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Research Paper

Health Outcomes and Economic Productivity in Nigeria: Short Run Evidence from OLS–HAC Estimation

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Abstract: This study investigates the short run relationship between key health outcomes and economic productivity in Nigeria using annual data from the World Development Indicators. Employing Ordinary Least Squares estimation with Newey West heteroskedasticity and autocorrelation consistent standard errors, alongside pairwise Granger causality tests, the study evaluates how life expectancy at birth, under five mortality, fertility rate, and current health expenditure influence labor force participation the proxy for economic productivity. The findings demonstrate that life expectancy has a statistically significant and strongly beneficial impact on labor participation, affirming the role of health as human capital. Under five mortalities also emerges positive and significant, suggesting that in the short run, child mortality related economic shocks may induce increased household labor supply. Fertility rate displays a negative and significant impact on labor participation, consistent with demographic and labor supply theory. Granger causality results reveal unidirectional causality from labor participation to both life expectancy and child mortality, indicating that higher economic engagement may enhance health outcomes while simultaneously exerting pressure on child survival. Collectively, the findings support a bidirectional health productivity nexus in Nigeria, where improved health enhances productivity in the short run, while higher productivity contributes to better health outcomes over time. The study recommends strengthening investments in life extending health services and child survival interventions to foster a healthier, more productive workforce and reduce vulnerability to mortality induced labor shocks.

Keywords: Labor force participation, Human capital, Life expectancy at birth, Under-five mortality, Fertility rate, Granger causality..

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1 | INTRODUCTION

The relationship between health outcomes and economic productivity has emerged as a critical area of research in development economics, particularly for developing nations like Nigeria. Health, as a component of human capital, directly influences economic performance through its impact on labor productivity, industrial output, and overall economic growth. In Nigeria, this relationship has garnered significant scholarly attention, with multiple studies confirm that better health status measured by indicators like life expectancy, reduced mortality, and lower disease burden positively impacts economic growth in Nigeria. Improved health enhances labor productivity and supports long term economic development, especially in labor intensive sectors (Kelani et al., 2019; Omeonu et al., 2022; Onisanwa, 2014; Ibikunle, 2019; Ogunjimi & Adebayo 2019). Recent empirical evidence from Nigeria demonstrates the substantial impact of health outcomes on economic productivity. Ugbaka and Ihuoma (2024) established that mortality rate, morbidity rate, infant mortality, literacy rate, and life expectancy significantly affect industrial productivity in both short run and long run periods. Similarly, Usman et al., (2015) confirmed a long run relationship between health outcomes and economic growth, finding that life expectancy and crude death rate have statistically significant negative impacts on economic growth over the period 1961 2012. The evidence further reveals that specific health indicators demonstrate varying relationships with productivity measures. Joshua et al., (2023) found that maternal mortality rate and HIV/AIDS prevalence rate negatively impact productivity in the long run, while life expectancy positively affects economic performance. Ibikunle (2019) corroborated these findings, showing that life expectancy impacts positively and significantly on GDP, with causality running from GDP to life expectancy.

Despite the growing body of research on health productivity relationships in Nigeria, several critical problems persist in the current understanding of this nexus. Existing studies present inconsistent findings regarding the direction and magnitude of causality between health outcomes and economic productivity. While Usman et al., (2015) found unidirectional causality running from health indicators to economic growth, Ibikunle et al., (2019) identified bidirectional relationships between some health variables and economic indicators, creating ambiguity in policy formulation. Ugbaka and Ihuoma (2024) noted contradictory results between short run and long run relationships, where economic growth and labor productivity showed abysmal long run impacts despite significant short run relationships. Agbai et al., (2023) identified unexplained negative relationships between public health expenditure and productivity, recommending further investigation into these counterintuitive findings. The existing literature lacks a comprehensive analysis that simultaneously examines the three critical health outcomes mentioned in demographic transition theory (life expectancy, child mortality and fertility rate) in relation to economic productivity. While individual studies have examined specific health indicators, Eze et al., (2025) and Eboh et al., (2022) there remains a gap in understanding how these interconnected health outcomes collectively influence Nigeria's economic productivity. Therefore, this study analyses the short run dynamics of health outcomes and economic growth proxied by life expectancy, child mortality, fertility rate labor force participation.

2 | LITERATURE REVIEW

The relationship between health outcomes and economic productivity is grounded in human capital theory, which posits that health constitutes a fundamental component of human capital that directly influences economic performance. Agbai et al., (2023) explicitly acknowledge this theoretical foundation, noting that "health as a human capital affects productivity directly through its impact on labor productivity." This conceptual framework has guided numerous empirical investigations in the Nigerian context, with researchers examining how various health indicators influence different measures of economic performance including life expectancy and child mortality (Elhag et al., 2026; Akram et al., 2025). Life expectancy emerges as a consistently significant predictor of economic performance across multiple studies. Joshua et al., (2023) found that life expectancy rate has a positive significant effect on productivity in the long run. Ibikunle et al., (2019) reinforced this finding, showing that life expectancy impacts positively and significantly on GDP for the period 1995 2017. However, Iseghohi (2021) presented contrasting evidence, finding that life expectancy rate at birth had no significant effect on output per worker during 2000Q1 to 2018Q4, highlighting potential temporal or methodological variations in findings. Child and maternal mortality consistently demonstrate negative relationships with economic productivity. Joshua et al., (2023) found that maternal mortality rate has a negative significant impact on productivity in the long run, though the effect was insignificant in the short run. Adewumi et al., (2019) examined multiple mortality indicators, finding that government health expenditure per capita showed positive relationships with neonatal mortality rate, child mortality rate, and infant mortality rate, suggesting inefficiencies in public health spending. Eboh et al., (2022) provided nuanced findings on child mortality's economic impact, showing that while government health expenditure had a negative and insignificant impact on under five child mortality, child mortality itself had a positive and significant

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impact on economic growth, presenting a counterintuitive relationship that requires further investigation.

3 | METHODOLOGY

This study employs both static and dynamic econometric techniques on a time series econometric approach to examine the relationship between health outcomes and economic productivity in Nigeria. Labor Force Participation (LFP) is used as a proxy for economic productivity, in line with labor economics literature, while health outcomes are captured through life expectancy at birth (LEB), under five mortality rate (MRU5), current health expenditure (CHE), and fertility rate (FER). GDP per capita (GDP_PP) is included as a control variable to account for income level effects on labor market behavior. Annual secondary data covering 23 observations was obtained from the World Development Indicators (WDI). Given the relatively small sample size and the potential for autocorrelation and heteroskedasticity in macroeconomic time series, the study employs Ordinary Least Squares (OLS) estimation with Newey–West Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors. This approach produces robust parameter estimates even when classical regression assumptions are violated, making it suitable for short annual datasets. In addition, pairwise Granger causality tests are conducted, using both approaches provides a comprehensive assessment of both the magnitude of relationships and the direction of causality. The baseline model is expressed as an estimable econometric model as follows:

$$LFP_t = \beta_0 + \beta_1 LEB_t + \beta_2 MRU5_t + \beta_3 LEB_t + \beta_4 CHE_t + \beta_5 FER_t + \beta_6 GDP\_PP_t + \mu_t \ldots\ldots \quad (1)$$

Where; LEB_t, $MRU5_t$, LEB_t, CHE_t, FER_t and GDP_PP_t stands for Labor Force Participation rate (proxy for economic productivity), Life Expectancy at Birth, Under Five Mortality Rate, Current Health Expenditure (% of GDP), Fertility Rate and GDP per Capita respectively. β_0 for constant, $\beta_1 - \beta_5$ as parameters to be estimated and μ_t capturing the disturbance (error term).

4 | RESULTS AND DISCUSSION

4.1 | graphical representation of variables

Figure 1 below depicts the patterns which gave important clues about the expected signs, strength of relationships, and causality direction, many of which were confirmed in the regression and Granger causality tests.

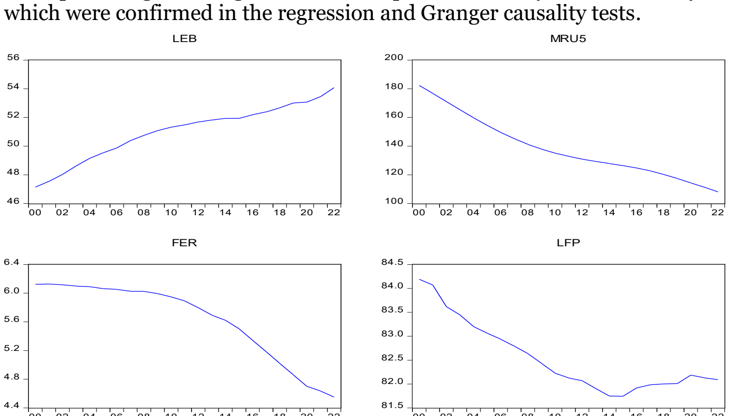

Figure 1: Graphical Representation of Variables

Source: Authors' computation

Life Expectancy at Birth (LEB) The graph shows a steady increase from 2000 to 2022. This upward trend reflects improvements in health care, nutrition, sanitation, vaccination, and socioeconomic development. In regression model, LEB had a strong, positive, and significant coefficient with labor participation, this makes intuitive sense because higher life expectancy usually reflects a healthier, more productive population, which translates into greater labor force participation. In the figure above, a steady decline in the under 5 mortality rates (MUR5) from 2000 to 2022. Children are dying less frequently, suggesting improvements in child health, nutrition, and healthcare, However, in the regression, MRU5 had a positive coefficient on LFP that is higher MRU5 is associated with higher LFP. Even though MRU5 is falling in the graph, the regression result indicates an empirical pattern where years with relatively higher child mortality corresponded with relatively higher labor force participation. Fertility Rate (FER) shows a downward trend, particularly sharp after 2010, declining fertility is usually associated with rising education for women, greater access to family planning, urbanization, economic development. In the regression, FER had a negative and significant coefficient on labor which is consistent with economic theory.

4.2 | Analysis of Health Outcomes and Economic Productivity in Nigeria

The study examined the health outcomes and economic productivity. Life expectancy at birth (LEB), under five mortality rate (MRU5), current health expenditure (CHE) and fertility rate (FER) as explanatory variables. GDP per capita (GDP_PP) was included as a control variable to account for income level effects on labor market behavior.

Table 1: Ordinary Least Squares (OLS) Estimation Newey–West (HAC) standard errors

Variable	Coef.	Std. Error	t Statistic	Prob.
LEB	1.24784	0.00891	140.056	0
MRU5	0.15729	0.00347	45.3396	0
CHE	0.05001	0.06326	0.79058	0.44
FER	0.54396	0.14738	3.69088	0.002
GDP_PP	0.00429	0.0108	0.39728	0.696

Source: Authors' computation

The coefficient of LEB is positive and highly significant, indicating that longer life expectancy substantially increases labor force participation. Economically, this finding aligns with human capital and productivity theory: healthier and longer living individuals are more likely to remain economically active, contributing positively and healthier over extended periods, this finding is in conformity with that of (Joshua et al., 2023; Ibikunle, 2019; Anochiwa et al., 2019). MRU5 remains positive and statistically significant, even after controlling for fertility and GDP per capita. While Higher child mortality rates are linked to lower economic productivity, but the short run effect is often statistically insignificant or weaker compared to long run effects see (Eboh et al., 2022; Joshua et al., 2023; Awoyemi et al., 2023). However, the positive coefficient in this study likely reflects as less time for childcare therefore inducing engagement in labor participation especially mothers. The fertility rate exhibits a negative and highly significant effect on labor force participation. Higher fertility reduces LFP, particularly among women, due to time spent on childcare and household responsibilities. This is consistent with demographic and labor supply theory and demonstrates the significant role of reproductive behavior in shaping labor market outcomes.

4.3 | Causal Analysis Between Health Outcomes and Economic Productivity

The Pairwise Granger Causality results provided insight into the direction of predictive influence among the variables in the model. Using 2 lags and 21 observations, variables of interest were reported in table two below.

Table 2: Granger Causality Test

Null Hypothesis:	F statistics	Prob
LFP does not Granger Cause LEB	5.47542	0.0154
LEB does not Granger Cause LFP	0.41768	0.6656
LFP does not Granger Cause MRU5	4.00892	0.0388
MRU5 does not Granger Cause LFP	1.90079	0.1817

Source: Authors' computation

In the table 2 above, labor participation in a unidirectional causality predicts life expectancy. Higher LFP may lead to higher income, better access to healthcare, improved nutrition, and therefore higher life expectancy. Conversely, the analysis above in 4.2 reveal a positive and statistically significant relationship between life expectancy and labor force participation, suggesting that improvements in health status enhance individuals' capacity to participate in productive economic activities. In addition, labor force participation in a unidirectional causality predicts child mortality. This likely reflects a tradeoff between work and child care. Higher LFP especially of mothers may reduce time available for childcare, worsening child survival outcomes. The short run analysis in 4.2 above indicate that higher under 5 mortality (MRU5) is associated with an increase in labor force participation, suggesting that households may supply more labor in response to child related economic shocks.

Table 3: Post Estimation Diagnostics

Test	Statistic	p value
Ramsey RESET Test	4.73	0.0297
Model Fit (R^2)	0.95	—

Source: Authors' computation

The Ramsey RESET test indicates evidence of model misspecification (F = 4.73, p = 0.0297), suggesting that the functional form may be incomplete or that relevant variables or nonlinear effects are omitted. While HAC standard errors correct for heteroskedasticity and autocorrelation, they do not resolve specification errors; hence, the results should be interpreted with

caution. Future research could improve model specification by incorporating additional control variables, exploring nonlinear transformations, or estimating alternative functional forms to better capture the health–productivity relationship in Nigeria. Because the study employes the Heteroskedasticity Autocorrelation Consistency (HAC) /Newey–West standards, Durbin–Watson is no longer a valid diagnostic and can be ignored. HAC already corrects for serial correlation in the standard errors. The model demonstrates a high explanatory power with an R^2 of 0.951 and an adjusted R^2 of 0.940, indicating that the included variables account for a substantial proportion of the variation in labor force participation.

5 | CONCLUSION AND RECOMMENDATION

The short run estimates reveal a positive and statistically significant relationship between life expectancy, mortality rate under five and labor force participation, suggesting that improvements in health status enhance individuals' capacity to participate in productive economic activities, at the same time households may supply more labor in response to child related economic shocks. Complementing to these findings, the Granger causality test reveals unidirectional causal flow from labor force participation to life expectancy and that labor force participation predicts to child mortality. The combined evidence therefore supports a bidirectional health productivity nexus in Nigeria, where better health promotes productivity, child mortality shocks on the other hand elevate labor supply, while intense labor participation contributes to worsening child survival. Conversely, the Granger causality tests indicate a, implying that increases in economic productivity and household income subsequently improve living standards and health outcomes over time. The combined evidence therefore supports a bidirectional health–productivity nexus in Nigeria, where better health promotes productivity in the short run, while sustained productivity gains reinforce health improvements in the long run. This study further recommended Investments in improving life expectancy, including preventive and curative health measures to enhance labor force participation on one hand. Reducing child mortality through child health interventions and social protection programs can mitigate the need for coping driven increases in adult labor participation, leading to a healthier and more sustainable workforce on the other hand.

Conflict of Interest
The author(s) declare that there are no conflicts of interest regarding the publication of this manuscript.

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Author Contributions
The author(s) contributed substantially to the conception and design of the study, data collection, data analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

Informed Consent
Informed consent was obtained from all participants involved in the study.

Use of Generative AI
The author(s) confirm that generative AI tools were used solely for minor language refinement purposes and did not contribute to the intellectual content, analysis, interpretation, or conclusions of the study.

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