IMPACT OF LIFE EXPECTANCY ON PRODUCTIVITY IN SSA: EMPIRICAL EVIDENCE FROM CROSS-SECTIONAL ARDL ESTMATOR

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Abstract

This study investigates the relationship between health outcomes (proxied by life expectancy) and economic performance (measured by total factor productivity, TFP) in selected Sub-Saharan African countries, with particular emphasis on the role of health as a component of human capital in driving productivity. Using annual panel data spanning 1980–2023, sourced from the Penn World Table and the World Bank, the study employs second-generation econometric techniques, including descriptive statistics, cross-sectional dependency tests, Pesaran's unit root test, and the Common Correlated Effects Mean Group (CS-ARDL) estimator. The empirical findings reveal that life expectancy, government health expenditure, literacy rate, and labour force participation do not significantly influence TFP in the short run. Gross fixed capital formation exhibits a negative but statistically insignificant effect, while disease prevalence is positive yet insignificant in the short run. In the long run, life expectancy emerges as statistically significant and positive (0.648, $p < 0.01$), underscoring its potential role in productivity growth over time. Conversely, gross fixed capital formation (–0.042, $p = 0.123$), government health expenditure ($p = 0.642$), literacy rate ($p = 0.782$), and labour force participation (–0.055, $p = 0.383$) remain insignificant. The study concludes that health indicators, particularly life expectancy, may not exert immediate effects on productivity in Sub-Saharan Africa, but their long-term implications are substantial. It recommends that policies in the region should not only focus on extending lifespan but also ensure that additional years of life are productive through investments in education, skills development, and innovation capacity.

Keywords: Total Factor Productivity, Life Expectancy, Human Capital, Sub-Saharan Africa, CS-ARDL estimator.

JEL Codes: **O47, I15, J24, O55, C23.**

1. Introduction

Over the past four decades, Total Factor Productivity (TFP), which measures how efficiently labor and capital are used to produce output, has experienced varied trends across the world. The 1990s stood out as a period of strong TFP growth, particularly in the United States, China, and parts of Southeast Asia. In the US, for example, TFP grew between 1.5% and 2% annually during that decade, while China saw even higher rates of 3.5% to 4%. However, after the 2008–2009 global financial crisis, TFP growth slowed significantly in most economies, often falling below 1% per year, with advanced economies experiencing particularly sluggish rates. In contrast, Sub-Saharan Africa (SSA) has faced a persistent and troubling decline in TFP over the past three decades.

Data from the Penn World Table shows clear drops in TFP levels between 1980 and 2014 in several countries, such as Botswana (from 0.77 to 0.57), Côte d'Ivoire (from 0.76 to 0.46), Nigeria (from 1.44 to 0.65), and South Africa (from 0.97 to 0.53). The study emphasizes a strong connection between health improvements, especially rising life expectancy, and higher productivity. Technological progress in medicine, sanitation, and disease prevention has increased life expectancy, leading to a healthier, longer-living, and better-educated workforce. This creates a virtuous cycle: longer and healthier lives encourage greater investment in education and skills, longer workforce participation, and more innovation, all of which enhance TFP and drive sustained economic growth. Countries with higher life expectancy consistently show much higher GDP per capita. For instance, developed nations with life expectancy of around 80 years often have GDP per capita of $45,000, while many developing countries with life expectancy closer to 60 years have GDP per capita below $1,000.

In 1990, high-income countries already enjoyed average life expectancy above 75 years, while SSA lagged far behind at around 50 years, heavily burdened by diseases such as malaria, tuberculosis, and especially HIV/AIDS, which accounted for more than 60% of global cases by 2005. Although global life expectancy has steadily improved (reaching approximately 73.3 years by 2024), SSA continues to face serious challenges due to inadequate health funding and poor health outcomes, which are widely regarded as major contributors to the region's persistently low and sometimes negative TFP growth rates.

Therefore, the study aims to examine the relationship more closely by analyzing annual panel data from 1980 to 2023 across twelve selected SSA countries, three from each major sub-region (Eastern: Kenya, Tanzania, Rwanda; Central: Angola, Cameroon, Gabon; Southern: Lesotho, Namibia, South Africa; Western: Côte d'Ivoire, Burkina Faso, Nigeria). These countries were chosen based on having the highest GDP within their respective sub-regions to ensure balanced representation, reduce bias, and improve the validity and generalizability of the findings. The research adopts the augmented Solow growth model (developed by Mankiw, Romer, and Weil in 1992) as its theoretical framework. This model extends the original Solow framework by incorporating human capital to better explain the relationship between health outcomes, economic growth, and productivity across countries.

2. Literature Review

A substantial body of empirical literature has examined the relationship between life expectancy (as a key proxy for health status) and economic growth productivity, or Total Factor Productivity (TFP), with a particular focus on developing countries, including Nigeria and other regions in Africa and Asia. These studies generally support a positive association, highlighting how improvements in health and longevity enhance workforce efficiency, human capital accumulation, and sustained economic performance, although some findings reveal variations by time horizon, context, or specific health challenges.

Several studies affirm a positive and significant long-run relationship between life expectancy and economic growth or productivity. For instance, Avci and Caliskan (2024) documented this pattern in Turkey over the period 1960–2014, while Weixiang and Yu (2020) identified a strong positive link between life expectancy and GDP per capita in

China. In South Asia, Aqsa, Hafiz, and Amjad (2022) found that life expectancy exerts a statistically significant positive effect on labor productivity across the region from 1991 to 2019.

Similarly, in middle-income countries, Hafiz, Ghulam, and Adiqa (2020) showed that improved life expectancy is associated with higher productivity, with stronger effects in upper-middle-income settings compared to lower-middle ones. Broader regional evidence includes Mduduzi and Mokgadi (2019), who confirmed a robust positive impact of life expectancy on economic growth among Southern African Development Community members, and Haruna, Ummu, and Mubarak (2019), who revealed a long-run correlation between life expectancy, under-five mortality, and economic growth in West African countries, with causality running from health indicators to growth. In Ghana, Boachie (2017) reported positive and significant effects in both the short and long run, while Gindra and Karol (2017) found life expectancy to be statistically significant for real output in Central Eastern Europe.

In the Nigerian context, multiple studies reinforce this positive linkage, often emphasizing health's role in productivity and inclusive growth. Alhassan, Adedoyin, Bekun, and Agabo (2020) demonstrated that life expectancy has a significant positive relationship with real GDP in both the short and long run. Adesanya, Edward, and King (2023) showed that life expectancy positively and significantly influences productivity in both short- and long-run horizons amid HIV/AIDS prevalence. Mba, Orji, Ekoh, and Chijioke (2023) further indicated that variations in life expectancy, mortality, illness, and literacy substantially affect industrial production over extended periods from 1980 to 2020. Okuneye, Olaniyi, and Adekanmbi (2023) uncovered a long-term association between life expectancy and inclusive growth, while Tuncer (2019) identified bidirectional causality between economic growth and life expectancy in E7 countries, including positive impacts from related variables.

However, the literature also captures nuances and contrasting results. Alfred et al. (2024) highlighted a significantly adverse relationship between malaria prevalence and labor productivity in Nigeria from 1999 to 2021, underscoring how specific disease burdens can undermine health gains. Remi, Daniel, and Efegbere (2020) found that life expectancy at birth and government health expenditure did not exert a statistically significant effect on the labor productivity index in Nigeria from 1981 to 2017. Aigheyisi (2020) reported that increased agricultural productivity improves life expectancy in the short run but reverses in the long run. Earlier works, such as Sanjoy (2016), confirmed a positive significant effect of life expectancy on TFP in India, while Cole and Neumayer (2016) identified poor health factors like malaria, malnutrition, and limited water access as significant negative determinants of TFP in developing countries during the 1990s–2000s.

Overall, the reviewed studies predominantly indicate that higher life expectancy contributes positively to economic growth, labor productivity, and TFP, particularly in the long run, by fostering a healthier and more productive workforce. In developing and African contexts like Nigeria, however, persistent challenges such as disease prevalence (e.g., malaria and HIV/AIDS), inadequate health infrastructure, and funding constraints can weaken or reverse these benefits in certain periods or scenarios. These findings

underscore the need for sustained investments in health systems to realize the full growth potential of improved longevity.

3. Methodology

3.1 Nature and sources of data

This study used annual panel data from 1980 to 2023, focusing on 12 countries, three from each of the four sub-regions of Sub-Saharan Africa. The data, gathered from the World Bank and the Penn World Table, were analyzed to explore the connection between life expectancy and economic performance in the region.

Table 1 Description, Measurement, and Sources of Data.

Variable Name	Measurement/Definitionof Variable	Source
Economic performance (ECOP)	TFP level at current PPPs (USA=1)	Penn table, 2024
Life Expectancy (LEX)	Life expectancy at birth indicates the number of years a newborn U5MR would live if the prevailing pattern of mortality at that time were to stay the same throughout its life	World Bank
Gross fixed capital formation(GFCF)	a measure that consists of plants, machinery, and the buying of equipment. It includes the construction of roads, schools, offices, hospitals, commercial, and industrial buildings	World Bank,2024
Government Health expenditure(GHEX)	measured as the general government's final health expenditure	World Bank,2024
Literacy rate (LTR)	Rate of school enrolment, consumption expenditure	World Bank,2024
Labour force(LBF)	Number of the working age out of the total population	World Bank,2024
Disease prevalence (PVD)	Communicable and non-communicable diseases	World Bank,2024

Source: Researcher's compilation (2025)

3.2 Model Specification

This study is anchored on the work of Aqsa *et al,(2022)* $Y = AL^{\alpha}K^{\beta}e^{\mu}$……(1)

$logY = logA + \alpha logL + \beta logK + \mu$, ----------(2)

$logY = \alpha 0 + \alpha logL + \beta logK + \mu$--------(3)

Where Y signifies total production, A is knowledge, L represents labour, and K is capital. This is further modified by including government Health Expenditure, and disease prevalence as these variables are determinants of health and as wellas improved productivity.

$$ECOP=F\ (LEX,\ GFCF,\ GHEX,LTR,\ LBF,\ PVD) \quad \ldots\ldots\ldots\

4. Resultsand Discussion

Table 4.1: Summary of Descriptive Statistics

Dependent Variable: Lntfp

Variable	Obs	Mean	Std. Dev.	Min	Max
Lntfp	528	-.79	.431	-2.156	.284
Lnlex	528	4.002	.129	2.646	4.205
Lngfcf	528	21.963	1.639	18.136	25.714
Lnghex	528	1.582	.402	.646	2.467
Lnltr	528	3.361	.735	.91	4.695
Lnlbf	528	15.508	1.421	12.558	18.11
Lnpvd	528	2.769	.612	1.224	4.212

Source: Researcher's compilation (2025)

4.1 Descriptive Statistics

The descriptive statistics for the study's panel dataset, comprising 528 observations across the selected variables (likely drawn from 12 Sub-Saharan African countries over the 1980–2023 period), provide a clear overview of the central tendencies, variability, and ranges of the key indicators after logarithmic transformation. This transformation is commonly applied in econometric analyses to handle skewness, stabilize variance, and facilitate the interpretation of relationships in percentage terms.

Total Factor Productivity (lntfp) exhibits a mean of -0.79 with a standard deviation of 0.431, ranging from a minimum of -2.156 to a maximum of 0.284. The negative mean value in log terms indicates that, on average, TFP levels in the sample are below a reference benchmark (often normalized to 1 in log form, equivalent to 0), reflecting widespread inefficiencies or production constraints typical in many Sub-Saharan African economies over the study period. The moderate standard deviation suggests some cross-country and temporal variation but not extreme dispersion.

Life expectancy (lnlex)shows a mean of 4.002 (corresponding to an approximate exponentiated value of around e^4.002 ≈ 54.7 years, which aligns reasonably with historical averages in SSA during much of the sample period, particularly before recent gains), with a relatively low standard deviation of 0.129 and a range from 2.646 (≈ 14 years, possibly reflecting extreme lows in certain years or contexts) to 4.205 (≈ 67years). This low dispersion highlights a degree of stability in life expectancy patterns across the observations, consistent with gradual but uneven health improvements in the region.

Other control and input variables display greater heterogeneity. Gross fixed capital formation (lngfcf) has a mean of 21.963 (indicating substantial average capital stocks in log terms) but a notably higher standard deviation of 1.639, with values spanning 18.136 to 25.714, underscoring significant differences in investment and capital accumulation across countries and time. Similarly, government health expenditure (lnghex) averages 1.582 with a standard deviation of 0.402 and a wide range from 0.646 to 2.467, pointing to considerable variation in public health funding levels, some observations reflect very limited spending, while others show more substantial commitments.

Literacy rate (lnltr) presents a mean of 3.361 (approximate exponentiated value around 28.8 percent) but a high standard deviation of 0.735 and an extreme range from 0.91 (very low literacy) to 4.695 (much higher levels), illustrating the broad educational disparities persisting in the sample. Labor force (lnlbf) averages 15.508 with a standard deviation of 1.421 and a range from 12.558 to 18.11, reflecting notable differences in workforce sizes across the countries. Finally, disease prevalence level (lnpvd) has a mean of 2.769 with a standard deviation of 0.612 and a range from 1.224 to 4.212, indicating moderate to high variation in health burdens, which could play a key role in influencing productivity outcomes.

Overall, the statistics reveal substantial socioeconomic heterogeneity in the dataset, particularly in areas such as capital investment, health spending, literacy, labor force scale, and disease prevalence, while life expectancy remains comparatively more uniform. These patterns are consistent with the broader challenges in Sub-Saharan Africa, including inefficiencies in production, uneven health investments, and persistent disease burdens, which the study likely seeks to explore in relation to TFP dynamics.

4.2 Cross-Sectional Dependency Test

Testing for weak cross-sectional dependence (CSD)
H0: weak cross-section dependence
H1: strong cross-section dependence

Table 4.2: Cross-Sectional Dependency Test

	CD	CDw	CDw+	CD*
tfp	17.550	-1.080	195.540	-2.190
	(0.000)	(0.281)	(0.000)	(0.028)
lex	28.180	-2.680	264.480	-0.940
	(0.000)	(0.007)	(0.000)	(0.345)
gfcf	33.010	-2.940	266.760	1.730
	{0.000}	{0.003}	{(0.000}	{0.083}
ghex	-0.590	-3.640	182.970	7.280
	{0.555}	{0.000}	{0.000}	{0.000}
ltr	25.530	2.250	209.640	-0.520
	{0.000}	{0.024}	{0.000}	{0.602}
lbf	51.390	-3.310	414.220	-2.490
	{0.000}	{0.001}	{0.000}	{0.013}

pvd	3.500 {0.000}	9.910 (0.000}	242.630 {0.000}	-0.790 {0.429}

p-values in parenthesis. References CD:Pesaran (2015, 2021) CDw: Juodis, Reese (2021) CD*:Pesaran, Xie (2021)with 4 PC(s)

The cross-sectional dependence (CSD) tests conducted on the study's panel dataset reveal substantial evidence of strong cross-sectional dependence across most key variables, indicating significant interdependencies among the selected Sub-Saharan African countries. These tests examine the null hypothesis (H_0) of weak cross-sectional dependence against the alternative (H_1) of strong dependence, using a suite of modern statistics: the standard CD test (Pesaran, 2015/2021), the weighted CDw test (Juodis & Reese, 2021), the power-enhanced CDw+ test, and the bias-corrected CD* test (Pesaran & Xie, 2021). Rejection of the null (typically at $p < 0.05$) signals strong dependence, often arising from common factors such as regional economic shocks, shared policies, trade linkages, or spillover effects in health and productivity outcomes.

For total factor productivity (tfp), the standard CD test strongly rejects weak dependence (statistic 17.550, p = 0.000), as do the CDw+ (195.540, p = 0.000) and CD* tests, although the CDw test suggests weak dependence (-1.080, p = 0.281). Life expectancy (lex) exhibits consistent strong dependence under the CD (28.180, p = 0.000), CDw (-2.680, p = 0.007), and CDw+ (264.480, p = 0.000) tests, with only the CD* failing to reject the null. Similar patterns emerge for gross fixed capital formation (gfcf) and labor force (lbf), where multiple tests (including CD, CDw, CDw+, and CD*) overwhelmingly indicate strong dependence, reflecting notable cross-country correlations in investment and workforce dynamics. Literacy rate (ltr) and disease prevalence (pvd) also show strong dependence in most tests (e.g., CD and CDw/CDw+ for both), though the CD* occasionally suggests weaker dependence.

Government health expenditure (ghex) presents the most mixed results: the standard CD test fails to reject weak dependence (-0.590, p = 0.555), but the CDw (-3.640, p = 0.000), CDw+ (182.970, p = 0.000), and CD* (7.280, p = 0.000) tests all point to strong dependence. This inconsistency highlights that cross-sectional correlations may not be uniform across methodologies, possibly due to differences in how each test handles factors like latent common shocks or panel heterogeneity.

Overall, the predominance of strong cross-sectional dependence, particularly evident in tfp, life expectancy, capital formation, labor force, literacy, and disease prevalence, demonstrates substantial heterogeneity and interdependence among the countries in the sample. Such findings are common in regional panels like Sub-Saharan Africa, where shared macroeconomic conditions, health crises, or policy spillovers create interconnected outcomes. This justifies moving beyond first-generation panel methods (which assume cross-sectional independence) to second-generation approaches that explicitly account for these dependencies. Accordingly, the study appropriately adopts the Cross-Sectionally Augmented ARDL (CS-ARDL) estimator, which augments the traditional ARDL framework with cross-sectional averages to control for unobserved common factors, enabling reliable estimation of both short-run dynamics and long-run

relationships while addressing CSD. This methodological choice enhances the robustness of subsequent analyses examining the impact of life expectancy and related factors on total factor productivity.

Table 4.3: Unit Root with Trend

Variable	t-bar	Z[t-bar]	P-value	Stationarity Status
Tfp	-2.367	-0.108	0.457	Non-stationary
Lex	-2.357	-0.069	0.473	Non-stationary
Gfcf	-2.325	0.059	0.523	Non-Stationary
Ghex	-3.308	-3.812	0.000	Stationary
Ltr	-3.040	-2.755	0003	Stationary
Lbf	-1.678	2.608	0.995	Non-stationary
Pvd	-3.675	-5.254	0.000	Stationary
Without Trend				
Tfp	-2.453	-2.518	0.006	Stationary
Lex	-1.994	-0.827	0.204	Non-stationary (but D.lex is stationary
Gfcf	-2.661	-3.284	0.001	Stationary
Ghex	-3.339	-5.783	0.000	Stationary
Ltr	-3.040	-4.680	0.000	Stationary
Lbf	-1.797	-0.100	0.460	Non-stationary (but D.lbf is stationary)
Pvd	-3.735	-7.240	0.000	Stationary

Source*:* Researchers Compilation, (2025)

4.3 Unit Root Test

The unit root tests, conducted using Pesaran's Cross-Sectionally Augmented Dickey-Fuller (CADF) test to account for cross-sectional dependence, assess the stationarity properties of the study's key variables both with and without a deterministic trend. The null hypothesis (H_0) assumes the presence of a unit root (non-stationarity), while the alternative (H_1) indicates stationarity. Decisions are based on the t-bar statistic compared to critical values at 10%, 5%, and 1% significance levels, along with the Z[t-bar] statistic and its p-value.

With trend, most variables are found to be non-stationary at levels. Specifically, total factor productivity (tfp) has a t-bar of -2.367 (Z[t-bar] = -0.108, p = 0.457), failing to reject the null at conventional levels. Similarly, life expectancy (lex) (t-bar = -2.357, p = 0.473), gross fixed capital formation (gfcf) (t-bar = -2.325, p = 0.523), and labor force (lbf) (t-bar = -1.678, p = 0.995) are non-stationary. In contrast, government health expenditure (ghex) (t-bar = -3.308, Z[t-bar] = -3.812, p = 0.000), literacy rate (ltr) (t-bar = -3.040, Z[t-bar] = -2.755, p = 0.003), and disease prevalence (pvd) (t-bar = -3.675, Z[t-bar] = -5.254, p = 0.000) are stationary, with rejection of the null hypothesis at the 1% level (and 5% for ltr).

In contrast, without trend, the results differ notably. Total factor productivity (tfp) is stationary at levels (t-bar = -2.453, Z[t-bar] = -2.518, p = 0.006), as are gross fixed capital formation (gfcf), government health expenditure (ghex), literacy rate (ltr), and disease prevalence (pvd), all showing p-values below 0.01 and strong rejection of the unit root null. However, life expectancy (lex) (t-bar = -1.994, p = 0.204) and labor force (lbf) (t-bar = -1.797, p = 0.460) remain non-stationary at levels. When first-differenced, both become strongly stationary: D.lex (t-bar = -2.790, p = 0.000) and D.lbf (t-bar = -3.251, p = 0.000), confirming that lex and lbf are integrated of order one, I(1), while the others are integrated of order zero, I(0).

These mixed stationarity results, where the majority of variables are stationary at levels (especially without trend) and only life expectancy and labor force require first differencing—have important implications for econometric modeling. Non-stationary variables in levels can lead to spurious regression problems and unreliable inferences if not properly handled. The presence of both I(0) and I(1) variables in the dataset makes the Cross-Sectionally Augmented ARDL (CS-ARDL) approach particularly suitable, as it is robust to cross-sectional dependence and can consistently estimate short-run dynamics and long-run relationships regardless of whether variables are I(0) or I(1), without requiring pre-testing for cointegration or imposing strict integration orders (Pesaran, Shin, & Smith, 2001). This flexibility supports the study's choice of CS-ARDL for analyzing the relationship between life expectancy, health-related factors, and total factor productivity in the Sub-Saharan African context.

Table 4.4: Dynamic Common Correlated Effects Mean Group (CS-ARDL) Estimation Results

Dependent Variable: L.lntfp

Lntfp	Coef.	Std.Err.	Z	P>z	[95% Conf.	Interval]
Short Run Est.						
Mean Group:						
L.lntfp	0.648	0.043	15.200	0.000	0.564	0.731
Lnlex	0.413	0.337	1.230	0.220	-0.247	1.074
Lngfcf	-0.042	0.027	-1.540	0.123	-0.096	0.012
Lnghex	-0.039	0.083	-0.470	0.642	-0.201	0.124
Lnltr	0.009	0.032	0.280	0.782	-0.054	0.071
Lnlbf	-0.055	0.063	-0.870	0.383	-0.178	0.068
Lnpvd	0.116	0.075	1.550	0.121	-0.031	0.263
Adjust. Term						
Mean Group:						
lr_lntfp	-0.352	0.043	-8.270	0.000	-0.436	-0.269
Long Run Est.						
Mean Group:						
lr_lnltr	-0.065	0.107	-0.610	0.543	-0.274	0.144
lr_lngfcf	-0.150	0.075	-1.990	0.047	-0.298	-0.002
lr_lnghex	-0.088	0.379	-0.230	0.816	-0.830	0.654
lr_lnlbf	-0.103	0.167	-0.620	0.538	-0.430	0.224
lr_lnlex	0.798	0.912	0.880	0.382	-0.990	2.586
lr_lnpvd	0.537	0.281	1.910	0.056	-0.013	1.087

Source: Researchers Compilation, (2025)

4.4 Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL)

The Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) Mean Group estimator results, presented in Table 4.4, examine the short-run and long-run relationships between total factor productivity (lnTFP) and its determinants in a panel of 12 Sub-Saharan African countries, spanning 504 observations (average 42 per cross-section). This second-generation approach incorporates cross-sectional averages to address unobserved common factors and dependence, yielding robust estimates despite persistent inter-country correlations.

Model diagnostics confirm overall validity, the F-statistic ($F(120, 384) = 16.38$, $p < 0.01$) indicates joint significance of the regressors, while R-squared values show 16% explanation of overall variance and a strong 89% at the Mean Group level. The CD statistic (-2.28, $p = 0.0223$) supports weak cross-sectional dependence post-augmentation, validating the CCE-based methodology.

(L.lntfp) positive and highly significant (0.648, $p < 0.01$), implying that past TFP levels strongly shape current outcomes. However, most explanatory variables show insignificant immediate effects. Life expectancy (lnlex) is positive but statistically insignificant (0.413, $p = 0.220$), suggesting health and longevity improvements do not translate into rapid productivity gains, consistent with findings from Iseghohi (2021) and Onyema et al. (2019), but contrasting with studies like Mba et al. (2023), Aqsa et al. (2022), and Ullah (2019). Gross fixed capital formation (lngfcf) (-0.042, $p = 0.123$), government health expenditure (lnghex) ($p = 0.642$), literacy rate (lnltr) ($p = 0.782$), labor force (lnlbf) (-0.055, $p = 0.383$), and disease prevalence (lnpvd) (0.116, $p = 0.121$) all lack significance, indicating that short-term fluctuations in capital investment, public health spending, education, labor supply, and disease dynamics do not immediately drive productivity changes. These patterns align with Remi et al. (2020) on health expenditure but contradict Pajooyan (2015).

The error correction term (lr_lntfp) is negative and highly significant (-0.352, $p < 0.01$), confirming stable long-run equilibrium dynamics. Approximately 35.2% of any disequilibrium is corrected annually, reflecting gradual convergence after short-run shocks.

In the long run, the results are more nuanced and often counterintuitive. Gross fixed capital formation (lr_lngfcf) exerts a negative and significant impact (-0.150, $p = 0.047$), suggesting that higher capital accumulation may not enhance productivity—possibly due to inefficiencies, misallocation, or poor infrastructure governance, as highlighted in SSA contexts (Ndulu et al., 2007). Disease prevalence (lr_lnpvd) shows a marginally positive association (0.537, $p = 0.056$), an unexpected finding potentially linked to labor market distortions or informal sector dynamics. Literacy rate (lr_lnltr) ($p = 0.543$) and labor force (lr_lnlbf) ($p = 0.538$) remain insignificant, implying limited long-term productivity contributions from education and labor supply. Notably, life expectancy (lr_lnlex) is positive but insignificant (0.798, $p = 0.382$), and government health expenditure (lr_lnghex) ($p = 0.816$) also lacks significance, negating evidence from Adesanya et al. (2023) and Alhassan et al. (2020) on a strong health-productivity link.

These findings suggest that while TFP is highly persistent, short-run influences from health, capital, education, labor, and disease remain limited, with effects potentially requiring longer horizons to materialize. The significant error-correction term underscores the system's return to equilibrium post-shocks, emphasizing long-term structural policies. The negative long-run role of capital investment points to the need for better allocation and efficiency rather than mere volume increases. The marginal positive effect of disease prevalence highlights complex informal economy interactions. Insignificant impacts from health expenditure, literacy, and labor force may reflect underlying constraints: corruption, lack of transparency, and inefficiencies in public spending (Lewis, 2006; Anyanwu and Erhijakpor, 2009); poor education quality despite formal literacy (Hanushek and Woessmann, 2008; Pritchett, 2013); labor market rigidities, underemployment, and concentration in low-productivity sectors (Rodrik, 2014; McMillan, Rodrik, and Verduzco-Gallo, 2014); and health infrastructure weaknesses where life expectancy gains do not convert into productive years (Acemoglu and Johnson, 2007; Weli, 2007).

5. Conclusion and Recommendation

5.1 Conclusion

This study set out to investigate the impact of life expectancyon total factor productivity (TFP) in selected Sub-Saharan African countries, with a particular focus on the role of health outcomes as a component of human capital in driving economic performance. In the long run, gross fixed capital formation was found to have a negative and statistically significant effect on productivity, raising concerns about the efficiency of capital investment in the region. Although life expectancy and other health-related indicators did not show statistically significant effects in the long run, the marginal significance of disease prevalence indicates that health conditions might influence productivity through complex, possibly indirect channels. Overall, the study concludes that while health indicators, particularly life expectancy, may not exert immediate or direct effects on productivity in Sub-Saharan Africa, their broader implications cannot be discounted. The persistent productivity effects observed over time point to the importance of long-term investment in health infrastructure, human capital development, and institutional quality.

5.2 Recommendations

Since life expectancy was found to be statistically insignificant in explaining long-run total factor productivity (TFP), it is recommended that policy in Sub-Saharan Africa should not only aim at extending lifespan but also ensure that the added years are productive through investments in education, skills training, and innovation capacity. The insignificant result suggests that longer life expectancy alone does not automatically translate into productivity gains without parallel improvements in human capital quality, labor market participation, and technological adoption. Policymakers should therefore integrate health policies with broader economic strategies by strengthening health–education linkages, enhancing workforce productivity, and creating enabling environments for innovation. This integrated approach would allow improvements in longevity to have a more meaningful impact on long-run productivity growth

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