** | **Df** | **Prob.** |
| D(MMR,2) | 30.90146 | 2 | 0.0000 |
| D(FDI) | 0.864910 | 2 | 0.6489 |
| D(GFCF,2) | 8.366075 | 2 | 0.0153 |
| D(LEXB,2) | 0.301001 | 2 | 0.8603 |
| D(IMR,2) | 1.291537 | 2 | 0.5243 |
| All | 46.95219 | 10 | 0.0000 |

**Table 8. White Test**

| Test | Statistics | d.f | Prob. |
|---|---|---|---|
| Breusch-Pagan LM | 8775.000 | 325 | 0.0000 |
| Pesaran scaled LM | 330.4165 | | 0.0000 |
| Pesaran CD | 93.67497 | | 0.0000 |

*Source: Author's Computation Using Eviews 9*

## *Authors' Profile*

**John Okafor** is a Doctorate student in the Department of Economics and Statistics, University of Benin, Benin City, Nigeria. He obtained his first and second degree in the same university and has proven to be a scholar in international trade, health economics and econometrics. Currently he is integrating FDI and health as it affects SSA countries for his doctorate program.

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