A Reassessment of the Fertility Rate-Poverty Rate Nexus: Evidence from Nigeria

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DOI: https://dx.doi.org/10.47772/IJRISS.2024.804090

Received: 11 March 2024; Accepted: 04 April 2024; Published: 08 May 2024

ABSTRACT

This research aimed to uncover the connection between two variables specifically within Nigeria. Using data from 1980 to 2016 and a modified Solow model, researchers identified a clear positive relationship between high fertility rates and poverty levels in the country. The study indicates that the causality primarily stems from fertility rates leading to poverty, emphasizing the necessity for interventions to address these challenges. The absence of social safety nets and support programs in Nigeria contributes to larger family sizes, resulting in inadequate healthcare, limited educational opportunities, and restricted economic prospects. These results highlight the critical need to revisit and strengthen the National Population Policy to effectively tackle these issues, emphasizing the essential role of government leadership in driving these much-needed reforms.

The correlation between the main variables was established using the SVAR and innovation accounting method. The findings reveal a significant and strong positive correlation between poverty and fertility rate, with this correlation surpassing that of other variables examined. The study suggests that this may be attributed to the lack of social safety nets and family support programs in Nigeria, leading to the consequences of larger family sizes, including inadequate healthcare, limited access to education, lack of economic opportunities, and restricted social mobility. Based on these empirical findings, an immediate reassessment and revitalization of the National Population Policy (NPP) are warranted, with strong leadership from the Federal Government required from both the Executive and the National Assembly.

Keywords: Fertility Rate, Poverty Rate, Population Growth, SVAR, Solow Growth Model

INTRODUCTION

Scholastics, arrangement creators, devout educators, as well as third division associations have been debating on the causal relationship between ripeness rate and destitution, without any frame of agreement or closure in seeing. The wrangle about has centred around the questions of how the number of children in a family lessens the family's show well-being and future prospects, whether destitution contributes to tall richness, and in case tall ripeness rate may be a indication, instead of a cause of destitution. This talk about, which happens at both the large scale- and the micro-levels, are approximately the linkage and heading of causality.

Despite these talks, a watched slant in a few created nations of Europe, and Central Asia, appears that over time, as incomes rise, richness tends to drop. In other words, there's not much wrangling about the presence of a relationship between progressed living conditions and lower ripeness. Where talk about remains dynamic and at times very disagreeable must do with the course of causality —i.e. "Does decrease ripeness make strides the financial prospects of families and societies?" or "Does the advancement of the financial status of families and social orders lead to diminished fertility?"

In order to determine whether lower ripeness rates—and particularly, open approaches intended to lower richness rates—can result in improved living standards and higher livelihoods, or whether concentrating on

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

improving living standards will undoubtedly result in lower ripeness rates—this paper contextualizes these issues to Nigeria and attempts to address the heading of causality.

The goal of this paper is to determine the kind of interaction (direction of causality) that exists between the ripeness rate and the destitution rate and to experimentally illustrate a specific state of such in Nigeria. Of course, a great deal of research has been done on this topic. The goal is to first ascertain what conclusions policymakers might draw from Nigeria's engagement, and then to ascertain. The reason is to undertake to distinguish what policymakers can conclude from Nigeria's involvement, and after that to distinguish the tall affect approaches that might ensure Nigeria reaps maximum advantage from the rising statistic reward.

Statement of Problem

The enduringly high fertility rate poses a greater risk to reducing poverty in many African nations compared to the impact of HIV/AIDS (UNFPA, 2016).Failure to address this issue could undermine poverty alleviation efforts undertaken by governments, civil society, and aid organizations, potentially endangering the long-term economic growth prospects of these countries. Based on the World Bank Global Development Report 2015/2016, extreme poverty persists at alarming levels, with approximately 700 million individuals - one-tenth of the global population - living on less than $1.90.Sub-Saharan Africa harbors the majority of profoundly impoverished populations, with Nigeria ranking among the countries with the highest number of impoverished individuals.

According to the 2016 poverty report from the National Bureau of Statistics (NBS), around 112 million Nigerians, constitute 67%.A noticeable trend associated with the high poverty rates in Sub-Saharan Africa is the rapid population growth surpassing advancements in economic development (UNFPA, 2014; Pew Research Center, 2015). of the 30 countries projected to have the most rapid population growth between 2015 and 2050, 29 are situated in Sub-Saharan Africa, with 13 of these countries currently exhibiting total fertility rates of 5.

Collectively, these nations are expected to contribute to 20% of the global population growth during the same period, with Nigeria alone accounting for 2% of the total increase. Nigeria boasts one of the highest fertility rates globally, ranking 13th out of 223 countries (CIA World Factbook, 2016), with little indication of decline.

These statistics underscore two critical issues: the country's population, bolstered by the high fertility rate, is expanding faster than the resources available to support them, and a significant number of women and children continue to succumb due to complications during childbirth, with inadequate family planning identified as a major contributor (Akanni et al.2015)

With the observed dearth in studies that deal with the macro-economic effects of high fertility rates in Nigeria, this study develops from previous studies in other jurisdictions, but with evidence from Nigeria. Specifically, this study improves on those work in two key dimensions. First, it will determine the direction of causality between fertility and poverty as a basis for addressing the poverty dilemma facing the country, and then ground estimate of the magnitudes of the impact of poverty on fertility rate (and vice versa) on advanced econometric methodology with an improved theoretical framework (see Weil, (2008) and Coleman and Rowthorn (2011) for base framework developed upon).

LITERATURE REVIEW

This section presents a review of pieces of the literature to put the study in context. The review covers empirical findings.

Empirical Literature

There is a noticeable lack of literature discussing the connection between the fertility rate and poverty in Nigeria. Historically, the absence of access to modern contraceptives led to the belief that managing fertility was costly and perpetuated vicious cycles of high fertility and poverty (Ehrlich and Holdren 1971, Ehrlich and Ehrlich 1990). However, the conviction regarding the role of fertility rate in reducing poverty often surpasses the supporting evidence. Challenges arise due to the complexity of where family planning programs are implemented, primarily influenced by the demand for children, making it difficult to conduct thorough evaluations (Pritchett 1994, Schultz 1994 and 2005). Despite these difficulties, the few existing studies warrant examination.

Cleland, Bernstein, Ezeh, Faundes, Glasier, and Innis (2006) in their sexual and reproductive world survey, discovered that encouraging family planning in nations with high birth rates can potentially prevent 32% of all maternal deaths and almost 10% of child deaths, as well as alleviate poverty and hunger. They continued by saying that it would also make a significant contribution to long-term environmental sustainability, the accomplishment of universal primary education, and the empowerment of women.

Kamphuis (2012) investigated China`s family planning policies and their economic consequences since the 1970s. His research indicates that declining fertility rates initially coincide with increased income per capita but later result in rapid population aging, declining working-age population ratios, and ultimately lead to increased poverty rates in China.

Asogwa and Ugwunta (2013) identified uncontrolled fertility as a significant factor driving population growth in Nigeria and established its correlation with poverty. They concluded that high fertility rates contribute to population growth and negatively impact per capita income, leading to high poverty rates, inadequate housing, poor sanitation, low quality of life, high unemployment, inflation, and excessive strain on resources.

Ashraf, Weil, and Wilde (2013) quantitatively studied the impact of fertility reduction on output per capita, affirming that lowering fertility rates by transitioning to a lower projection can significantly increase output per capita.

Aidi, Emecheta, Chisom, and Ikenna (2016) explored the intertwined relationship between population dynamics and economic growth in Nigeria from 1970 to 2014, revealing an inverse correlation between core demographic variables and economic growth, stressing the need for the Nigerian government to address high fertility rates.

Karra, Canning, and Wilde (2017) used a demographic–economic macrosimulation model to estimate the impact of a decline in fertility on economic growth in Nigeria. They improved on previous modeling approaches by including four previously disregarded channels: the impact of fertility on savings; the relationship between education and fertility; the impact of fertility on health; and the impact of a more realistic three-sector model that takes into account market imperfections, which are common in developing nations. According to their model, a decrease in fertility will have more beneficial consequences and accelerate economic growth. Using the simulation exercise, they deduce that these hitherto disregarded routes could potentially have greater significance than the conventional channels that have been contemplated up to this point. They contended that reduced fertility over time willlower fertility and increase female education, which in turn lowers fertility in the next generation and produces a multiplier effect from any initial change in fertility.

One critical question persists – the direction of causality. While previous studies(see Ademoju, Alemide, Ibekwe, Nweke, Ogunwole, and Waziri, 2000; Caldwell, and Wane, 2002; Adeleye, and Adeleye, 2003; Okediji, 2003; Anyanwu, Ezegbe, Eskey, 2013)focused mainly on microeconomic analyses and family planning methods, few macroeconomic studies have empirically examined the interrelationship between fertility rates and poverty levels in Nigeria. This research seeks to bridge this gap by scrutinizing the dynamics between these variables within a Structural Vector Autoregressive (SVAR) framework, allowing for a comprehensive analysis of their mutual influence. This type of exercise requires a Structural Vector Autoregressive (SVAR) framework, which addresses the identification problem associated with the

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

regression of simultaneous equation models and models all endogenous variables simultaneously rather than one equation at a time (Watson, 1994; Lutkepohl, 2005, 2012).

THEORETICAL FRAMEWORK AND RESEARCH METHODOLOGY

Theoretical Framework

The fertility rate has a direct impact on the rate of growth, which in turn influences both the capacity and consumption needs of an economy. This relationship is elucidated in a modified version of the Solow Model, chosen for its ability to analyze the economic repercussions of a decline in population growth resulting from a decrease in fertility rates. The Solow model, a straightforward framework based on a Cobb-Douglas production function, primarily focuses on the level of income per capita determined by the amount of capital available per worker.

The Solow Model with Population Growth

In addition to capital depreciation and investment in capital stocks, population growth also interacts with the amount of capital per worker in the economy. Positive population growth, all else equal, will lead to a decline in the level of capital available per worker.

Furthermore, this will then lead to reduced production output per worker. The negative relationship between positive population growth and the decline in capital per worker is called capital dilution.

A country with high population growth must invest most of its output in new capital to keep the level of capital per worker constant due to capital dilution. The effects of depreciation, population growth, and investment on capital accumulation are then discussed.

Theoretical Analysis of the Solow Model

This section will make use of a Cobb-Douglas production function with input factors capital (K) and labour (L), and including a parameter for the level of productivity (A):

$$Y = AK^{\alpha}L^{(1-\alpha)} \qquad (1)$$

The parameter α in the production function measures the share of capital in National Income. The analysis starts with rewriting the Cobb-Douglas production function in per-worker terms, dividing the equation (1) by L.

$$y = A\,(K/L)^{\alpha}\,(L/L)^{(1-\alpha)} = Ak^{\alpha} = f(k) \qquad (2)$$

Due to the fact that the labour term in the per-worker production function does not change, output per worker can be written as a function of capital per-worker.

First, the fundamental process of capital accumulation in terms of workers will be the main emphasis, with population increase being ignored. Along with the premise that a constant portion, γ, of output per worker is invested in capital each period, a constant fraction, δ, of the current capital stock per worker is assumed to decay. This results in a function that represents how the capital per worker changes over time under the combined effects of investment and depreciation:

$$\Delta k = \gamma\, f(k) - \delta k \qquad (3)$$

Secondly, this basic function of the accumulation of capital per worker can be extended by adding the negative effect of population growth on capital per worker to equation (3). This capital dilution works in the exact same way as depreciation. Labour force growth is assumed to be equal to the level of population growth and is measured by *n*:

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

$\Delta k = \gamma\ f(k) - \delta k - nk = \gamma\ f(k) - (\delta + n)\ k$ (4)

"Parameter n is influenced by both fertility and mortality rates. In this paper's theoretical analysis, it is assumed that mortality rates remain constant, meaning that parameter n is solely impacted by fertility rates. This assumption is considered valid when evaluating the economic consequences of a decline in population growth during the final two stages of the demographic transition, where mortality rates are deemed stable, as illustrated in Figure 3. The capital stock per-worker rises when investment exceeds the combined negative impact of depreciation and capital dilution. Conversely, the capital stock per-worker decreases when investment falls short of the combined effects of depreciation and population growth.".

A steady-state stock of capital per-worker will be reached if the capital stock does not change, in other words; if equation (4) equals zero. This would imply that the investment in the capital stock has to be equal to the combined negative effect of depreciation and population growth on the capital stock per-worker:

$\gamma\ f(k) = (\delta + n)\ k$ (5)

Rewriting equation (5) leads to the steady-state stock of capital per-worker, $k^{steady\text{-}state}$:

$k^{steady\text{-}state} = [\gamma A / (\delta + n)]^{(1/1-\alpha)}$ (6)

Substituting this steady-state stock of capital per worker into equation (2) will yield the steady-state level of output per worker, $y^{steady\text{-}state}$:

$y^{steady\text{-}state} = A(k^{steady\text{-}state})^{\alpha} = A^{(1/1-\alpha)}\ (\delta + n)]^{(1/1-\alpha)}$ (7)

Thirdly, the impact of population growth on income per worker in a country within the Solow model will be discussed. Population growth affects the steady-state level of income per capita negatively (see equation (7)). A lower population growth rate, measured by n, causes the $(\delta + n)$ term to decline and therefore causes the income per-worker in the steady-state, $y^{steady\text{-}state}$, to increase. The drop in the population growth rates, resulting from the drop in fertility rates, in Nigeria should have had a positive effect on income per capita because of less capital dilution. The impact of population growth on the steady-state income per capita level in the Solow model can also be seen in figure 1.

Determining the steady-state levels of capital and output per-worker can also be done in a figure. In Figure 1, the steady-state capital stock per-worker is found at the point where the investment curve and the line representing depreciation and population growth intersect:

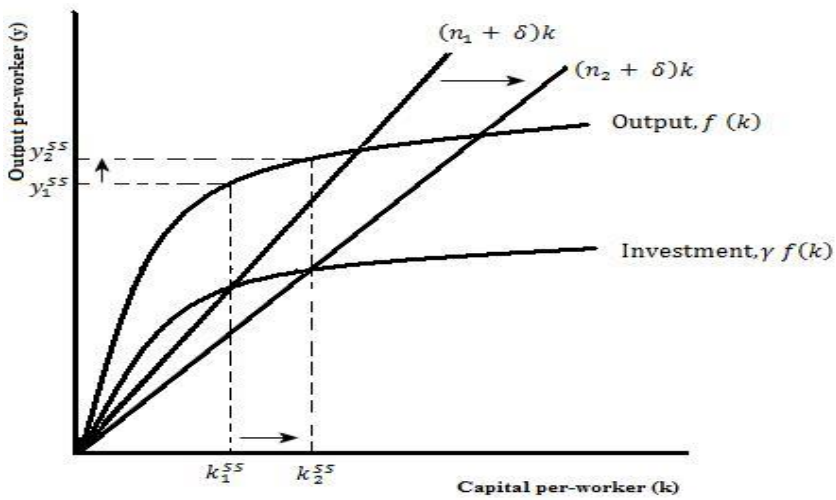

Figure 3: The Solow Model Incorporating a Decline in Population Growth

Source: Author's based on the Solow model

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

Figure 1 shows that the line representing the depreciation and capital dilution effect rotates outward if the level of *n* drops from, where . This causes the steady-state level of output per-worker to increase as a result of a higher steady-state capital stock per-worker.

With the use of Solow model's theoretical framework, it can be argued therefore that reductions in fertility rates, while assuming mortality rates to be constant, will cause the capital stock per worker to increase and hence lead to higher levels of income per capita

Research Methodology

Applying the Solovian framework to analyze the relationship between fertility rates and poverty in Nigeria, this research employs the structural vector autoregression (SVAR) method to investigate the impact of birth rates on poverty within the model. It also examines impulse response functions (IRF) and forecast error variance (FEVD) decomposition as discussed by Adebiyi (2009) and Adrangi& Allender (1998). SVAR, a more refined version of VAR, has gained popularity as a useful tool for assessing economic models, particularly in macroeconomic literature according to Sarte (1997). This method extends the conventional VAR analysis by identifying independent disturbances through constraints based on economic theory rather than the traditional VAR's theoretical constraints as proposed by McCoy (1997). The key advantage of this technique lies in its capacity to capture responses, transmit shocks, and understand the economic impact among interconnected variables within a given economy or research context as indicated by Udoh (2009).

We consider the interaction offertility ratethrough population change and poverty (or vice versa)in Nigeria.So, we are looking at three (3) endogenous economic time series and *p* lags . The endogenous linearequations can be explicitly specified as follows:

$$A_0 y_t = A_1 y_{t-1} + \dots + A_k y_{t-k} + CD_t + Be_t$$

where $y_t = (y_{1t}, y_{2t}, \dots y_{nt})$ is an nx1 vector of non-policy and policy variables and A_i and C are parameter matrices of order n x n. Dt contains all deterministic variables which may consist of a constant, a linear trend, seasonal dummy variables as well as other specified dummy variables. Moreover, et, which is an nx1 vector of structural shock or innovations in policy and non-policy variables, is assumed to be a white noise process with $(0,1_n)$.

Drawing on the theoretical and empirical literature of Solow and Ashraf, Weil, and Wilde, (2013) respectively, the model for this study is represented by a two-component vector (y_t) of endogenous variables defined as

$$y_t = (fr, pov,) \qquad (2)$$

Where fr is the variable that measure fertility rate and pov is the variable that measures poverty,

In Equation (2) above, all variables are in logarithmic form. Moreover, to achieve identification of the SVAR, this study draws from the theoretical and empirical literature as well as the 'trickle down model' adopted from Jalilian and Weiss (2004).

Given that matrix B is diagonal and of order 3 x 3, matrix A now has the following non-recursive structure:

Matrix B

$$\begin{bmatrix} fit_t & pgr_t pov_t \\ 1 \quad 0* & \\ *1 \quad * & \\ ** \quad 1 & \end{bmatrix}$$

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The non-recursive identification scheme described above is defined simply a constraint indicated by zero (0) an asterisk (*), which represents parameters estimated freely. Implementing this scheme is logical because the impulse response function it produces is not influenced by the variable order in the SVAR system.

In the first instance, we have the birth rate equation, which is solely determined by the poverty level, aligning with the principles of the "demographic dividend theory." This theory suggests that the birth rate adapts in response to fluctuations in the economic growth rate, influenced by changes in poverty.

Furthermore, the subsequent line highlights that the rate of population growth in an economy is contingent on both fertility rates and poverty levels, while the third line underscores that poverty is influenced by both the birth rate and population growth.

To analyze the model represented by Equation (2) above, a Structural Vector Autoregressive (SVAR) framework which models all endogenous variables jointly rather than one equation at a time and also deals with the issue of identification common with regression of simultaneous equation models will be utilized (see Watson, 1994; Lutkepohl, 2005, 2011).

Given a VAR(p) model of Y_t is;

$$Y_t = A_1 Y_{t-1} + A_p Y_{t-p} + \eta_t \text{ or } A(L)Y_t = \eta_t \quad (1)$$

Where $A(L) = I - A_1L - \dots - A_PL^P$ and L is the lag operator, and where the disturbance η_t is a martingale difference sequence with covariance matrix Σ_η, so that η_t is serially uncorrelated.

In practice, Y_t will generally have a non zero mean and the VAR in (1) would include an intercept. the assumption of zero mean and no intercept in the var is made without loss of generality to simplify notation.

The VAR (1) is the *reduced-form* VAR. The i^{th}equation in (1) is the population regression of Y_{it} onto lagged values of Y_t..Because (1) is the population regression of Y_t. onto its lags, its parameters $A(L)$ *and* Σ_η are identified.

The innovation in Y_{it} is the one-step ahead forecast error, η_{it}, in the i^{th}equation in (1). The vector moving average representation of Y_t, which in general will be infinite order, expresses $Y_t$in terms of current and past values of the innovations:

$$Y_t = C(L)\eta_t, \text{ where } C(L) = I + C_1L + C_2L^2 + \dots = A(L)^{-1} \quad (2)$$

The SVAR model represents $Y_t$not in terms of its innovations η_t, but rather in terms of underlying structural shocks e_t, where these structural shocks represent unexpected exogenous disturbances to structural economic relationships.

The SVAR assumes that the innovations are a linear combination of the unobserved structural shocks:

$$\eta_t = He_t \quad (3)$$

The structural shocks are assumed to be uncorrelated.

Substituting (3) into (2) and (1) delivers the structural VAR and the Structural Moving Average

$$A(L) = He_t \text{ or } B(L)Y_t = e_t, \text{ where } B(L) = H^1A(L) \quad \text{(Structural VAR)} \quad (4)$$

$$Y_t = D(L)e_t, \text{ where } D(L) = C(L)H, \quad \text{(Structural MA)} \quad (5)$$

The second expression in (4) holds if H^1 exist.

The structural forecast error variance decomposition (SFEVD) and structural impulse response functions (SIRFs) are two of the SVAR analytical methods that will be used in this investigation. Assuming that the errors are equal to zero, the SIRFs plot the reaction of each variable's present and future values to a one-unit rise in the current value of one of the SVAR errors (Gottschalk, 2001). Conversely, the SFEVD represents the amount of variance in the forecasting error caused by a particular shock at a certain time horizon (Kilian, 2011).

The structural MA in (5) summarizes the dynamic causal effect of the shocks on current and future Y_t, and it directly delivers two key objects in the SVAR analysis: the SIRF and the decomposition of $Y_t$into structural shocks. With the assumption of uncorrelation in the structural shocks, the structural MA representation also delivers the structural forecast error variance decomposition.

The fertility rate passed through to poverty will also be computed. It will be calculated from the impulse response function results. The pass through can be defined as the accumulated effect of a structural one standard deviation to the nominal effective fertility rate in period *t* on the poverty rate in period *t.* Note that the accumulated response measures the effects of fertility rate changes on the poverty rate. The dynamic pass-through elasticity (φ) of poverty at time *t is given by:*

$$FRTPT^{\varphi} = \frac{\%\Delta POV}{\%\Delta FRT}$$

The numerator is the percentage change in the level of the poverty rate between period zero, when the initial fertility rate shock strikes, and at time *t. The denominator is the* percentage change in the nominal effective fertility rate at time 0.

Data Description and Source

The variables to be utilize in this study are shown in the table below

Table 1: Abbreviations and Corresponding Economic Variables

S/N	Variable Name	Abbreviation
1	Population Growth rate	PGR
2	Poverty Rate	POV
4	Fertility Rate	FRT

To achieve the objective of the study, quarterly data for the period 1980:1 – 2016:4 were employed. This period comprises the period of economic regulation (1980–85) and the period of economic deregulation (1986–2016) in Nigeria. The two main justifications for the use of quarterly data are, first, that the estimation using the SVAR technique requires a large database; and second, that there is a desire to minimize any problems with temporal aggregation (Christiano and Eichenbaum 1987).

In the absence of quarterly GDP data for the variables in Nigeria, Gandolfo’s (1981) algorithm for the interpolation of annual GDP series into quarterly series will be used. This interpolation technique is justified because it is quite robust and is based on order statistical theory which is not confined to any variable type, whether stock or flow.

In the study, data are obtained from the Central Bank of Nigeria’s Statistical Bulletin (various years), the National Bureau of Statistics (various years) and the World Bank data bank.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

ANALYSIS OF ESTIMATION RESULTS AND FINDINGS

4.1 Unit Root

Empirical findings have shown that most economic time series are strongly trended and hence non-stationary (Iyoha M.A. 2004). The Unit Root Test is conducted to verify the stationarity or otherwise of the selected macroeconomic variables. The result of the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) used in the study are shown in table 4.1 below:

Table 2: Unit Root test

	LEVELS		FIRST DIFFERENCE	
Variables	ADF	PP	ADF	PP
FRT	-0.131	1.090	-2.879**	-2.735**
POV	-1.522	-1.517	-5.834*	-5.834*
PGR	-3.386**	-4.114*	-1.641	-2.986**

Note: *, **, and * represents significance at 1%, 5% and 10% respectively**

Source: Authors Computation from Eviews 7

Prior to the examination of the nexus between fertility rate and poverty, the times series properties of the variables are first investigated using ADF and PP tests. The ADF test was based on Akaike Information Criterion (AIC). The ADF and the PP results revealed that fertility rate and poverty rate are I(1) variables. While the population growth rate is shown to be I(0) variable by the ADF and supported byPP.

Co-integration Test and Error Correction Model

The results of the unit root tests calls for stability test for the model at the appropriate lag length. Thus before cointegration estimation, the optimal lag length of 6 was chosen using the Akaike Information Criterion (AIC), Final Prediction Error (FPE), and Hannan-Quinn information Criteria (HQ). Since all these criteria have unanimously agreed on a VAR order of 6, a lag length of 6 was selected as the VAR order. The residual of the VAR is also tested for autocorrelation at this lag length and found to be free of serial correlation. Hence, the lag length of 6 is chosen as the optimum lag; this equally confirmed what is usually expected of annual data. The summary of optimum lag selection is shown in the table below.

Selection of Optimal Lag Length of the Model

Table 3: VAR Lag Length Selection Criteria-LHCPI

Lag	LogL	LR	FPE	AIC	SC	HQ
0	152.2726	NA	1.32e-08	-9.630491	-9.491718	-9.585254
1	316.9185	286.8026	5.77e-13	-19.67216	-19.11707	-19.49122
2	356.8960	61.90065	7.97e-14	-21.67071	-20.69930	-21.35406
3	407.6703	68.79093	5.65e-15	-24.36583	-22.97810*	-23.91346
4	416.0149	9.690477	6.47e-15	-24.32354	-22.51949	-23.73546
5	437.2444	20.54469*	3.46e-15	-25.11254	-22.89217	-24.38876
6	450.7240	10.43586	**3.41e-15***	**-25.40155***	-22.76486	**-24.54206***

Source: Authors Computation from Eviews 7

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

Going further with the cointegration, since all the variables are either integrated of order 0 or 1 and none of the variable is I(2) in the model, therefore, ARDL approach to co integration is the most appropriate technique of estimation (Pesaran, Shin, and Smith, 1996).

Estimating the ARDL model, the computed F statistic with lag of order 6 is given in Table 4. The value of F statistics lies below the upper bound value of F statistics. Therefore, null hypothesis of no long run relationship cannot be rejected and we conclude that there is no long run relationship among variables. Thus, for the rest of the analysis the VAR model is carried out in first differences and no error-correction terms are included (Sims, 1990).

Table 4: ARDL Bounds Test

Test Statistic	Critical Value	
F-statistics	3.52560	
Critical Value Bounds		
Significance	I0 Bounds	I1 Bounds
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.35

Source: Authors Computation from Eviews 7

SVAR Estimation Result

The model consists of three variables. Prior to the estimation of the Structural VAR, the time series data was transformed to a stationary series via differencing. As stated above in the absence of cointegration among the variables, SVAR was estimated in first differences. That is; *ΔFRT, ΔPOV and ΔPGR,* denote the first differences of the Fertility Rate, Population Growth Rate, and Poverty Rate. The lag length was selected using same criteria as used above. Since these criteria suggested 6 as the order of the unrestricted VAR model in first difference, a lag

To find out more about the type of residual errors, diagnostic tests are run. At delays between 1 and 3, the hypothesis of no serial autocorrelation could not be rejected by the Lagrange multiplier (LM) or the Breusch-Godfrey test with a high p-value larger than 5 percent (see Table 7). In a similar vein, the calculated Jarque-Bera normalcy test is shown in Table 8. Because there is extra kurtosis in the residuals, this test contradicts the null hypothesis of normalcy. Upon eye inspection, several outliers may be seen in the residuals. Relevantly, it should be noted that Monte Carlo tests for serial autocorrelation should remain very accurate even if the normality assumption is disregarded (Lutkepohl, 1991, and Mackinnon, 2005).

For the SVAR model, the likelihood ratio test (LR-test) is calculated. The likelihood ratio test (LR-test) is computed for the SVAR model. That is whether the covariance matrix of the residual for SVAR model is diagonal. They were found to be non-zero. The relevance of this test is, if the covariance of the matrix residuals is zero there is no point using contemporaneous restrictions to identify the SVAR system (Sanusi, 2010).

The LR statistic is found to be greater than the critical value, so we reject the null hypothesis that the restriction is not valid. Therefore, we can accept the imposed identification restrictions within matrix B. Similarly, this suggests that shocks in the entire equations have contemporaneous correlation in the system - hence this gives justification for structural VAR to take into consideration the contemporaneous correlation among the variables. Without the SVAR, this contemporaneous correlation among the variables would have been neglected by the unrestricted VAR model.

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Table 7: VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	32.47028	0.0002
2	34.09806	0.0001
3	27.98274	0.0010
4	5.708102	0.7687
5	13.23662	0.1522
6	7.821806	0.5522

Source: Authors Computation from Eviews 7

Table 8: VAR Residual Normality Tests of the individual equations

Variables	**FRT**	**PGR**	**POV**
Normality JB	2.260607	957.9898	105.8900
Prob	0.3229	0.0000	0.0000
Skewness	0.090306	1.930701	0.928774
Prob	0.6649	0.0000	0.0000
Kurtosis	3.600440	15.31651	6.868485
Prob	0.1499	0.0000	0.0000

Source: Authors Computation from Eviews 7

The estimated system of the shocks from the SVAR can be seen from equation 6 to 8 given below. The coefficients of the structural shocks (impulse response coefficients) ε^{FRT}, ε^{POV} , and ε^{PGR}, represent the given standard deviations of the variables in the system. The p-values are given in parenthesis below the co-efficient estimates. It can be seen that all the coefficients except the coefficient of fertility rate in the first equation confirm to apriori expectations. Of relevance to note, the contemporaneous relationship among our variables holds implicitly in the system.

$\varepsilon^{frt} = 0.8344\varepsilon^{POV}$ ………………………………………………..(6)

(0.8344)

$\varepsilon^{PGR} = 3.4295\varepsilon^{FRT} + 0.5452\varepsilon^{POV}$ …………………………….(7)

(0.0000) (0.5860)

$\varepsilon^{POV} = 5.338\varepsilon^{FRT} + 2.789\varepsilon^{PGR}$

(0.0000) (0.0000)

From the equation above, it is seen that fertility rate and poverty rate have a positive impact on each other. What is also clear, is that while the impact of poverty rate on fertility rate is not significant, the impact of fertility rate on poverty rate was highly significant. This will be examined further using innovation accounting.

Impulse Response (IR) Analysis

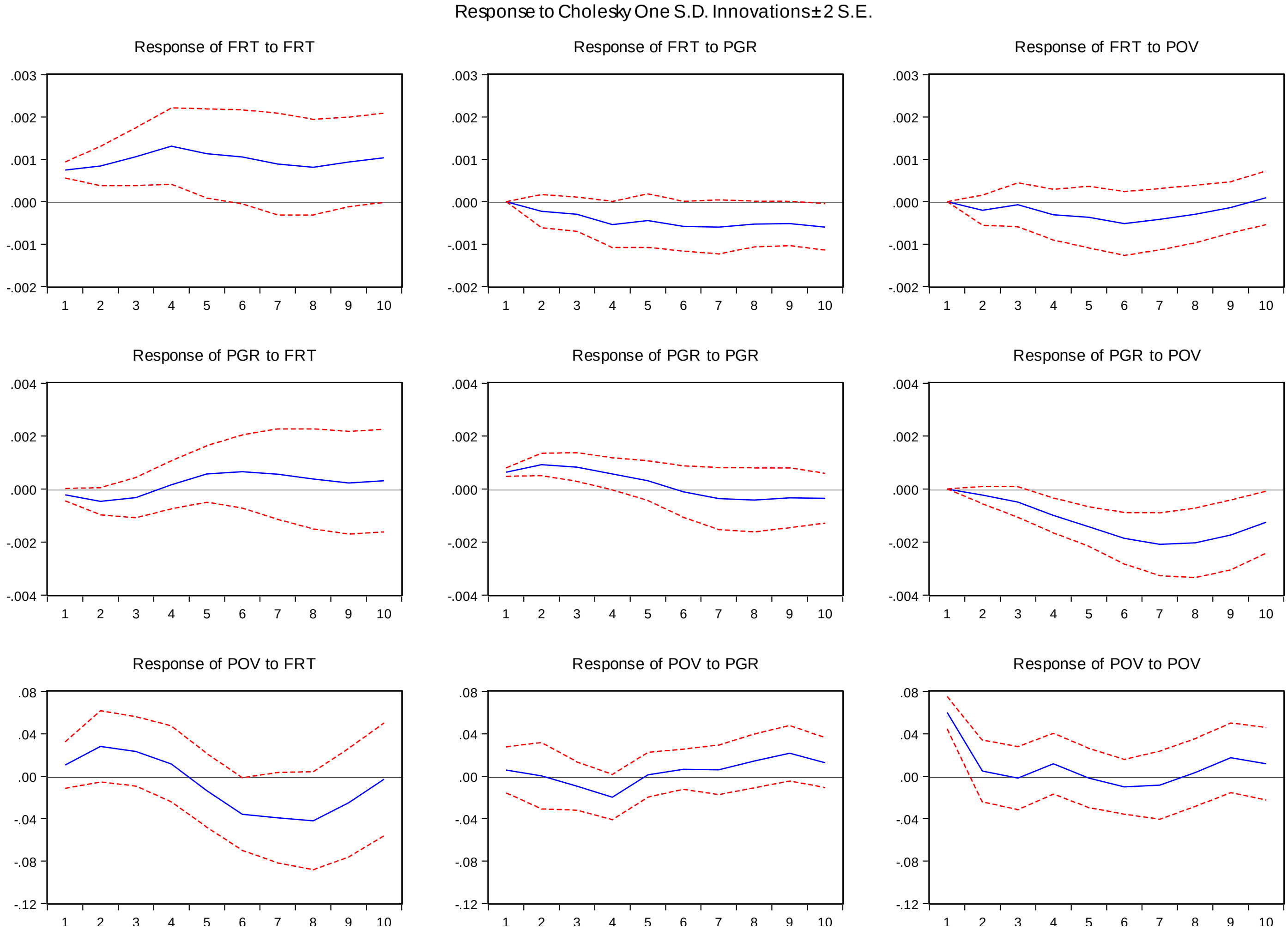
The results show that in case of a one-time shock of a positive one standard deviation innovation in

FRT, the effect on *FRT* will positive throughout the observed 10 periods, while the effect will be negative for population growth rateup to period 10. On poverty rate, the effect will be positive up till period 10, but then becomes positive thereafter.

A one-time shock of a positive one standard deviation innovation in *PGR* will cause poverty to decline and remain negative all through the 10 periods.

A one-time shock of a positive one standard deviation innovation in poverty will leave set fertility rate in decline, hitting negative in period 4 and remaining negative even at 10 periods.

Figure 3: Impulse response function



Source: Authors Computation from Eviews 7

Variance decomposition (VD) Analysis

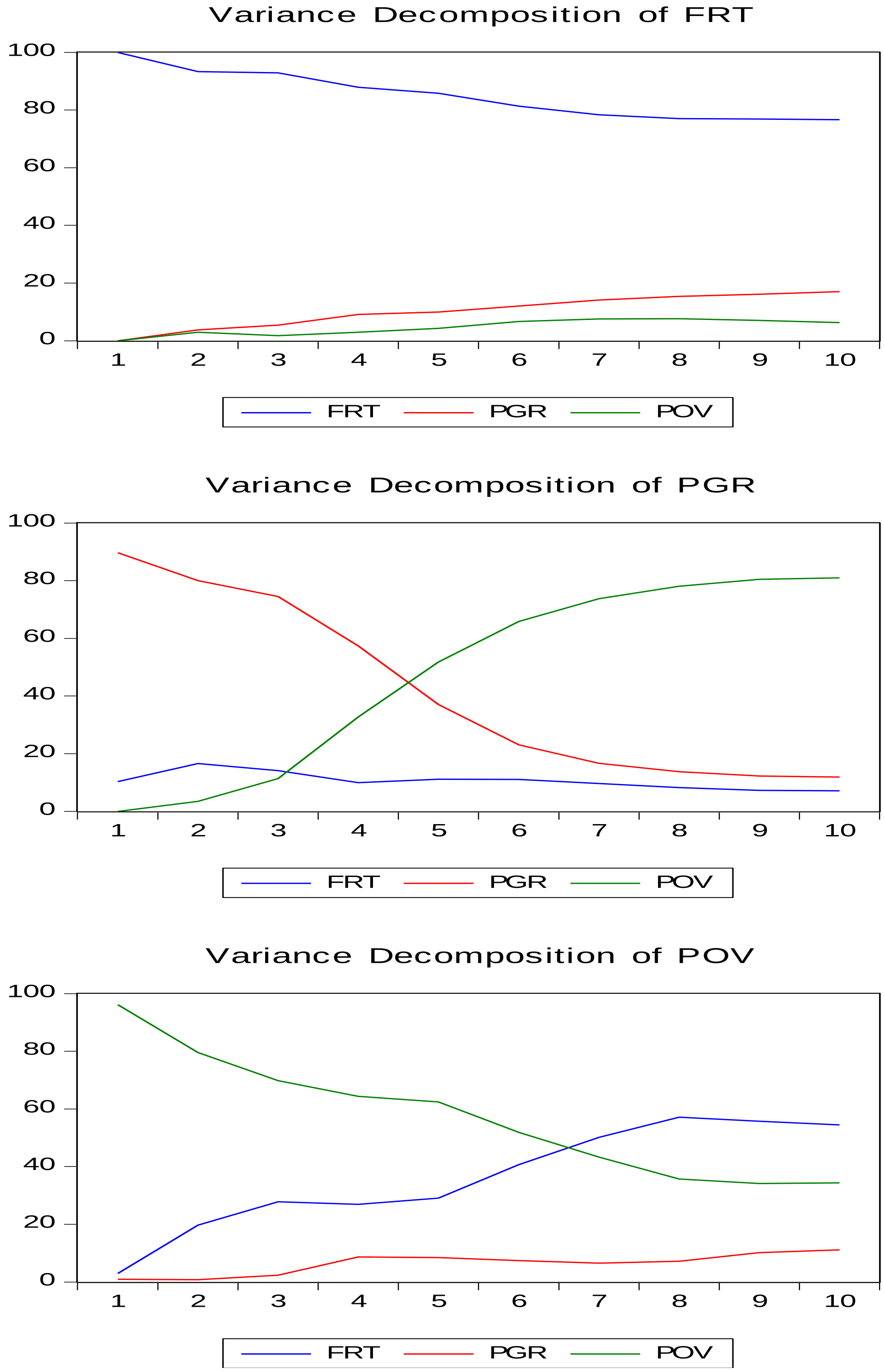
From the figure, variance decomposition of fertility rate indicates that short run dynamics in fertility rate are explained mostly by its own fluctuations, followed by Population Growth Rate, and then rate and Poverty rate. The weight of its own shock ranges from 100% in period one to 76% in period 10. And this percentage decreases as the forecast horizon increases. The percentage explained by both Population Growth Rate and poverty rate are quiet low, ranging from zero contribution from both in period one, to 17% in period 10 for Population Growth Rate and 6% forpoverty rate after 10 periods.

The variance decomposition of poverty rate shows that short run dynamics in poverty rate are explained mostly by its own fluctuations up to the sixth period (between 51% and 96%), then fertility rate

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

explains a significantly higher proportion of between 50 and 57%.

Figure 4: Variance Decomposition Analysis



Source: Authors Computation from Eviews 7

Fertility Rate Pass Through

Table 5 Shows the pass-through effect of changes in fertility rate to Poverty Rate. The result shows that elasticity of poverty in response to a change in fertility was greater than 1 (one) within the 10 period, showing higher degree of elasticity. It is clear, that a change in fertility rate leads to a more than proportionate change in poverty rate.

Table 5: Fertility Rate Pass Through effect

Time	elasticity (φ) of Pov
3	2.51
4	14.22
5	1.46
6	6.08
7	1.19
8	3.51
9	3.52
10	16.03

Source: Authors Computation from Eviews 7

The Granger Causality Result

The Granger causality test shows the interrelationship among variables. According to the Granger causality test result presented in table 4.7 below, it is seen fertility rate granger causes both GDP Growth rate and Poverty rate, and fertility rate is granger caused by both poverty and GDPGR. The summary of the Granger Causality Result is shown in the table below. The estimation result, as well as the decision(at the 10* level) is shown in table 6 below.

Table 6: Granger Causality result

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision
PGR does not Granger Cause FRT	31	1.72920	0.1715	Accept
FRT does not Granger Cause PGR		2.61445	0.0531	Reject
POV does not Granger Cause FRT	31	1.61425	0.2004	Accept
FRT does not Granger Cause POV		3.60460	0.0159	Reject
POV does not Granger Cause PGR	31	2.61588	0.0530	Reject
PGR does not Granger Cause POV		0.82943	0.5624	Accept

Source: Authors Computation from Eviews 7

The result above shows that while fertility rate granger causes poverty rate, the opposite does not hold. Same relationship also holds true for fertility rate and population growth. While fertility rate granger causes population growth rate, the opposite does not hold.

SUMMARY OF FINDINGS AND CONCLUSIONS

The findings of this study indicate a strong correlation between birth rates and poverty rates, with birth rates having a more significant impact on poverty rates than vice versa

The SVAR result shows that there is significant and positive impact of fertility rate on poverty, the result however shows an insignificant but positive impact of poverty on fertility rate. Also, the variance decomposition of poverty rate shows that short run dynamics in poverty rate are significantly explained in most part by fertility rate, accounting between 50% and 57%.Again, the pass-through effect showed that poverty rate was highly elastic to changes in the fertility rate.

The Granger Causality result shows bi-direction causality from fertility rate to poverty.

Particularly in Nigeria, where there is a lack of social safety nets or family support systems, larger families often experience lower standards of living due to the financial burden of education and skills development.(Knodel, Havanon, and Sittitrai, 1990). Conversely, smaller families are more inclined to save and are less susceptible to income fluctuations. Furthermore, the presence of multiple children in large families can lead to competition for resources, resulting in each child receiving a smaller share of the family's income, time, nutrition, and attention.

RECOMMENDATIONS

Based on the empirical findings, this study extends the following recommendations aimed at repositioning Nigeria for a new growth and pro-poor development trajectory that adequately caters for the fertility rate of the country.

i. Donors and governments (Federal and State) should explicitly state the urgency of voluntary family planning as a poverty reduction intervention, and persuasively explain its long-term benefits.
ii. There is the need to immediately review and revive the National Population Policy (NPP) (with one of its main objective of reducing fertility rate), with strong leadership from the Executive and the National Assembly.
iii. There is also the need to develop an action plan for the NPP. Key elements of the action plan should include (a) the targeted groups; (b) specific services, goods, or other benefits provided; (c) providers of assistance; (d) geographic coverage; (e) collaboration with public and private agencies, community organizations, and local leaders; and (f) the budget
iv. Various stakeholders should accelerate ongoing efforts to improve maternal and child health, and ensure all needs for family planning are met.
v. There is the need for governments at all level to accelerate access to and the quality of basic, secondary and post-secondary education for girls and boys.
vi. There is also the need to enact culturally-appropriate affirmative action policies and laws to encourage women’s participation in the workforce and in business opportunities, particularly inthe northern parts of the country.
vii. Each state should review its own population policy and implementation approaches, deriving guidance from the reviewed national policy.
viii. Finally, it is observed that the poor are an underutilized resource in policy formulation and implementation. National decision-makers and government officials should make concerted effort to understand the situation of the poor and other marginalized groups in order to meet their needs more effectively; Involve the poor and organizations that represent their interests in setting program priorities and directions; and insist that program planners and implementers involve beneficiaries in all stages of program planning and implementation.

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