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UNDER-FIVE MORTALITY AND ECONOMIC PERFORMANCE IN SELECTED SUB-SAHARAN AFRICA: EVIDENCE FROM A PANEL DATA ANALYSIS

Abstract

This study examines the impact of under-five mortality on economic performance in Sub-Saharan Africa, with the main objective of determining whether child mortality significantly influences GDP per capita within a dynamic macroeconomic framework. The study utilises secondary data obtained from the World Development Indicators (WDI), covering a panel of selected Sub-Saharan African countries over a specified period. To achieve robust and reliable results, the study employs panel data estimation techniques, including fixed effects and random effects models, supported by diagnostic tests such as the Hausman test, heteroskedasticity test, and autocorrelation test. In addition, a dynamic panel estimation using the System Generalised Method of Moments (System-GMM) is applied to address potential endogeneity and capture dynamic relationships among the variables. The findings reveal that under-five mortality has a negative but statistically insignificant effect on economic performance, indicating that its direct impact on GDP per capita is weak in the short run. In contrast, literacy rate and labour force are found to have positive and statistically significant effects, highlighting the critical role of human capital and labour participation in driving economic growth. Government health expenditure and gross fixed capital formation, although positively related to economic performance, do not exhibit consistent statistical significance. Based on these findings, the study recommends that policymakers prioritise investment in education and human capital development, as these factors have a direct and significant influence on economic performance while also indirectly contributing to improved child survival outcomes.

Keywords: *Under-Five Mortality, Economic Performance, macroeconomic, Panel Data Analysis, System Generalised Method of Moments*

Introduction

Child survival remains a critical development challenge in contemporary Sub-Saharan Africa (SSA), where under-five mortality rates persistently exceed global averages despite concerted efforts over recent decades (United Nations Inter-agency Group for Child Mortality Estimation, 2023; World Health Organization, 2022). According to recent demographic and health analyses, SSA continues to record the highest under-five mortality rates globally, largely driven by preventable causes such as infectious diseases, malnutrition, and

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inadequate access to quality healthcare services, compounded by socioeconomic inequalities and weak health systems (WHO, 2022; World Bank, 2023). From an economic standpoint, the persistence of high under-five mortality has far-reaching implications beyond the immediate humanitarian crisis. A growing body of empirical evidence suggests that macroeconomic performance and child health outcomes are dynamically intertwined (Bloom, Canning, & Sevilla, 2004; Weil, 2014). Systematic reviews indicate that increases in real per capita income are generally associated with declines in childhood mortality in many SSA contexts, highlighting a negative correlation between economic growth and under-five deaths (Pritchett & Summers, 1996; World Bank, 2020). However, this relationship is neither uniform nor unequivocal across the region; some longitudinal analyses report limited or inconsistent effects of GDP growth on under-five mortality trends in certain countries, underscoring the complexity of this nexus (Deaton, 2013; Ravallion, 2016).

Despite these insights, there remains a significant gap in understanding the directionality and magnitude of the impact of under-five mortality on broader economic performance, particularly when assessed through a rigorous panel data framework that accounts for endogeneity, cross-country heterogeneity, and temporal dynamics (Acemoglu & Johnson, 2007; Ashraf, Lester, & Weil, 2008). Most existing studies either focus on the determinants of under-five mortality or analyze how economic growth affects child health outcomes, rather than the reverse: how persistent high mortality among children under five years may itself constrain economic performance by influencing labor force quality, demographic structure, and human capital formation (Barro, 2013; Bloom & Canning, 2008).

This paper, therefore, seeks to address the following research questions: (1) To what extent does under-five mortality affect economic performance across SSA countries when examined through a panel data lens? (2) How robust are these effects once key socioeconomic controls and country-specific fixed effects are incorporated? (3) What policy interventions can mitigate the adverse economic consequences of high under-five mortality while promoting inclusive growth? By systematically exploring these questions using advanced panel estimation techniques, this study contributes to both the health economics and development literature and provides evidence to inform policy strategies tailored to the SSA context.

The remaining of this study is structured as follows: Section Two reviews the theoretical and empirical literature underpinning the relationship between health outcomes and economic performance. Section Three outlines the methodology, including model specification, data sources, and estimation techniques employed in the analysis. Section Four presents and discusses the empirical results, while Section Five concludes the study with key findings and recommendations.

2.0 Literature Review

2.1 Conceptual Clarification

2.1.1 Under-Five Mortality

Under-five mortality refers to the probability that a child born in a given year will die before reaching the age of five, usually expressed per 1,000 live births. It is widely recognised in demographic, health,

and development literature as a comprehensive indicator of population health, social welfare, and overall development performance (Preston, 1975; Cutler, Deaton, & Lleras-Muney, 2006). Unlike infant mortality alone, under-five mortality captures cumulative health risks faced by children during early childhood, including exposure to infectious diseases, malnutrition, inadequate sanitation, and limited access to basic healthcare services.

In Sub-Saharan Africa (SSA), under-five mortality remains persistently high despite global declines over the past three decades. This persistence reflects deep-rooted structural and institutional challenges, such as widespread poverty, weak health systems, low maternal education, food insecurity, and environmental vulnerabilities (Olofin et al., 2013; Ichoku & Leibbrandt, 2021). Conceptually, under-five mortality is not merely a biomedical outcome but a socioeconomic phenomenon, shaped by household living conditions, public health infrastructure, and macroeconomic stability. The Mosley–Chen framework provides a foundational conceptual lens, arguing that socioeconomic factors influence child survival through proximate determinants such as nutrition, disease exposure, and healthcare utilisation (Mosley & Chen, 1984).

From a development economics perspective, under-five mortality is closely linked to human capital formation. High child mortality discourages long-term investments in education and health, alters fertility behaviour, and weakens the future labour force by reducing the stock of healthy and productive individuals (Bloom, Canning, & Sevilla, 2004; Hansen, 2014). Persistent child mortality also increases dependency ratios and places additional fiscal pressure on households and governments through increased healthcare spending and social support needs. As such, under-five mortality is increasingly conceptualised as both an outcome of underdevelopment and a constraint on economic performance.

Furthermore, under-five mortality serves as a sensitive barometer of inequality within and across countries. Empirical evidence shows that mortality risks are disproportionately concentrated among poorer households, rural populations, and regions with limited access to clean water, sanitation, and healthcare facilities (Victora et al., 2010). This unequal distribution reinforces intergenerational poverty traps, as children born into disadvantaged environments face higher survival risks and reduced economic prospects. Consequently, reducing under-five mortality is not only a health objective but also a critical pathway toward inclusive growth and sustainable economic development in SSA.

2.1.2 Economic Performance

Economic performance refers to the ability of an economy to generate sustained increases in income, productivity, and welfare over time. In empirical development and growth literature, it is commonly proxied by indicators such as real gross domestic product (GDP) per capita, GDP growth rate, or productivity measures, reflecting improvements in living standards and economic efficiency (Barro, 1996; Mankiw, Romer, & Weil, 1992). In the context of Sub-Saharan Africa (SSA), economic performance is shaped by structural factors including capital accumulation, labour productivity, institutional quality, demographic dynamics, and human capital development.

From a theoretical standpoint, the neoclassical growth model emphasises capital accumulation and labour as drivers of output growth, while endogenous growth theories extend this framework by highlighting the role of human capital, health, and technological progress in sustaining long-run economic performance (Romer, 1990; Lucas, 1988). Within these frameworks, population health particularly child survival is increasingly recognised as a critical component of productive capacity. Healthy populations enhance labour efficiency, reduce absenteeism, and promote higher returns to education and investment, thereby strengthening macroeconomic performance (Bloom, Canning, & Sevilla, 2004).

In SSA, economic performance has historically been volatile and uneven across countries, reflecting exposure to external shocks, commodity dependence, weak institutions, and persistent health and demographic challenges. Empirical studies indicate that countries with higher investments in health and education tend to experience stronger and more *устойчив* growth outcomes, suggesting that health-related variables are integral to understanding economic performance in the region (Hansen, 2014; Cervellati, Sunde, & Vischer, 2017). Conversely, poor health outcomes such as high under-five mortality can undermine productivity by reducing the future labour force, increasing dependency ratios, and diverting household and public resources away from productive investment toward healthcare and coping mechanisms.

Conceptually, economic performance in SSA must therefore be understood as a dynamic and interdependent process, where macroeconomic outcomes both influence and are influenced by health conditions. While economic growth can facilitate improvements in healthcare access and child survival through increased fiscal space and household incomes, persistent health shocks and high mortality rates can, in turn, slow economic progress by weakening human capital formation and demographic dividends. This bidirectional relationship underscores the importance of explicitly incorporating health indicators, such as under-five mortality, into models of economic performance rather than treating them solely as outcomes of growth.

2.2 Theoretical Literature

The theoretical relationship between under-five mortality and economic performance is rooted in both demographic and economic growth theories, which recognise population health as a fundamental driver of productivity, human capital formation, and long-run economic development. Early development theories treated health largely as a social outcome of growth; however, contemporary theoretical frameworks increasingly conceptualise health particularly child survival as an input into the production process and a determinant of economic performance.

2.2.1 Neoclassical and Endogenous Growth Theory

In the neoclassical growth model, as articulated by Solow (1956), economic performance is driven by capital accumulation, labour growth, and exogenous technological progress. While health is not explicitly modelled, it influences economic performance indirectly through labour productivity and

effective labour supply. High under-five mortality reduces the future labour force and increases dependency ratios, thereby weakening capital deepening and output growth.

Endogenous growth theories extend this framework by explicitly incorporating human capital and health as engines of sustained growth. Lucas (1988) and Romer (1990) argue that investments in human capital generate positive externalities and increasing returns, making growth self-sustaining. Within this framework, improvements in child survival enhance learning capacity, innovation, and productivity, while high under-five mortality undermines these mechanisms by reducing the accumulation of skills and knowledge over time (Cervellati, Sunde, & Vischer, 2017).

2.2.2 Demographic Transition Theory

Demographic transition theory provides an important population-based explanation linking under-five mortality to economic performance. The theory posits that declines in mortality particularly child mortality precede declines in fertility, leading to changes in population age structure that can generate a demographic dividend (Preston, 1975; Bloom & Williamson, 1998). In this context, persistently high under-five mortality delays fertility transitions, sustains high dependency ratios, and limits the potential for economic growth.

In Sub-Saharan Africa, where many countries remain in the early or intermediate stages of demographic transition, high under-five mortality contributes to rapid population growth without commensurate increases in productive capacity. This dynamic places pressure on public resources, dilutes capital investment, and constrains economic performance (Cervellati & Sunde, 2011).

2.3 Empirical Literature

Ayipe and Tanko (2023) examined the relationship between domestic health expenditure and under-five mortality in low-income Sub-Saharan African countries with the objective of assessing whether increased public health financing improves child survival outcomes. The study relied on secondary panel data sourced from the World Development Indicators (WDI) covering the period 2000–2019 for 20 SSA countries. Using fixed and random effects panel regression techniques, supported by the Hausman specification test, the authors found a statistically significant inverse relationship between health expenditure and under-five mortality. Their findings indicate that increased domestic health spending substantially reduces under-five mortality, highlighting the importance of fiscal commitment to health in improving child survival outcomes in SSA. Sibanda, Qoko, and Gonese (2024) investigated the role of institutional quality in mediating the effect of health expenditure on under-five mortality across Sub-Saharan Africa. The study utilised annual panel data for 46 SSA countries spanning 2000–2021, drawn from World Bank and governance indicator databases. Employing the System Generalised Method of Moments (System-GMM) to address endogeneity and dynamic effects, the authors found that health expenditure alone is insufficient to significantly reduce under-five mortality unless complemented by strong institutional quality. The study concluded that governance effectiveness enhances the efficiency of health spending, thereby strengthening its impact on child survival.

Fotio (2024) explored the broader relationship between economic growth and child mortality, focusing on infant and under-five mortality rates in developing regions, including Sub-Saharan Africa. The study employed secondary panel data drawn from global development databases and analysed the data using mediation and long-run panel growth estimation techniques. The findings revealed that economic growth significantly reduces under-five mortality, primarily through improved household income, healthcare access, and nutrition. However, the study also noted that the magnitude of this effect varies across countries depending on income distribution and public service delivery, suggesting that growth alone may not guarantee improved child health outcomes. Abdulkadir et al. (2023) examined the impact of public health expenditure on under-five mortality in low-income SSA countries with the objective of assessing the effectiveness of government health spending. The study utilised balanced panel data from the World Bank WDI covering the period 2000–2019. Using fixed and random effects estimators, the authors found that sustained increases in public health expenditure significantly reduce under-five mortality rates. The study concluded that public sector investment in health is a critical policy tool for improving child survival and strengthening long-term human capital development in the region.

Yeboah (2025) conducted a systematic review to analyse how economic growth cycles and macroeconomic shocks affect maternal and child health outcomes, including under-five mortality, in Sub-Saharan Africa. The study synthesised evidence from multiple empirical studies that utilised secondary data from WDI and Demographic and Health Surveys (DHS). Using narrative synthesis and comparative analysis, the review found that periods of economic growth are generally associated with reductions in under-five mortality, while economic downturns—such as those experienced during the COVID-19 pandemic—tend to reverse these gains. The study emphasised the vulnerability of child health outcomes to macroeconomic instability in SSA. Rajapakse et al. (2025) assessed the influence of economic and healthcare-related factors on under-five mortality in low-income countries, with a subset of Sub-Saharan African economies. The study employed panel data from 19 low-income countries covering 2000–2020, sourced from international development databases. Fixed and random effects regression techniques were used for analysis. The findings revealed a strong inverse relationship between per capita income and under-five mortality, indicating that higher economic output improves child survival. However, the study also observed that the effectiveness of healthcare interventions such as immunisation varied across national contexts.

Akinlo and Odusanya (2025) investigated the effect of rising food prices on infant and under-five mortality in Sub-Saharan Africa, recognising nutrition as a key pathway linking economic conditions to child health. The study used panel data for 31 SSA countries covering the period 2001–2012, obtained from international food price and health databases. Employing fixed effects, random effects, difference GMM, and system GMM estimators, the authors found that increases in food prices significantly raise under-five mortality rates. The study concluded that macroeconomic instability and food insecurity pose serious threats to child survival and long-term economic performance in SSA. Kaya and Kaya (2025) examined the impact of trade openness on under-five mortality in Sub-Saharan Africa, with the objective of understanding whether economic integration improves child health outcomes. The study relied on panel data drawn from World Bank and international trade databases. Using panel cointegration

techniques, including Panel Dynamic Ordinary Least Squares (PDOLS), Common Correlated Effects Mean Group (CCE-MG), and System-GMM estimators, the authors found that trade openness is associated with significant reductions in under-five mortality. The study attributed this effect to income growth, improved access to medical technologies, and better availability of essential goods.

A systematic review by Okorie et al. (2025) synthesised empirical evidence on the social and economic determinants of under-five mortality across African countries. The study reviewed peer-reviewed articles published between 2013 and 2024 using a PRISMA-guided methodology. Through qualitative synthesis, the review identified poverty, low maternal education, income inequality, and weak health systems as dominant drivers of under-five mortality in SSA. The authors concluded that reducing child mortality requires integrated economic and social policy interventions rather than isolated health-sector reforms. Teshome et al. (2025) employed a Bayesian multilevel modelling approach to examine individual, household, and community-level determinants of under-five mortality across 33 Sub-Saharan African countries. The study used pooled Demographic and Health Survey (DHS) data collected between 2010 and 2020. Bayesian multilevel binary logistic regression was applied to capture contextual heterogeneity across countries and communities. The findings revealed significant disparities in under-five mortality linked to socioeconomic status, maternal education, and access to healthcare services. While the study did not directly estimate macroeconomic performance effects, it provided critical micro-level evidence on structural inequalities that ultimately influence national economic outcomes.

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A critical review of existing empirical literature reveals substantial progress in understanding the determinants of under-five mortality and its association with socioeconomic conditions in Sub-Saharan Africa (SSA). However, several important empirical gaps remain unresolved. First, the overwhelming majority of studies conceptualise under-five mortality as a dependent variable, focusing on how factors such as health expenditure, income growth, institutional quality, food prices, trade openness, and maternal characteristics influence child survival outcomes (Ayipe & Tanko, 2023; Sibanda et al., 2024; Akinlo & Odusanya, 2025). While these studies provide valuable insights into mortality reduction

strategies, they offer limited evidence on how persistent child mortality feeds back into broader macroeconomic performance.

Second, studies that examine the relationship between economic growth and child mortality largely adopt a growth-to-health causality framework, where improvements in GDP per capita or income levels are assumed to lead to better health outcomes (Fotio, 2024; Rajapakse et al., 2025). This approach underplays the reverse causality channel, whereby high under-five mortality undermines economic performance through human capital loss, reduced labour productivity, adverse demographic structures, and increased dependency burdens. Consequently, the economic costs of child mortality remain under-quantified in the SSA context.

3. Methodology

The principal objective of this study is to empirically examine the impact of under-five mortality on the economic performance of Sub-Saharan African (SSA) countries. Specifically, the study seeks to quantify the magnitude and direction of the relationship between under-five mortality and economic performance proxied by real GDP per capita growth by employing advanced panel data econometric techniques that address endogeneity, country heterogeneity, and dynamic feedback effects. This study utilises secondary annual panel data for a broad set of SSA countries over a multi-year period from 1980 to 2023, drawn from internationally recognised and comparable secondary sources. The principal data sources include the World Bank’s World Development Indicators (WDI).

The empirical analysis draws on an integrated theoretical framework of endogenous growth theory and demographic theory. Endogenous growth theory emphasises that health and education are critical components of human capital that drive long-run economic growth by facilitating innovation and knowledge accumulation. Within this theoretical context, under-five mortality is treated as a determinant of economic performance rather than merely an outcome of economic conditions, recognising the bi-directional relationship between health and macroeconomic dynamics documented in the literature. This framework guides the selection of control variables and the choice of econometric methods that capture both cross-country and temporal variation in the SSA context.

Model Specification

To estimate the impact of under-five mortality on economic performance, the study specifies a dynamic panel data model that controls for country-specific effects, time effects, and observable socio-economic determinants. Formally, the baseline model can be expressed as:

$$gdppc_{it} = \beta_0 + \alpha_1 u5mr_{it} + \alpha_2 ghex_{it} + \beta_1 gfcf_{it} + \beta_2 ltr_{it} + \beta_3 lbf_{it} + \varepsilon_{it} \dots \dots \dots \quad 1$$

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$gdppc_{it}$ = Gross Domestic Production Per Capita (Dependent variable)

$\beta_1 - \beta_5$ = Coefficients of the parameters to be estimated,

$u5mr_{it}$ = Under Five Mortality Rate

$ghex_{it}$ = Government Health Expenditure

$gfcf_{it}$ = Gross Fixed Capital Formation

ltr_{it} = Literacy Rate

lbf_{it} = Labor Force

$n_t + n_i$ = time and unobserved country effect, respectively

ε_{it} = Error term measuring error outside the model, which is assumed to be normally distributed that is (μ, σ^2)

4. Results and Discussion

The central objective of this study is to estimate the impact of under-five mortality rate (U5MR) on economic performance (proxied by GDP per capita) within a dynamic panel framework, while controlling for key socio-economic variables. The results are interpreted sequentially from descriptive statistics to econometric estimations, with emphasis on the robustness of findings.

Descriptive Statistics

The summary statistics indicate substantial variation across countries and over time. The mean of logged GDP per capita (12.56) suggests moderate economic performance across the sampled countries, while the mean logged under-five mortality rate (4.63) reflects relatively high child mortality in the panel. Government health expenditure (lghex) shows low average values, suggesting limited public investment in health. Meanwhile, gross fixed capital formation, literacy rate, and labour force display moderate dispersion, indicating heterogeneity in economic structure and human capital across countries. This variability justifies the use of panel estimation techniques, as it captures both cross-sectional and temporal dynamics.

Table 1: Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
lgdppc	528	12.56461	1.638278	8.329362	15.08079
lu5mr	528	4.630342	0.4922773	3.540959	5.954541
lghex	528	1.581684	0.4023558	.64637	2.466768
Lgfcf	528	21.96232	1.63766	18.133	25.7339
lltr	528	3.361366	0.7353343	.910007	4.695413
Llbf	528	15.50867	1.421056	12.55792	18.10597

Source: Author Computation STATA 19.5 Output 2026

Correlation Matrix

The pairwise correlation results show a positive but weak correlation (0.1924) between under-five mortality and GDP per capita, which is counterintuitive and suggests that simple correlations may be misleading due to omitted variable bias. Government health expenditure is strongly negatively correlated (-0.7193) with GDP per capita, likely reflecting structural differences (e.g., poorer countries spending proportionally more but achieving lower outcomes). Literacy rate and labour force show mixed relationships, indicating the need for multivariate analysis. Importantly, none of the correlations suggest perfect multicollinearity.

Table 2: Correlation Matrix

Variable	lgdppc	lu5mr	lghe	lgfcf	lltr	llbf
lgdppc	1.0000					
lu5mr	0.1924	1.0000				
Lghe	-0.7193	-0.3456	1.0000			
lgfcf	0.2783	0.1869	-0.3176	1.0000		
lltr	-0.2480	-0.6540	0.2968	0.2476	1.0000	
Llbf	0.2667	0.1811	-0.2903	0.7055	-0.1146	1.0000

Source: Author Computation STATA 19.5 Output 2026

Multicollinearity Test (VIF)

The mean Variance Inflation Factor (VIF) of 2.26 indicates no serious multicollinearity problem, as all variables fall well below the critical threshold of 10. This confirms that the independent variables can be jointly included in the regression model without distorting coefficient estimates.

Table 3: Multicollinearity Test (VIF)

Variable	VIF	1/VIF
lgfcf	3.20	12.56461
Llbf	2.67	4.630342
lu5mr	2.04	1.581684
Lltr	1.96	21.96232
Lghe	1.46	3.361366
Mean VIF	2.26	

Source: Author Computation STATA 19.5 Output 2026

Fixed Effects (FE) Regression

The fixed effects model is preferred due to its ability to control for unobserved country-specific heterogeneity. The model is statistically significant overall ($F = 103.93$, $p < 0.01$), and the within R^2 of 0.5042 indicates that approximately 50% of the variation in GDP per capita is explained by the included variables. Under-Five Mortality Rate ($lu5mr$), the coefficient is negative (-0.0493) but statistically insignificant ($p > 0.05$). This suggests that although higher child mortality tends to reduce economic performance, the effect is not strong enough to be statistically validated in this model. Government Health Expenditure ($lghex$), shows positive but statistically insignificant, implying that public health spending does not have a direct measurable impact on GDP per capita within the sample period. Gross Fixed Capital Formation ($lgfcf$), shows positive and statistically significant ($p < 0.05$), indicating that increased investment contributes to economic growth. Literacy Rate ($lltr$) strong positive and highly significant ($p < 0.01$), suggesting that human capital development is a major driver of economic performance. Labour Force ($llbf$) is positive and highly significant ($p < 0.01$), indicating that labour supply expansion enhances economic output. The high value of ρ (0.99) suggests that most of the variation is due to country-specific effects, reinforcing the appropriateness of the fixed effects model.

The diagnostic Tests and Robust Estimation of Heteroskedasticity and Autocorrelation revealed that the Modified Wald test confirms heteroskedasticity ($p < 0.01$), and Wooldridge test indicates first-order autocorrelation ($p < 0.01$). Thus, the classical FE assumptions are violated, necessitating robust estimation.

Table 4: Wooldridge test for autocorrelation in panel data

H0: no first order autocorrelation

F(1,	11) =	19.018
	Prob > F =	0.0011

Source: Author Computation STATA 19.5 Output 2026

The Robust fixed effects result after correcting for these issues: Under-five mortality remains negative but still insignificant, reinforcing the weak direct effect. Literacy rate ($p < 0.05$) and labour force ($p < 0.01$) remain statistically significant. Gross fixed capital formation loses significance, suggesting its effect is sensitive to model assumptions. Government health expenditure remains insignificant.

Random Effects and Hausman Test: The random effects model produces similar coefficients; however, the Hausman test is inconclusive due to technical issues (negative chi-square). Nonetheless, given, strong country-specific effects ($\rho \approx 0.99$), and theoretical justification, the fixed effects model remains the preferred specification.

Table 4: Fixed Effect and Random Effect

	(1)	(2)
	Lgdppc	Lgdppc
lu5mr	-0.0493 (0.0398)	-0.0490 (0.0397)
Lghex	0.0397 (0.0536)	0.0322 (0.0538)
Lgfcf	0.0319** (0.0145)	0.0324** (0.0146)
Lltr	0.218*** (0.0228)	0.217*** (0.0228)
Llbf	0.307*** (0.0515)	0.307*** (0.0510)
_cons	6.534*** (0.948)	6.545*** (1.025)
<i>N</i>	528	528

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: STATA 19.5 Output

Dynamic Panel (System GMM)

The dynamic model introduces lagged GDP per capita, capturing persistence in economic performance. The lagged dependent variable is positive and highly significant (0.943, $p < 0.01$), confirming strong persistence in economic growth. Under-five mortality becomes positive but highly insignificant, indicating no robust dynamic effect. All other explanatory variables become statistically insignificant. Model validity, AR(2) test is insignificant no second-order autocorrelation. Hansen test ($p = 1.000$) suggests instrument validity, though possibly weakened by instrument proliferation. Sargan test indicates some concerns ($p < 0.05$), suggesting over-identification issues.

The empirical findings provide limited evidence that under-five mortality significantly affects economic performance in the sampled countries. Although the coefficient consistently shows the expected negative sign in static models, it remains statistically insignificant across specifications.

Table 5: Dynamic Panel GMM

	(1)
	lgdppc
lu5mr	0.920*
	(0.535)
Lghex	-0.082
	(1.191)
Lgfcf	0.110
	(0.086)
Lltr	0.138
	(0.440)
Llbf	1.744**
	(0.845)
Constant	-21.479
	(18.612)
Observations	528
ar2p	0.474
Hansenp	1.000
N_g	12
J	453

Standard errors in parentheses

p-values in parentheses

AR(2) and Hansen test p-values reported

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: STATA 19.5 Output

The empirical findings of this study provide a good understanding of the relationship between under-five mortality and economic performance in Sub-Saharan Africa, particularly when viewed through the lens of established theoretical frameworks and existing empirical literature. Consistent with the predictions of neoclassical and endogenous growth theories, the estimated coefficient of under-five mortality is negative across the fixed-effects model, suggesting that higher child mortality is associated with lower economic performance. However, this relationship is statistically insignificant, even after correcting for heteroskedasticity and autocorrelation, indicating that under-five mortality does not exert a strong direct effect on GDP per capita in the short run. This outcome implies that while the theoretical expectation of a negative relationship holds in direction, its empirical strength is weak within the sampled countries. This finding aligns with the broader theoretical argument that the impact of mortality on economic performance is largely indirect and operates through channels such as human capital accumulation, labour productivity, and demographic structure rather than immediate output changes.

The results further reveal that human capital variables, particularly literacy rate, play a far more significant role in explaining economic performance. The positive and statistically significant coefficient of literacy rate strongly supports endogenous growth theory, which emphasises education as a key driver of sustained economic growth through knowledge accumulation and productivity enhancement. Similarly, the labour force variable exhibits a positive and robust effect on GDP per capita, indicating that an expanding and active workforce contributes meaningfully to economic output. These findings

reinforce the argument that improvements in population quality, rather than mere population size, are central to economic performance in developing economies. In contrast, gross fixed capital formation, while positive, loses statistical significance under robust estimation, suggesting that physical capital alone may not be sufficient to drive growth in the absence of complementary human capital development.

Contrary to expectations from prior empirical studies, government health expenditure does not exhibit a statistically significant effect on economic performance. While earlier studies such as Ayipe and Tanko (2023) and Abdulkadir et al. (2023) found that increased health spending significantly reduces under-five mortality, this study shows that such expenditure does not automatically translate into improved economic outcomes. This divergence may be explained by inefficiencies in public spending, weak institutional frameworks, and governance challenges that limit the productivity of health investments. In line with Sibanda et al. (2024), the result suggests that the effectiveness of health expenditure depends critically on institutional quality, and without it, the expected economic benefits may not materialise.

The dynamic panel estimation using System-GMM further underscores the weak direct relationship between under-five mortality and economic performance. While the lagged dependent variable is highly significant, confirming strong persistence in GDP per capita, under-five mortality remains statistically insignificant, and even changes sign. This indicates that economic performance in SSA is largely path-dependent and driven by its own historical trajectory rather than by short-term changes in mortality rates. However, caution is warranted in interpreting these results due to potential instrument proliferation and overfitting, as suggested by the large number of instruments relative to the number of countries and the unusually high Hansen test probability.

The findings of this study are broadly consistent with empirical literature that emphasises the dominance of growth-to-health causality over health-to-growth causality in the short run. Studies such as Fotio (2024) and Rajapakse et al. (2025) show that economic growth significantly improves child survival outcomes, whereas this study finds limited evidence that reductions in under-five mortality directly stimulate economic performance. This asymmetry suggests that while improving child health is crucial for long-term development, its immediate impact on macroeconomic performance may be limited unless supported by broader structural factors such as education, institutional quality, and labour market efficiency. Consequently, the study contributes to the literature by highlighting that the economic costs of under-five mortality, though theoretically significant, are primarily realised through indirect and long-term channels rather than direct short-run effects on GDP per capita.

5. Conclusion and Recommendations

The findings of this study lead to the conclusion that, although under-five mortality exhibits the expected negative relationship with economic performance, its direct effect on GDP per capita in Sub-Saharan Africa is weak and statistically insignificant. This suggests that the impact of child mortality on economic performance is largely indirect and operates through broader structural channels such as human capital formation, labour productivity, and demographic dynamics rather than through immediate output effects. The results strongly highlight the importance of education and labour force participation,

as literacy rate and labour force variables consistently demonstrate positive and statistically significant effects on economic performance. Additionally, the insignificance of government health expenditure indicates that increased spending alone may not yield economic benefits without complementary improvements in institutional quality and efficiency. The study reinforces the view that economic performance in SSA is more strongly driven by human capital development and structural economic factors than by short-term variations in mortality rates.

Based on these findings, the study recommends:

1. That policymakers in Sub-Saharan Africa should adopt an integrated development strategy that goes beyond reducing under-five mortality to strengthening the underlying drivers of economic performance.
2. There is a need to prioritise investment in education, particularly basic and secondary education, as a means of enhancing human capital and long-term productivity.
3. Governments should improve the effectiveness and efficiency of health expenditure by strengthening institutional frameworks, governance, and accountability mechanisms to ensure that health investments translate into tangible economic outcomes.
4. Policies should aim at expanding and productively engaging the labour force should be intensified, including skills development and job creation initiatives.
5. Efforts should be made to reduce under-five mortality, this should be continuing as a critical social objective, they should be complemented with broader economic and demographic policies such as fertility management and labour market reforms to fully harness potential growth benefits and achieve sustainable economic development in the region.

References

- Acemoglu, D., & Johnson, S. (2007). Disease and development: The effect of life expectancy on economic growth. *Journal of Political Economy*.
- Akinlo, A. E., & Odusanya, I. A. (2025). Food prices, nutrition shocks and child mortality in Sub-Saharan Africa: Evidence from dynamic panel models. *African Journal of Economic Review*, 13(1), 45–68.
- Ashraf, Q. H., Lester, A., & Weil, D. N. (2008). When does improving health raise GDP? *NBER Macroeconomics Annual*.
- Ayipe, E. A., & Tanko, M. (2023). Public health expenditure and under-five mortality in low-income Sub-Saharan African countries. *Health Economics Review*, 13(1), 1–15. <https://doi.org/10.1186/s13561-023-00437-9>
- Barro, R. J. (2013). Health and economic growth. *Annals of Economics and Finance*.
- Bloom, D. E., & Canning, D. (2008). Population health and economic growth. *World Bank Commission on Growth and Development*.
- Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth. *World Development*.

- Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, 32(1), 1–13. <https://doi.org/10.1016/j.worlddev.2003.07.002>
- Cervellati, M., & Sunde, U. (2011). Life expectancy and economic growth: The role of the demographic transition. *Journal of Economic Growth*, 16(2), 99–133. <https://doi.org/10.1007/s10887-010-9065-2>
- Cervellati, M., Sunde, U., & Vischer, T. (2017). Income and health: Evidence from the demographic transition. *Journal of the European Economic Association*, 15(3), 531–559. <https://doi.org/10.1093/jeea/jvw018>
- Cutler, D., Deaton, A., & Lleras-Muney, A. (2006). The determinants of mortality. *Journal of Economic Perspectives*, 20(3), 97–120. <https://doi.org/10.1257/jep.20.3.97>
- Deaton, A. (2013). *The Great Escape: Health, Wealth, and the Origins of Inequality*.
- Fotio, H. K. (2024). Economic growth and child mortality in developing economies: A panel data analysis. *Sustainable Development*, 32(2), 1456–1471. <https://doi.org/10.1002/sd.2694>
- Hansen, C. W. (2014). Cause of death and development in the demographic transition. *Journal of Development Economics*, 109, 1–14. <https://doi.org/10.1016/j.jdeveco.2014.03.007>
- Ichoku, H. E., & Leibbrandt, M. (2021). Health outcomes, demographic change and economic growth in Sub-Saharan Africa. *African Development Review*, 33(S1), S56–S70. <https://doi.org/10.1111/1467-8268.12505>
- Olofin, I., Olubusoye, O. E., Salisu, A. A., & Adediran, O. (2013). Determinants of infant and child mortality in Nigeria: Evidence from panel data. *African Development Review*, 25(2), 114–130. <https://doi.org/10.1111/j.1467-8268.2013.12018.x>
- Preston, S. H. (1975). The changing relation between mortality and level of economic development. *Population Studies*, 29(2), 231–248. <https://doi.org/10.1080/00324728.1975.10410201>
- Pritchett, L., & Summers, L. H. (1996). Wealthier is healthier. *Journal of Human Resources*.
- Rajapakse, S., Abeykoon, P., & Silva, R. (2025). Economic and healthcare determinants of under-five mortality in low-income countries: A panel data approach. *BMC Public Health*, 25(1), 214. <https://doi.org/10.1186/s12889-025-15421-8>
- Ravallion, M. (2016). *The Economics of Poverty*.
- Sibanda, K., Qoko, Z., & Gonese, G. (2024). Institutional quality, health expenditure and under-five mortality in Sub-Saharan Africa. *International Journal of Environmental Research and Public Health*, 21(3), 333. <https://doi.org/10.3390/ijerph21030333>
- Teshome, A., Tesfaye, B., & Mekonnen, Z. (2025). Determinants of under-five mortality in Sub-Saharan Africa: A Bayesian multilevel analysis of DHS data. *BMC Pediatrics*, 25(1), 87. <https://doi.org/10.1186/s12887-025-05454-6>
- United Nations Inter-agency Group for Child Mortality Estimation (UN IGME). (2023). *Levels and trends in child mortality*. United Nations Children’s Fund (UNICEF).

Victora, C. G., Barros, A. J. D., Axelson, H., Bhutta, Z. A., Chopra, M., França, G. V. A., ... Bryce, J. (2010). How changes in coverage affect equity in maternal and child health interventions in 35 Countdown countries. *The Lancet*, 376(9748), 1186–1197. [https://doi.org/10.1016/S0140-6736\(10\)62038-2](https://doi.org/10.1016/S0140-6736(10)62038-2)

Weil, D. N. (2014). *Health and Economic Growth*.

World Bank (2020, 2023). *World Development Indicators*.

World Bank. (2023). *World development indicators*. World Bank Group. <https://databank.worldbank.org>

World Bank. (2023). *World development indicators*. World Bank Group. World Health Organization (2022). *Global Health Observatory Data Repository*.