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Does Institutional Quality Enhance the Effect of Health Outcomes on Economic Growth? Insights from Sub-Saharan African Countries

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Abstract: Institutional quality (InQ) plays an important role in shaping economic growth (ECG), influencing how economies develop and perform. The literature addresses the nexus between InQ and ECG and the link between health and ECG; findings are often contradictory, creating knowledge gaps. Importantly, research on the interplay between InQ, health, and ECG in Sub-Saharan African (SSA) countries is particularly limited. This study aims to address this gap by evaluating how health impacts ECG, with an emphasis on the mediating role of InQ in the health–growth nexus in SSA. This study examines these interplays across 35 SSA countries from 2012 to 2022. The life expectancy at birth (LEX) and real gross domestic product per capita (GDP) are used as proxies for health outcomes and ECG, respectively. The system generalised method of moments estimator is employed to analyse data. Results show that the LEX has a strong positive effect on economic growth in SSA countries. Furthermore, the InQ indicators (such as control of corruption, government effectiveness, rule of law and political stability, and absence of violence) are positively correlated with ECG. When the LEX interacts with InQ indicators, InQ is identified as a key channel through which LEX influences ECG. The findings confirm that InQ plays a crucial role in the health–growth nexus, with the positive impact of LEX on ECG being more pronounced in countries with higher levels of InQ, while the effect is weaker in countries with lower levels of InQ. The findings of this study have crucial policy implications, highlighting the intricate link among institutional quality, health outcomes, and economic growth. This study's findings provide essential insights for policymakers to design focused strategies that improve InQ and health outcomes to achieve sustained ECG in SSA.

Keywords: growth; health outcome; institutional quality; life expectancy; SSA

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1. Introduction

In the quest for sustainable development, the interplay among institutional quality (InQ), health, and economic growth (ECG) becomes increasingly crucial (Gani 2011; Sani et al. 2019; Wandeda et al. 2021; Gebresilassie et al. 2024). InQ has emerged as a prominent area of study to gauge its influence on ECG (North 1996; Gani 2011; Sani et al. 2019; Gebresilassie et al. 2024). Accordingly, many studies have demonstrated the link between InQ and ECG across countries (Sani et al. 2019; Wandeda et al. 2021; Gasimov et al. 2023; Hussen 2023; Gebresilassie et al. 2024).

Wandeda et al. (2021) examined the impact of InQ on ECG (see Appendix B for acronyms and abbreviations) for 35 Sub-Saharan African (SSA) countries covering 2006–2018.

Using a two-step S-GMM, they found the beneficial effect of InQ on ECG. Importantly, the impact of InQ on ECG varies with the level of income in the region. The enhancement in InQ is less likely to enhance the growth rate of middle-income countries than low-income countries in SSA. Moreover, evidence has indicated that InQ plays a crucial role in explaining the differences in ECG among countries. The differences in InQ are attributed to the ECG of the SSA countries (Hall et al. 2010; Gebresilassie et al. 2024). For example, the differences in ECG performance between Botswana and Nigeria are due to the differences in InQ between the two countries (Fosu and Gafa 2019).

Other empirical evidence underscores the economic slowdown in SSA associated with weak InQ (Alam et al. 2017; Gasimov et al. 2023; Hussen 2023). Alam et al. (2017) found that government effectiveness (GEF) positively influences SSA's ECG. Furthermore, Hussen (2023) observed that promoting investment and democratic and regulatory institutions impact SSA's economies. Gasimov et al. (2023) demonstrated the positive and negative effects of InQ dimensions on ECG for post-Soviet countries. Gebresilassie et al. (2024) examined the impact of GEF on ECG in SSA countries. However, the links among InQ, health outcomes, and ECG remain unexplored, particularly in SSA.

The relationship between health and ECG is well recognised. Health improvements can significantly enhance ECG. Despite the global progress in ECG and health outcomes, SSA continues to lag, with both poor InQ and adverse health outcomes (Sani et al. 2019). SSA also exhibits some of the worst health statistics (World Health Statistics 2021, 2022, 2023). For example, the global life expectancy[1] (LEX) has improved from 46.5 years in 1950 to around 73.3 years in 2019. However, the progress in the African region was slower, with the lowest LEX at 37.6 years in 1950 and 61.24 years in 2019 (World Health Statistics 2021, 2022) (Figure 1). The overall gains in LEX reveal insightful changes in mortality over the past years. While Africa has reduced its under-five mortality rate (U5MR), it remains the highest globally, at 70 deaths per 1000 births, compared with the global average of 37 deaths per 1000 births in 2022 (World Health Statistics 2023).

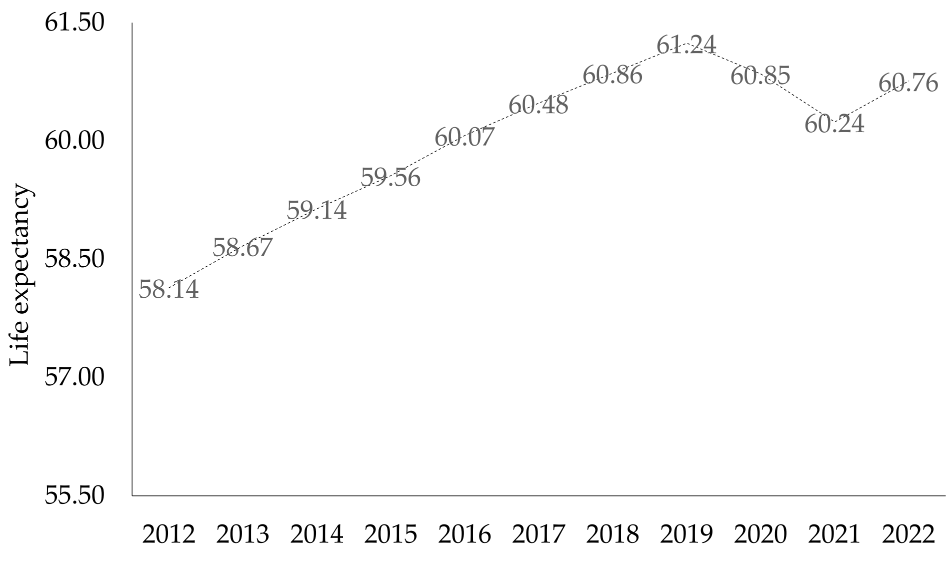

Figure 1. Health outcome measured as life expectancy (total), 2012–2022. Source: Authors' computation from WDI data source (2012–2022).

Few researchers have examined the impact of InQ on health outcomes (Boachie 2017; Hall et al. 2018; De Luca et al. 2021; Sharma et al. 2022). These studies indicate that InQ has a strong impact on health outcomes (Boachie 2017; Hall et al. 2018; De Luca et al. 2021; Sharma et al. 2022). For example, Ouedraogo et al. (2020) assessed the effect of InQ on health outcomes using data from 45 SSA countries from 1996 to 2018, showing that InQ significantly positively impacts health outcomes. Using a fixed effects estimator, Sharma (2020) also found a strong positive effect of InQ on health outcomes in SSA. In

Italy, De Luca et al. (2021) evaluated the effect of InQ on healthcare services provisions covering 2007–2012. They found that InQ has a strong beneficial effect on healthcare services provision. Corruption (CCR), an indicator of InQ, has been shown to adversely affect health, growth, and development (Vian 2020), as well as happiness and life expectancy (Achim et al. 2020). Addressing CCR could strengthen the healthcare systems, potentially contributing to universal health coverage (Vian 2020). Socoliuc et al. (2022) found that higher InQ is correlated with reductions in the death of a child and enhanced LEX within the European Union. Sharma et al. (2022) found that InQ has a strong beneficial effect on health outcomes. In SSA countries, a study by Makuta and O'Hare (2015) revealed that strong InQ has a positive effect on health outcomes, implying that in countries with higher levels of InQ, public health spending is more efficient than in countries with lower levels of InQ.

While the literature addresses the nexus between InQ and ECG and the link between health and ECG, findings are often contradictory, creating knowledge gaps. Research on the interplay among InQ, health, and ECG in SSA is particularly limited. The present study aims to address this gap by evaluating how health impacts ECG, with an emphasis on the mediating role of InQ in the health–growth nexus in SSA. Strong InQ and improved health outcomes are expected to enhance ECG.

This study contributes to the health–growth nexus literature in three significant ways. This study explores the tripartite linkages among InQ, health, and ECG in SSA. The majority of the existing studies examined the link between health outcomes and economic growth, while other studies assessed the link between InQ and economic growth. This study, however, explores the interplay among these three variables (InQ, health, and economic growth), which is understudied in the context of SSA countries. Second, InQ is a pressing issue in developing countries like SSA countries; this study evaluates the mediating role of InQ in the health–growth nexus in SSA. This study employs six separate InQ indicator impacts on the health–growth nexus, which remains underexplored in earlier studies. The use of six separate InQ indicators provides a nuanced understanding of the specific effects of these indicators on economic growth, and exploring them separately assists in identifying how the specific InQ indicators contribute to economic growth or hinder development (Acemoglu and Johnson 2007; Rodrik et al. 2004). A combined InQ index can hide these specific effects, leading to a loss of nuanced insights into how these InQ indicators affect ECG. Furthermore, an S-GMM is employed to address serial correlation, endogeneity, and cross-sectional dependencies. The S-GMM differs from the traditional static panel estimators in that it mitigates endogeneity by using instruments and, as a result, provides efficient and unbiased estimates. In summary, the findings drawn from this study are anticipated to enhance existing knowledge and offer valuable insights for policymakers into achieving sustainable growth and improving overall health outcomes in SSA.

The paper is outlined below. The following section reviews the literature on InQ, health, and ECG nexus. Section 3 describes the sources of the data and methodology. Section 4 presents the empirical results of the study. Section 5 discusses the findings in reference to the previous studies, while the last section concludes.

2. Literature

2.1. Conceptual Framework

Earlier studies have mainly focused on the macroeconomic variables, developing a conceptual framework that explores the macroeconomic determinants of economic growth such as foreign direct investment, inflation, investment, population growth, trade openness, and others (Sani et al. 2019; Alabed et al. 2021; Wandeda et al. 2021; Chomen 2022; Gebresilassie et al. 2024). In addition, evidence reveals that InQ influences health outcomes (Boachie 2017; Hall et al. 2018; De Luca et al. 2021; Sharma et al. 2022). Furthermore, some earlier studies also examined the effect of health outcomes on economic growth (Boachie 2017; Hall et al. 2018; De Luca et al. 2021), while some other earlier studies also examined the role of InQ on economic growth (Sani et al. 2019; Alabed et al. 2021; Wandeda et al. 2021; Chomen 2022; Gebresilassie et al. 2024).

Although many empirical studies adopted similar patterns, most of them have not adequately simultaneously addressed the triplet effects of InQ, health, and their interactions on economic growth, at least in the context of SSA countries. These factors (InQ, health outcomes, and their interaction effects) that can have direct or indirect (mediating) effects on ECG are often underexplored in the literature.

While developing this conceptual framework, we took into account these issues to address the gap in the literature. Figure 2 illustrates the conceptual framework developed for this study. Line 1 shows the conventional approach that explores the determinants of economic growth, with extensive literature examining how macroeconomic factors directly affect economic growth (Sani et al. 2019; Alabed et al. 2021; Wandeda et al. 2021; Chomen 2022; Gebresilassie et al. 2024). Line 2 shows how these macroeconomic factors directly influence health outcomes, while line 3 illustrates that InQ can directly influence the macroeconomic variables. Line 4 shows the direct impact of InQ on health outcomes, while line 5 outlines the indirect (mediating) effect of InQ and the direct effect of health outcomes on economic growth (ECG). Finally, line 6 illustrates the direct separate s of InQ on the ECG.

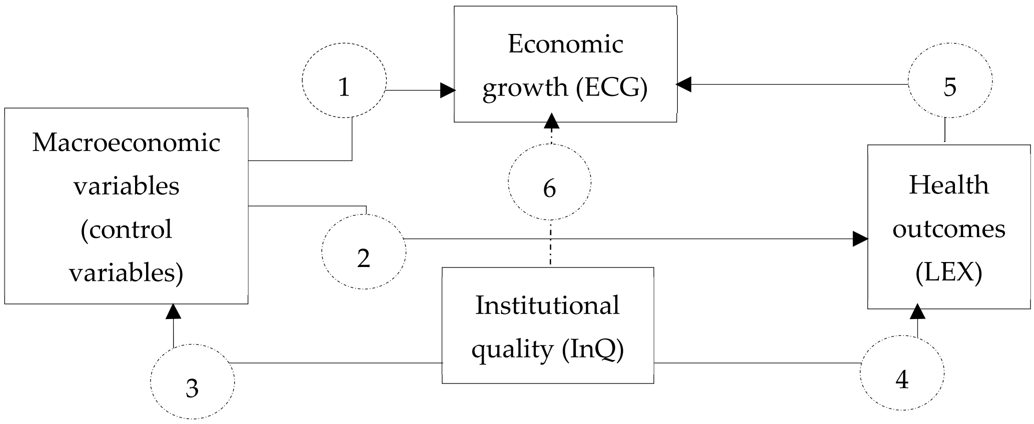

Figure 2. Conceptual framework of the study. Source: Adopted from Azimi and Rahman (2024) with slight modification.

2.2. Review of Empirical Studies

2.2.1. Institutional Quality and Economic Growth

InQ plays an important role in shaping ECG, influencing how economies develop and perform. North (1990) defined institution (or InQ) as "the humanly devised constraints that shape human interaction". North further explained institution as "the interaction between institutions and organizations that shapes the institutional evolution of an economy". As Institutions are the rules of the game, North notes, "organizations and their entrepreneurs are the players" (North 1996). Institutions are considered by economists to be different sets of determinants in formal and informal institutions that shape the behaviour of organisations that influence ECG (Becherair 2014).

Evidence indicates that InQ is an important non-economic factor in ECG (Gani 2011; Gebresilassie et al. 2024). Accordingly, there is a growing agreement among policy analysts, economists, and researchers that InQ contributes a notable role in examining the variations in ECG among countries. Using a fixed-effects model, Gani (2011) assessed the InQ–growth nexus in 84 developing countries covering 1996–2006. Using a panel data estimator, the author reveals that GEF and PSV are positively and strongly associated with ECG, while voice, accountability (VA), and CCR are negatively associated with ECG. The author concludes that an improvement in InQ is a basis for effective and sustained ECG in developing countries. Iheonu et al. (2017) explored the impact of InQ on ECG in 12 West African countries spanning 1996–2015 using mixed (such as fixed effects, random effects and 2SLS) approaches. They found that InQ had a beneficial effect on ECG. Sani et al. (2019) examined the role of debt and InQ on ECG (real GDP per capita) in 46 SSA countries covering 2000–2014. Using S-GMM, they found that InQ had both direct and indirect effects on ECG, indicating that the interaction between InQ and debt had a strong and positive beneficial effect on the debt–growth link. Wandeda et al. (2021) assessed the effect of InQ on ECG in 35 SSA countries spanning 2006 to 2018. Based on the S-GMM analysis, the results indicate the beneficial impact of InQ on ECG. The findings reveal that the role of InQ on ECG differs with countries in the SSA regional location. In the West African region, InQ has a stronger effect on ECG than in the Central Africa and Eastern Africa regions. Furthermore, the impact of InQ on ECG differs with countries' income levels. An enhancement in InQ is more likely to enhance the ECG of countries with low income levels than the countries with middle income levels in SSA.

Alabed et al. (2021) evaluated the role of InQ and financial inclusion on ECG in 20 countries of SSA covering 2004–2020 using the S-GMM. They found that InQ has varied effects using "real GDP", "real GDP per capita", and "GDP growth rate" as outcome variables of interest. The InQ index had a beneficial effect on ECG when it was measured in GDP growth rate and per capita GDP and a regressive effect on growth when it was measured using real GDP. Moreover, financial inclusion had a beneficial effect on ECG (real GDP). Furthermore, Gebresilassie et al. 2024 utilised an S-GMM estimator to explain whether InQ affects ECG in 37 SSA countries spanning 2012–2022. The results reveal that CCR and GEF have detrimental effects on the SSA's ECG. Importantly, they found that the interaction between CCR and GEF worsens the negative impact of CCR on ECG in SSA economies. These imply that SSA's economic performance could be enhanced by improving the InQ in the SSA region. Furthermore, Using GEF and CCR, Gebresilassie et al. (2024) explored their impact on ECG in 37 SSA countries spanning 2012–2022. Based on the estimates of the S-GMM, CCR and GEF had negative effects on ECG. Moreover, they found that the interaction between GEF and CCR affected ECG. However, using the S-GMM, Chomen (2022) evaluated the impact of InQ on ECG (GDP per capita) in 43 SSA countries over 13-year periods. The estimation results revealed that the InQ did not have any impact on ECG.

2.2.2. InQ, Health, and ECG

Emamgholipour and Asemane (2016) investigated the impact of InQ on health outcomes (U5MR) in 27 OECD countries covering 1996–2012. Using a GMM technique, the results indicated that InQ significantly affected U5MR. A 1% increase in lagged U5MR led to a 0.83% increase in U5MR. Similarly, a 1% improvement in control of corruption (CCR) and rule of law (RLA) dimensions of InQ decreased U5MR by 0.05% and 0.08%, respectively. Furthermore, a 1% increase in the total fertility rate led to a 0.09% increase in U5MR. The findings of the study suggest that an improvement of InQ (mainly CCR and RLA) significantly decreases U5MR. Ibukun (2021) explored the effect of InQ and health expenditure on U5MR and adult mortality in 15 ECOWAS countries covering 2000–2018. Using the "panel fully modified least squares and the fixed effects model", the findings reveal that poor InQ (CCR) increases adult mortality while InQ (political stability) reduces U5MR and adults. Moreover, the findings reveal that urbanisation and health expenditure influence health outcomes.

The nexus between health and ECG has gained great attention in recent years. Few empirical researchers have examined the impact of health outcomes on ECG in the existing literature; where such empirical studies have been carried out, the findings are either inconclusive or contradicting at best. Very few empirical studies have tried to explore the causality between ECG and health outcomes. For example, Boachie (2017) examined the impact of health outcomes on the growth rate of Ghana covering 1982–2012 using the "Autoregressive Distributed Lag-ARDL" estimator. The LEX was used as a proxy measure of health to assess its impact on ECG. The author found that both in the short- and long-run, a better health outcome enhances Ghana's ECG. The author concluded that investing in the health sector of the country could enhance not only the health status of the people but also the income of the country.

In India, Mohapatra (2017) explored the causal linkage between ECG and government spending on health and infant mortality rate (IMR) on 20-year panel data. The author found that the GDP of the country causes government spending on health both in the short- and long-run. Moreover, in the long run, government spending on health and growth was found to cause IMR. Furthermore, Odhiambo (2021) examined the causal nexus between health spending and ECG in SSA spanning 2008–2017 by employing the "panel Granger-causality model". The author found that the causality nexus between health and ECG depends on the SSA countries' level of annual income and the proxy measure employed for health spending. The author indicated that the causality link is from health (life expectancy) to growth for middle-income SSA countries both in the short run and long run.

The causality link is from health (life expectancy) to ECG in low-income SSA countries. Donkor et al. (2023) explored the role of InQ (CCR and PSV) on child mortality using an S-GMM estimator for 26 emerging countries covering 2000–2016. The study indicated that CCR was found to be the most crucial factor affecting under-five child mortality (U5MR), while they found that political stability has reduced both U5MR and adult deaths. This implies that PSV plays an important role in minimising the untimely deaths of U5MR and adults in emerging countries.

Few studies have also studied the effect of InQ on health outcomes. CCR, a measure of InQ indicators, remains the most crucial factor affecting health outcomes. High levels of corruption have a strong effect on the population. Corruption is adversely correlated with a country's health outcomes. Countries with the lowest level of CCR have reduced IMR and child mortality rates and higher life expectancy (Factor and Kang 2015; Lio and Lee 2016). Overall, good governance in the healthcare context signifies that the sector (health) is operating successfully and efficiently.

The role of InQ in health literature has been proposed to be a crucial issue since 1980 (Emamgholipour and Asemane 2016). Ouedraogo et al. (2020) examined the role of InQ on health outcomes in 45 SSA countries over the period 1996 to 2018. Using a two-step least square (2SLS) estimator, the results indicate that InQ indicators (such as "rule of law, control of corruption, government effectiveness, voice and accountability, and political stability and absence of violence") enhance health outcomes. Furthermore, they found that economic development, access to electricity, and basic education enhance the health outcomes of the SSA.

Improving InQ is becoming more important throughout the globe, mainly in developing countries like SSA countries, which are making significant economic reforms and investment-attractive initiatives (Globerman and Shapiro 2002) to establish a conducive environment for sustained ECG. Hadipour et al. (2023) investigated the role of InQ on health outcomes in 158 countries over the period 2001–2020. Using fixed effects and S-GMM estimators, they found that the composited InQ index and six measures of InQ affected IMR while it had a strong and beneficial effect on LEX for high-income countries.

In low-income countries, InQ indicators such as CCR, PSV, and VA had a strong beneficial effect on LEX. Furthermore, Arize et al. (2024) assessed the health expenditure and health outcomes menus (measured in terms of LEX, infant (IMR), maternal and adult mortality (MAR) rates) while highlighting the role GEF as an indicator InQ plays in 45 SSA countries covering 1960–2022. Based on the autoregressive distributed lag (ARDL) estimator analysis and using Nigeria as an example, the results indicate that an improvement in GEF reduces MAR and IMR. One-unit improvement in GEF decreases MAR by 0.11 units, and an improvement in GEF decreases IMR by 0.49 units, whereas the impact of GEF on LEX was found to be not significant.

2.3. Research Gaps

Although many studies have contributed substantially to the existing literature on how institutional quality influences economic growth and how institutional quality affects health outcomes, exploring the mediating role of InQ in the heath–growth nexus could enhance growth. Importantly, there are no studies to our knowledge that examine the effects of InQ, health, and their interactions on ECG in the context of SSA countries. In addition, a variety of estimators (pooled panel OLS, GLS, S-GMM, random and effect effects) have been adopted to explore the InQ–growth nexus and InQ–health nexus, and very few on the links among InQ, health, and ECG, leading to contradictory findings. Importantly, various studies have employed different outcome variables (dependent variables), for example, real GDP per capita (Becherair 2014; Boachie 2017; Alabed et al. 2021; Chomen 2022; Gebresilassie et al. 2024), real GDP (Alabed et al. 2021), and GDP growth rate (Gani 2011; Alabed et al. 2021; Wandeda et al. 2021). Another important gap in the literature is the absence of the interaction between InQ and health outcomes on economic growth in SSA, which is a novel finding of this study. While the effect of institutional quality on ECG in most developing countries, including SSA countries, has been widely studied, the effect of health outcomes on economic growth has not been extensively explored in SSA. Importantly, in SSA, the mediating effect of institutional quality on the health–growth nexus has been underexplored. This study, therefore, aims to address these research gaps by examining how institutional quality, health outcomes, and their interactions affect economic growth in SSA countries.

Hence, in line with the developed conceptual framework and to address these empirical research gaps, we have proposed the following three major interconnected research hypotheses:

H_1. *LEX enhances ECG, i.e., LEX has a beneficial effect on economic growth.*

H_2. *InQ improves ECG, i.e., InQ has a beneficial effect on economic growth.*

H_3. *Interaction of InQ with health outcome (LEX) enhances the beneficial effects of life expectancy on economic growth, i.e., the interactions between InQ and LEX ($InQ * LEX$) improve the beneficial effects of LEX on economic growth.*

3. Methodology

To assess the role of InQ on the health–growth nexus, datasets were obtained from the World Health Organization (WHO), the World Development Indicator (WDI), the World Economic Outlook (WEO), and the United Nations (UN) databases from 2012 to 2022 for a panel of 35 SSA countries. The selection of SSA countries as a case study shows the role of institutional quality on the health–growth nexus, which has never been studied in these countries, to our knowledge. The sample countries and study period have been selected based on the available complete data for the included study variables (see Appendix A).

3.1. Description of Variables

To evaluate the role of InQ on the health–growth nexus, the real GDP per capita (constant 2015 USD) is employed as a proxy for ECG (dependent variable), consistent with existing literature (Becherair 2014; Boachie 2017; Sani et al. 2019; Alabed et al. 2021; Chomen 2022; Gebresilassie et al. 2024). This study uses six InQ indicators (CCR, GEF, PSV, RQT, RLA, and VA), as shown in Table 1 and described by Kaufmann et al. (2010) as the primary independent variable of interest. The estimates or indices of InQ in standard normal units range from −2.5 (weakest) to 2.5 scales (strongest); the greater values correspond to good InQ (governance) and vice versa. The IQ indicators are defined based on Kaufmann et al. (2010) as follows:

i. Control of Corruption (CCR) is defined as *"capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests."*
ii. Government Effectiveness (GEF) is defined as *"capturing perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism".*

iii. Political Instability and Absence of Violence (PSV) *"measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism"*.

iv. Regulatory Quality (RQT) is defined as *"capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development"*.

v. Rule of Law (RLA) is defined as *"capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence"*.

vi. Voice and Accountability (*VA*) is defined as *"capturing perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism"*.

Table 1. Sources, descriptions of variables, and their roles.

Symbol Used	Definition and Measurement	Expected Sign	Data Sources	Role of the Variables
GDP	GDP per capita (constant 2015 USD)		World Development Indicators (WDI)	Main dependent variable
FDI	Foreign direct investment, net inflows (% of annual GDP)	Positive		Control explanatory variables
GOV	General government final consumption expenditures (% of GDP)	Positive		
IVT	Gross capital formation (% of annual GDP)	Positive		
POP	Population growth rate (annual %)	Negative		
INF	Inflation, consumer price index (% annual)	Negative		
LEX	Life expectancy at birth, total (years): "indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life"	Positive		Main explanatory variable
InQ	The indices (estimates) of the InQ indicators range from −2.5 (weak) to +2.5 (strong)		WGI	Main explanatory variable
CCR	"Control of corruption"	Negative		
GEF	"Government effectiveness"	Positive		
PSV	"Political stability and absence of violence/terrorism"	Negative		
RQT	"Regulatory quality"	Positive		
RLA	"Rule of law"	Positive		
VA	"Voice and accountability"	Positive		

Note: Own compilation from the data sources.

In addition, the health outcome is measured using life expectancy at birth in total years (LEX) and under-five child mortality (U5MR). In this study, LEX is used as a proxy for health. Furthermore, to minimise the omitted variables issue, control variables (macroeconomic independent variables) such as "foreign direct investment (FDI)", government expenditure (GOV), investment (IVT), inflation rate (INF), and population growth (POP) have been included in the regression model along with the main independent variables of interest (InQ and LEX).

3.2. Model Specifications

To assess the impact of InQ on the health–growth nexus, this study is guided by the "exogenous growth theory" specified below:

$$GDP_{pcg,it} = \alpha_1 GDP_{pcg,i(t-1)} + \alpha_j LEX'_{it} + \alpha_k InQ'_{it} + \alpha_q X'_{it} + \gamma_t + v_i + \varepsilon_{it} \quad (1)$$

where $GDP_{pcg,it}$ denotes real GDP per capita (annual). $GDP_{pcg,i(t-1)}$ is the one-year-lagged GDP per capita. InQ'_{it} refers to the InQ indicators ("control of corruption—CCR, government effectiveness—GEF, political stability and absence of violence—PSV, regulatory quality—RQT, rule of law—RLA and voice and accountability—VA"). X_{it} refers to the set of control variables. α_1, α_j, α_k, α_l, and α_q are estimated parameters. γ_t is an unobserved time-specific error term (period effect) while v_i is the country-specific error term (country fixed effect). ε_{it} denotes the idiosyncratic error term. i = 1, 2,3, ..., N (cross-sections) and $t = 2012,\ 2013, \ldots\ldots 2022$ (time periods).

The growth model is augmented with the interaction between LEX and InQ $(LEX'_{it} * InQ'_{it})$ into Equation (1) and is specified below:

$$lnGDP_{pcg,it} = \alpha_1 lnGDP_{pcg,i(t-1)} + \alpha_j lnLEX'_{it} + \alpha_k lnIQ'_{it} + \alpha_l ln\left(LEX'_{it} * InQ'_{it}\right) + \alpha_q lnX'_{it} + \gamma_t + v_i + \varepsilon_{it} \tag{2}$$

where ln denotes natural logarithm, and $LEX'_{it} * InQ'_{it}$ denotes the linear interaction between InQ and LEX.

3.3. Techniques/Procedures of Analysis

According to earlier studies, the lag of ECG (dependent variable) could affect the present growth. In addition, the explanatory variables, which are included in our dynamic model, could be exogenous. Estimating the effect of InQ on the health–growth nexus employing static techniques could lead to biased, inefficient, and inconsistent parameter estimates. Hence, to ensure the validity of the parameter estimates, various estimation techniques or procedures have been employed.

Firstly, to check whether the data are stationary, "the Levin-Lin-Chu (LLC)" unit root test was employed (Levin et al. 2002). Then, to address whether there is a panel effect or not, we applied the Breusch Pagant test (Breusch and Pagan 1979) (pooled ordinary least square–pooled panel OLS). The estimate indicates there is a panel effect, which suggests that the pooled panel OLS could not be an efficient estimator.

To address the question, "Is there any correlation between the explanatory variables and error terms?", the Hausman test was applied either to use a fixed effect (FE) or random effect (RE) estimator (Hausman 1978). Accordingly, the FE technique was found suitable, as it showed no association between independent variables and the error terms. We also diagnosed autocorrelation and heteroskedasticity. However, the use of pooled panel OLS, FE, and RE static panel model techniques could yield inconsistent and biased estimates while variables in these models are exogenous (Campos and Kinoshita 2008), which is the case in this study on the role of InQ in the health–growth nexus. Here, the covariates (independent variables) included in the growth model are exogenous to the ECG. In addition, the inclusion of the lagged dependent variable may contribute to high serial correlation (Wooldridge 2010).

To address these issues, we applied the GMM, the most appropriate estimator and a commonly used dynamic panel data model (Judson and Owen 1999). The difference (D-GMM) and system GMM (S-GMM) were developed by Arellano and Bond (1991). The D-GMM estimator fails to account for the changes in persistent covariates in the model, resulting in weak instrumental variables. According to Arellano and Bover (1995) and Blundell and Bond (1998), D-GMM produced inefficient, inconsistent, and biased parameter estimates because the study period was very short and the instruments weak, while the S-GMM produced more efficient estimates due to the inclusion of additional instruments. In addition, the S-GMM estimator addresses omitted variable biases, endogeneity, and measurement errors efficiently with endogenous explanatory variables. Hence, unlike other dynamic panel estimators, the S-GMM estimator provides efficient, robust, and unbiased regression estimates when there is a large number of observations and short time periods, like in the present study (Arellano and Bond 1991; Blundell and Bond 1998). Thus, this study employed the two-step S-GMM panel dynamic technique to examine the role of InQ on the health–growth nexus in SSA. The S-GMM technique eliminates endogeneity by using internal instruments instead of external ones (Ramzan et al. 2019). To check the validity of the instrument sets employed in the S-GMM estimator, the Hansen test was estimated. Arellano–Bond AR(1) and AR(2) serial correlation tests on the residuals were also conducted. These tests assess the validity of instrumental variables and the existence of serial correlation in the estimator residuals (Blundell and Bond 1998).

Figure 3 shows the steps used to select appropriate regression models. Initially, data were obtained relating to InQ, health outcomes, and control or macroeconomic variables from international databases. Secondly, a panel unit root test was performed using LLC. Thirdly, based on the pre-estimation tests, appropriate and suitable regression models were selected (S-GMM). Finally, post-estimation tests were computed to check the robustness of the estimates. 'Stata' version 17 was used to compute the statistical analyses.

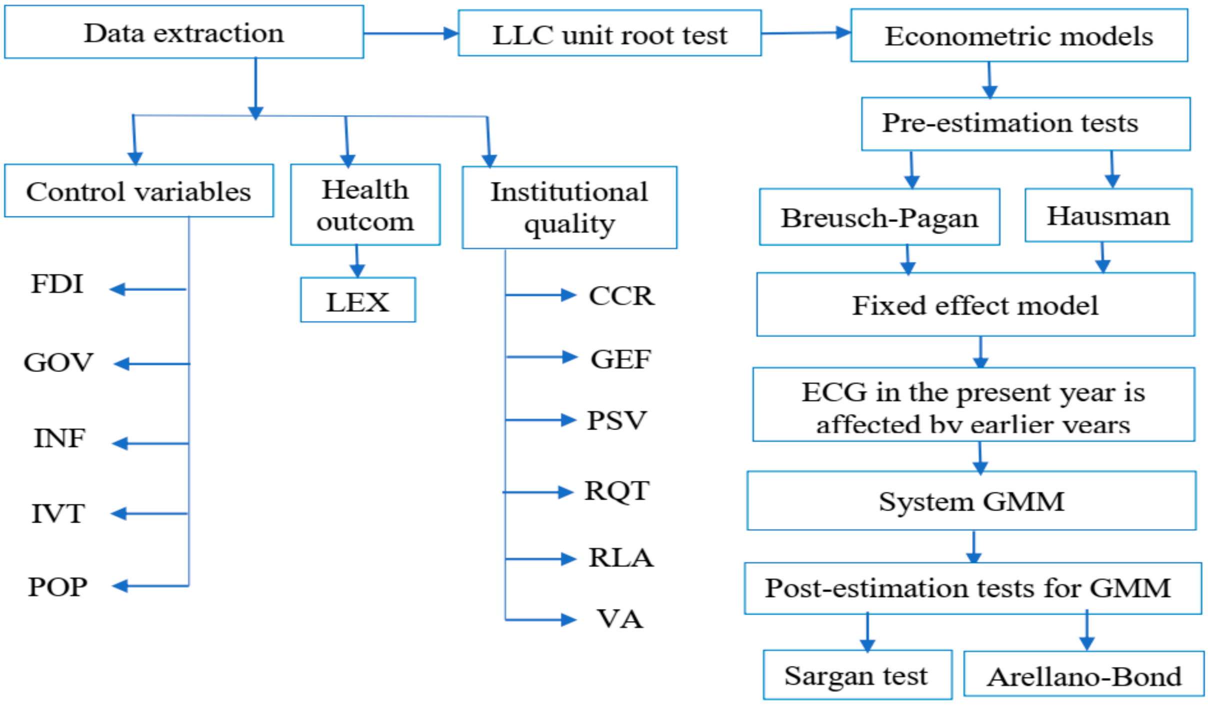

Figure 3. Steps used to select a regression model. Source: Authors' compilation from reviewed empirical literature.

4. Results

4.1. Preliminary Analysis

Initially, we analyse the panel unit root test to identify the heterogeneity problem. The heterogeneity is considered to be a problem in time analysis, and hence, it must also be checked in panel data analysis.

4.1.1. Test for Cross-Sectional Dependence

Technologies, economic integration, skills, and knowledge could overflow through urbanisation in SSA countries. Thus, panel datasets might retain the CSD, leading to endogeneity problems. Hence, panel stationarity (unit root) tests and cross-sectional dependence (CSD) are crucial in panel data regression analysis (Guo et al. 2023). Otherwise, we could obtain inconsistent and biased regression estimates (Said and Acheampong 2023). The CSD test has been applied because of its advantage of addressing the size distortion problem present in other tests. Table 2 presents evidence to reject the null hypothesis (H0) of no CSD due to the significance of the pairwise correlation coefficients of the included variables, suggesting the existence of CSD among the study panels.

Table 2. Estimates of CSD and panel unit root test (LLC).

Variables	CSD		LLC t-Statistics	
	LLC-Test	*p*-Value	I[0]	I[1]
GDP	−3.7549 ***	0.001	−3.2163 ***	−6.8271 ***
FDI	−8.5171 ***	0.000	−4.5132 ***	−4.1923 ***
GOV	−5.0632 ***	0.000	−11.2341 ***	−8.6532 ***
IVT	−9.8742 ***	0.000	−1.1235 ***	−4.5243 ***
POP	−4.0574 ***	0.000	−2.3571 **	−9.3217 ***
INF	−3.2603 ***	0.000	−9.2137 ***	−7.2361 ***
LEX	−5.5698 ***	0.000	−1.3142 ***	−4.6253 ***
CCR	−7.2655 ***	0.032	−1.1653 **	−2.2981 ***
GEF	−4.5304 ***	0.000	1.2741 ***	−3.634 ***
PSV	−8.4404 ***	0.000	−1.3271 **	−3.383 ***
RQT	−8.0112 ***	0.000	1.1973 ***	−3.272 **
RLA	−9.7091 ***	0.076	−1.4146 *	−3.649 ***
VA	−8.2937 ***	0.000	1.9161 **	−2.775 ***

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.1.2. Test for Panel Unit Root

The LLC panel unit root test (Levin et al. 2002) was employed to examine the presence of panel stationarity following the CSD to check the integration order of the panels (Pesaran 2021). The LLC estimates show that all the included variables are stationary at a level and first difference. As indicated in Table 2, we did not accept the null hypothesis (H_0) of LLC: The series has a unit root-not-stationary. We accepted the alternative hypothesis (H_a) that at least one panel or series is stationary. This is because the obtained *p*-values of the individual unit root test for the series of the variables were less than 10%.

4.2. Descriptive Statistics

The descriptive statistics of the pooled SSA countries are presented in Table 3. The average estimate of the GDP per capita (GDP_{pc}) is 2425.616 USD, with standard deviations (Std. Dev.) of 3260.333. These imply that there are significant variations in economic growth across the sample countries in SSA. The POP has an average value of 2.334, suggesting the rate of growth is medium, with a variation of 0.851. Importantly, the average value of LEX is 62.238 years, with Std. Dev. of 5.391. This implies that there are high variations in LEX across the sample SSA countries. Moreover, the average for GEF measures of institutional quality is −0.673, with a Std. Dev. of 0.642. The rule of law (RLA) has a mean of −0.487, with a Std. Dev. of 0.798.

Table 3. Descriptive statistics.

Variable	Observations	Mean	Std. Dev.	Min	Max
GDP_{pc}	385	2425.616	3260.333	262.185	19,481.646
FDI	385	4.157	6.636	−17.292	56.288
GOV	385	15.752	7.241	3.588	40.554
IVT	385	24.249	9.768	2.178	76.782
POP	385	2.334	0.851	−0.301	3.867
INF	385	10.576	38.337	−3.233	557.202
LEX	385	62.238	5.391	47.835	77.237
CCR	385	−0.558	0.704	−1.599	1.698
GEF	385	−0.673	0.642	−1.879	1.153
PSV	385	−0.583	0.611	−1.851	1.024
RQT	385	−0.582	0.585	−1.893	1.197
RLA	385	−0.487	0.798	−2.699	1.104
VA	385	−0.489	0.724	−1.849	0.975

Source: Own computation.

4.3. Analysis of Correlation Matrix

The correlation estimates (see Appendix D) indicate that the majority of the covariates have a positive correlation with economic growth. Life expectancy has a strong positive association with economic growth. This implies that life expectancy rises side by side with growth. Furthermore, the institutional quality indicators such as the "rule of law, political stability, and absence of violence, government effectiveness and voice, and accountability" in their order are strongly correlated with control of corruption. Moreover, government expenditure (GOV), FDI, and investment have a positive correlation with growth, while population growth and inflation have a negative correlation with growth. In sum, the majority of the variables have positive associations with economic growth.

4.4. Regression Results

4.4.1. Diagnostic Estimation Tests

While using the S-GMM, the instrumental variables were tested using the Hansen test statistics. The Arellano–Bond test diagnosis examines the autocorrelation of errors. As shown in Table 4, the tests proposed by Arellano and Bond (1991) (H_0: no autocorrelation versus H_a: autocorrelation) (AR(2) test statistics) show that there is no second-order autocorrelation since the *p*-values are not significant. The Sagan test (H_0: the instrumental variables are valid versus H_a: the instrumental variables are not valid) is used to ascertain the overall validity of the instruments in the S-GMM estimation (Chong and Calderon 2000). The estimates of the Hansen test confirm the validity of the instruments in the S-GMM model since the *p*-values are greater than 10%, and the null hypothesis cannot be rejected. Furthermore, the Arellano and Bond (1991) AR(2) test statistics provide no evidence of autocorrelation since the *p*-values are greater than 10%. These diagnostic estimation tests confirm the validity and consistency of the S-GMM estimator used in this study. The variance inflation factor (VIF) also reveals the absence of multicollinearity, as the values are less than 10 (Gujarati and Porter 2009). The computed VIF estimates for the variables used in this study are presented in Appendix C. Moreover, we have included the robustness check using the pooled ordinary least square (pooled OLS) and fixed effect (FE), which can be seen in Appendix E.

Table 4. Summary of the two-step S-GMM estimates.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Coef. [Std.Err]	**Coef. [Std.Err)**	**Coef. [Std.Err]**	**Coef. [Std.Err]**	**Coef. [Std.Err]**	**Coef. [Std.Err)**
$lnGDP_{(t-1)}$	−0.4351 *** [0.105]	−0.5395 *** [0.0893]	−0.1053 * [0.0543]	−0.4339 ** [0.1663]	−0.6682 *** [0.0563]	−0.2562 ** [0.0815]
lnFDI	0.0858 *** [0.0592]	0.3495 ** [0.1754]	0.4192 *** [0.0841]	0.4366 *** [0.0952]	0.6332 *** [0.0713]	0.7349 *** [0.0774]
lnGOV	0.0319 *** [0.0083]	0.1706 *** [0.0133]	0.0801 ** [0.0453]	0.1061 *** [0.0062]	0.3997 *** [0.0393]	0.6948 ** [0.1583]
lnINT	0.0411 *** [0.0063]	0.1921 *** [0.0192]	0.1212 *** [0.0242]	0.1172 *** [0.0162]	0.0836 *** [0.008]	0.1199 *** [0.0153]
lnINF	−0.1658 *** [0.0152]	−0.1015 *** [0.0192]	−0.2009 *** [0.0573]	−0.1693 *** [0.0263]	−0.1424 *** [0.0132]	−0.0523 *** [0.0136]
lnPOP	−0.2658 ** [0.0441]	−0.1349 *** [0.0081]	−0.5233 *** [0.1073]	−0.1757 [0.0782]	−0.2026 * [0.1113]	−0.1127 *** [0.0325]
lnLEX	0.1029 *** [0.0303]	0.1424 *** [0.0152]	0.4294 *** [0.0622]	0.1304 *** [0.0178]	0.2230 * [0.0951]	0.2034 * [0.1117]
CCR	2.8031 *** [0.2824]	-	-	-	-	-
CCR*LEX	6.9345 *** [1.6465]	-	-	-	-	-
GEF	-	3.2483 *** [0.8193]	-	-	-	-
GEF*LEX	-	7.1813 *** [1.8234]	-	-	-	-
PSV	-	-	2.7612 ** [0.5332]	-	-	-
PSV*LEX	-	-	5.8616 *** [0.8325]	-	-	-

Table 4. *Cont.*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Coef. [Std.Err]	Coef. [Std.Err)	Coef. [Std.Err]	Coef. [Std.Err]	Coef. [Std.Err]	Coef. [Std.Err)
RQT	-	-	-	−1.4511 [0.3635]	-	-
RQT*LEX	-	-	-	−0.0686 [1.0315]	-	-
RLA	-	-	-	-	2.1233 ** [0.8631]	-
RLA*LEX	-	-	-	-	8.5678 *** [2.0672]	-
VA	-	-	-	-	-	−0.2446 [0.4554]
VA*LEX	-	-	-	-	-	−0.0993 [0.3392]
Cons	−0.2361 [1.0752]	1.0451 [0.1063]	−0.1791 [0.1394]	0.2595 [0.1332]	0.5606 [0.1953]	1.0019 [0.5325]
Observations	385	385	385	385	385	385
Instruments	21	21	21	21	21	21
Countries	35	35	35	35	35	35
Hansen [*p-Value*]	0.232	0.274	0.252	0.195	0.217	0.221
AR_1 [*p-Value*]	0.032 **	0.028 **	0.029 **	0.047 **	0.033 **	0.024 **
AR_2 [*p-Value*]	0.243	0.316	0.432	0.325	0.309	0.287
R-Squared	0.358	0.397	0.312	0.377	0.338	0.416

Source: Own computation. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors (Std.err) are in brackets. AR(1) and AR(2) test for first- and second-order autocorrelation, respectively.

4.4.2. Effect of Health (LEX) on ECG

Table 4 provides the estimates for the individual effect of the dimension of institutional quality on the health–growth nexus using the two-step S-GMM technique. In specification (1), health outcome (life expectancy) and control variables are included, and the results indicate that life expectancy has a strong and statistically positive effect on economic growth. Specifically, the coefficient of life expectancy implies that a 1% improvement (or increase) in life expectancy at birth leads to 10.29%, 14.24%, 42.94%, 13.04%, 22.30%, and 20.34% increases in economic growth in specifications 1, 2, 3, 4, 5, and 6, respectively. Overall, a higher life expectancy indicates that a better health standard can enhance labour efficiency (quality of human capital) and reduce mortality, which in turn enhances the overall economic growth of a country. Thus, our results confirmed the hypothesis outlined that the health outcome (LEX) has a strong beneficial impact on economic growth in SSA countries.

The results of macroeconomic factors affecting economic growth, which are involved in the present study as control variables, are found to be consistent with the existing literature, as shown in Table 4. The negative coefficient of the $lnGDP_{(t-1)}$ indicates convergence of the long-term economic growth trajectory, whereby less affluent nations have outperformed wealthier ones in economic growth since the initial period. Investment (INT) positively and significantly affects ECG across the specifications. This implies that investment stimulates SSA's economies. In contrast, the population growth rate (POP) is found to affect the SSA's economies. This indicates that an increase in the POP significantly decreases the economic growth of SSA.

4.4.3. Effect of Institutional Quality on ECG

The correlation matrix (see Appendix D) shows that there is a correlation among institutional quality indicators; hence, estimating the institutional quality indicator in a single-dynamic model might lead to biased estimates, and they might have overlapping effects (Gani 2011). Zhuang et al. (2010) highlighted the six indicators of institutional quality that have distinct impacts on growth, which vary based on a country's historical background, developmental stage, and the duration of the study period. Thus, to avoid the overlapping effects among each institutional quality indicator and observe the individual effect of each indicator of institutional quality on economic growth while controlling for the control variable influence on growth, the S-GMM estimator was computed by regressing each of the indicators of institutional quality one at a time, in line with Zhuang et al. (2010) (Table 4, specifications 1–6).

Table 4 provides the results of the individual effects of institutional quality indicators on economic growth. Accordingly, the results reveal that the indicators of institutional quality have varied effects on the economic growth of the SSA region. The institutional quality indicators that foster the growth of SSA, in order of their intensity of effects, control of corruption, political stability and absence of violence, rule of law and government effectiveness, have strong impacts on economic growth. Specifically, the coefficient of control of corruption has been found to have a significant beneficial effect on economic growth. The finding on this indicator (CCR) suggests that economic growth increases by 2.8031 units. In a similar vein, political stability and the absence of violence have a significant beneficial effect on economic growth. This implies that an improvement in political stability and absence of violence upsurges economic growth by 2.7612 units. Equally, the rule of law influences economic growth and is found to be significant. This suggests that an improvement in the rule of law leads to a 2.1233 unit rise in output growth. Moreover, the coefficient on government effectiveness is positively associated with economic growth. This result delivers robust evidence that SSA has an effective provision of public services that would cause higher economic growth. The increase in government effectiveness enhanced economic growth by 1.3224 units. Hence, our results reveal that improvement in institutional quality indicators (particularly "control of corruption, government effectiveness, regulatory quality and political stability, and absence of violence") has a beneficial or positive effect on economic growth in SSA countries.

4.4.4. Role of InQ on the Health–Growth Nexus

As shown in Table 4, another novel finding of this study is the interaction effects between institutional quality indicators and life expectancy on growth in SSA economies. The positive signs of the interaction coefficients reveal that institutional quality indicators have strong and significant indirect effects on the growth of SSA economies. These imply that when there is better institutional quality, the impact of life expectancy on economic growth is much higher than its effect on economic growth alone. Specifically, the interaction effect between government effectiveness and life expectancy (GEF*LEX) on economic growth is positive and significant. This means that a one-point increase in GEF*LEX augments the growth of SSA's economies by 7.1813 units, which is twice that of the individual effect of the government effectiveness indicator of institutional quality on economic growth. Similarly, the political stability and absence of violence (PSV) is another dimension of political stability and absence of violence when it interacts with life expectancy (PSV*LEX), and the interactive term has a strong beneficial effect on economic growth. This result implies that a one-point improvement (increase) in PSV*LEX enhances growth by 5.8616 units. Furthermore, the interaction between control of corruption and life expectancy (CCR*LEX) has a significant beneficial impact on growth. The findings of this interaction imply that a one-point improvement in the interactive term (CCR*LEX) enhances ECG by 6.9345 units.

Furthermore, the interaction term between the rule of law and life expectancy (RLA*LEX) has a strong, significant, beneficial impact on growth. This finding implies that a one-point improvement in RLA*LEX improves economic growth by 8.5678 units, which is four times that of the individual effect of the rule of law dimension of the institutional quality on economic growth. This suggests that the impact of life expectancy on growth is higher in the presence of the effective and efficient enforcement of the rule of law than in the opposite of it. Overall, our results reveal the interaction between institutional quality and life expectancy on the health–growth nexus in SSA countries.

5. Discussion

The nexus between health outcomes and economic growth has been a topic of growing interest among scholars and development practitioners. However, less emphasis has been placed on whether institutional quality plays a notable role in the health-growth nexus. This study has explored the impact of health outcomes, institutional quality, and their interaction on growth in SSA countries.

The impact of health outcomes (life expectancy) on economic growth in SSA countries is found to be positive and significant. The findings of this study provide adequate evidence that better health outcomes enhance growth. This implies that good health is strongly correlated with economic growth. A higher life expectancy often enhances economic growth by enhancing the quality of human capital; a healthier individual is more productive and can contribute more reliably to economic growth. Evidence shows that as LEX increases, there is an increase in labour efficiency, saving, and investment in education that positively and strongly affects economic growth (Acemoglu and Johnson 2007; Bloom et al. 2004). This result is in line with earlier studies (Boachie 2017; Mohapatra 2017; Odhiambo 2021). However, this is against the findings of Echevarria and Iza (2006), who found a negative effect of LEX on economic growth.

While examining the effect of institutional quality on child mortality, Donkor et al. (2023) indicated that corruption affected under-five child mortality, while political stability reduced both U5MR and adult deaths. Life expectancy is the reflection of local conditions, as well as demographic, economic, and social context (institutions). In developing countries, life expectancy is reduced where there is weak governance and the imminence level of corruption is higher. Corruption diminishes the performance of healthcare services, affecting life expectancy and, hence, the overall population health. An improvement in institutional quality enhances life expectancy (Ouedraogo et al. 2020). Moreover, better institutional quality improves the provision of quality healthcare services and enhances their access and utilisation (Azfar and Gurgur 2008). Moreover, better institutional quality provides incentives to individuals, privates, and states to invest more in health and education facilities (Sen 2015).

This study also evaluated the individual effect of institutional quality indicators on economic growth. The findings of this study reveal that better institutional quality is fundamental for growth in SSA. Hence, institutional quality affects the economic growth of the SSA region, implying that improvement in institutional quality enhances economic growth. Accordingly, government effectiveness has the strongest positive impact on economic growth in SSA economies. This result provides strong evidence that SSA has effective governments (or public services) that are significantly and positively correlated with economic growth. Rodrik et al. (2004) revealed that countries with weak institutional quality have low incomes, while other studies indicate that countries with higher institutional quality are the richer countries (Chong and Calderon 2000; Knack and Keefer 1995; Mauro 1995). Knack and Keefer (1995) and Mauro (1995) confirmed the adverse effect of weak institutional quality on growth. Hall and Jones (1998) indicated that weak institutional quality decreases overall productivity, which in turn also cuts down productivity growth. Past studies evaluated the effect of government effectiveness on growth. For example, Fischer et al. (2001) examined the efficiency of the Palestinian economy during 1994–2000. They found that excessive official procedure, inefficient bureaucracy, mismanagement of resources, and weak governance discouraged local and international investors and, hence, had a regressive effect on growth. Consistent with this result, Gani (2011) explored the effect of institutional quality on growth and found that government effectiveness has a strong positive impact on growth. In a similar vein, Yıldırım and Gökalp (2016) assessed the role of institutional quality on economic performance nexus in 38 developing countries covering 2000–2011 and found that institutional quality had a beneficial effect on the performance of the economy. Furthermore, while examining the impact of institutional quality on growth, Alam et al. (2017) found that government effectiveness has a positive and significant effect on SSA's economies. Moreover, while examining the effect of institutional quality on growth in 35 SSA countries spanning 2006–2018, Wandeda et al. (2021) found that government effectiveness has a strong beneficial effect on economic growth. The finding of the present study is, however, against the findings of Gebresilassie et al. (2024), who found a negative effect of government effectiveness on economic growth.

Furthermore, political stability (PSV) has a strong and significant beneficial effect on economic growth. This finding provides evidence that political stability is crucial for the sustained growth of the SSA region. This result is in line with past research (Gani 2011; Iheonu et al. 2017; Wandeda et al. 2021). Gani (2011), in his evaluation of the role of institutional quality on economic growth, showed that PSV had a strong beneficial impact on ECG. Similarly, Alabed et al. (2021) revealed the beneficial effect of institutional quality on economic growth (GDP growth rate and GDP per capita) while it affects growth (real GDP) in SSA. However, this finding was against the findings of Yıldırım and Gökalp (2016), who showed that "a one-point increase in political stability level decreases per capita GDP by 3.4%".

This study's results indicate that control of corruption has a strong beneficial impact on economic growth. This implies that an improvement in the control of corruption enhances the SSA counties' economic growth. The result of control of corruption in this study agrees with previous studies (Gani 2011; Wandeda et al. 2021; Gebresilassie et al. 2024). Gani (2011) and Wandeda et al. (2021) had similar findings of the positive effect of corruption on growth, as opposed to those of Gebresilassie et al. (2024). In a similar vein, the rule of law is another barometer of institutional quality, which is positively correlated with economic growth in SSA. This means that an improvement in the rule of law increases economic activities and enhances economic growth in SSA. This result is consistent with earlier studies in the field, highlighting that an improved rule of law dimension of institutional quality is linked to economic growth (Iheonu et al. 2017; Alabed et al. 2021; Wandeda et al. 2021). High-quality institutions can lead to positive economic growth (Sani et al. 2019; Alabed et al. 2021; Wandeda et al. 2021). This implies that countries with better institutional quality experience higher economic growth than countries with lower institutional quality. These findings support the conclusions reached by Gebresilassie et al. (2024), Wandeda et al. (2021), Iheonu et al. (2017), and Alabed et al. (2021).

Weak and ineffective institutional quality undermines the economic growth of countries while vitiating the health of the population (Socoliuc et al. 2022). Another remarkable result in SSA countries is the effects of the interactions between institutional quality and life expectancy on the health–growth nexus. The positive signs of the coefficients of the interactions between institutional quality and life expectancy (InQ*LEX) indicate that they have strong and significant effects on growth. These imply that in the presence of improved institutional quality, the impact of health on growth is much higher than its effect alone. Similarly, the interaction between government effectiveness and life expectancy (GEF*LEX) has a strong beneficial impact on growth. This suggests that the provision of effective and efficient public services, the government effectiveness dimension of institutional quality, makes the effect of life expectancy on growth higher than in the absence of it. This finding is in agreement with previous studies (Iheonu et al. 2017; Alabed et al. 2021; Wandeda et al. 2021), which revealed that government effectiveness has a strong positive effect on economic growth. However, this finding was against the findings of Gebresilassie et al. (2024), who found that government effectiveness affected growth in SSA economies. Well-trained health personnel (nurses, midwives, and physicians) could deliver quality public healthcare services to the population that enhance health outcomes (Ouedraogo et al. 2020), which in turn improves economic growth. When governments are more effective in the provision of quality public services and increase public spending for health, long-term positive health outcomes could be achieved. Several people could benefit from access to healthcare services provision and, thus, longevity (LEX) will be enhanced (Aísa et al. 2014), which in turn ensures long-term growth.

The positive effect of political stability and absence of violence (PSV) on economic growth occurs when the political stability and absence of violence interact with life expectancy (RLA*LEX). This implies that the impact of life expectancy on economic growth is higher in the absence of violence and political instability. This result is in parallel with past studies (Yıldırım and Gökalp 2016; Iheonu et al. 2017; Ouedraogo et al. 2020; Wandeda et al. 2021). The absence of violence and a stable political environment are the most important indicators of institutional quality that affect the interest of policymakers in enhancing health. In a stable political environment with the absence of violence, governments will be more interested in allocating more of their budget and willing to invest in health (Liang and Mirelman 2014), which could, in turn, enhance health outcomes and economic growth. Moreover, the presence of violence could play a role in the spread of diseases (such as HIV/AIDS, malaria, etc.). These diseases could worsen health outcomes through malnutrition, lack of clean drinking water, and other services that are caused by the obliteration of productive assets and the forced displacement of people (Akbulut-Yuksel 2014), which in turn influence the economic growth of the societies. Political stability enhances the legal framework of the economy by ensuring the validity of issued contracts and also contributes to the general stability of the macroeconomy (Rajan and Zingales 2003). Efficient political stability has dual impacts of reducing fluctuations in economic production and enhancing economic growth while also decreasing the likelihood of a debt crisis.

Furthermore, the interaction between control of corruption and life expectancy (CCR *LEX) has a strong beneficial impact on economic growth in SSA. The finding of this interactive term suggests that the impact of life expectancy on economic growth is higher in the presence of improved control of corruption. This finding is in line with earlier studies (Iheonu et al. 2017; Alabed et al. 2021; Wandeda et al. 2021). Controlling corruption is highly associated with reduced overall mortality rates because government resources are efficiently utilised in countries with less corruption intensity (Ouedraogo et al. 2020). Moreover, the interaction term between the rule of law and life expectancy (RLA*LEX) has a strong, significant, beneficial effect on economic growth. The values of the interaction suggest that the effect of life expectancy on economic growth is higher in the presence of effective rule of law enforcement. Improving the rule of law can enhance growth. The finding of this interaction term is in parallel with past findings (Iheonu et al. 2017; Alabed et al. 2021; Wandeda et al. 2021). A well-functioning regulatory structure plays a notable role in affecting economic success (Jalilian et al. 2007).

6. Conclusions and Policy Implications

Strong institutions continue to play an important role in running the economy, while health outcomes also affect economic growth. In particular, health outcomes and institutional quality significantly affect the growth of developing countries like SSA countries. This study delivers valuable insights into the links among institutional quality, health outcomes, and their interaction effects on ECG in 35 SSA countries covering 2012–2022. Based on a two-step S-GMM estimator analysis, this study indicates several imperative findings. The results indicate that health outcome (LEX) enhances SSA's economies. The health outcome has a beneficial effect on economic growth in SSA economies. The obtained results validated the strong positive effects of institutional quality (particularly CCR, PSV, RLA, and GEF) on the SSA's economies. These imply that strong governance institutions and improved health outcomes have beneficial effects on economic activities that support sustained growth in SSA economies. The institutional quality moderates the association between health outcomes and economic growth, which indirectly influences growth through health outcomes. Hence, the interactions between institutional quality and life expectancy strongly influence economic growth. These suggest that institutional quality improves the beneficial impact of life expectancy on economic growth in SSA countries.

Policies should prioritise enhancing health outcomes and institutional quality, which in turn improves people's productivity and the region's economies. Hence, this study provides potential recommendations to enhance growth in SSA economies, which are outlined below:

- The findings revealed that health outcomes have been found to considerably enhance the growth rate of SSA economies. Policymakers of SSA must prioritise the allocation of more budgets towards the health sector.

- This study showed an improvement in institutional quality enhances the economic growth of SSA economies. Institutional quality plays a mediating role in enhancing the positive effect of LEX on ECG. The governments of the SSA must formulate policies and strategies in their public organisations that not only enhance InQ but also enhance productivity (ECG) and the health status of the population in SSA.
- SSA governments must concentrate on improving InQ (mainly "control of corruption, rule of law, government effectiveness and political stability, and absence of violence") and health outcomes as crucial factors for attaining sustained economic growth in the economies of SSA.

7. Limitations and Future Studies

This study examines the role of InQ in the health–growth nexus on economic growth in SSA countries; however, it is not without limitations. First, the aggregate dataset on the health-specific sector gave us a broad view of the effect of health on ECG. This is due to the lack of available disaggregated datasets on the health-specific sector limiting the depth of the present analysis. However, the disaggregated dataset could provide deeper, valuable insights and enable us to use a cross-sector analysis of policy measures and their effects. Future research having these disaggregated datasets on the health-specific sector can address the gap observed in this study. Second, unemployment rate, interest rate, and political stability variables were not included in this study due to over-specification problems that could affect the ECG in SSA countries. Third, we failed to examine the effect of the study period 2012–2022, including the COVID-19 pandemic, as an influence on InQ, health outcomes, and economic growth in SSA countries. Hence, future studies that include these factors in their analyses enable deeper and more nuanced insight into these factors affecting the economic growth of SSA countries. Moreover, further research is also needed to examine a comparative analysis of the role of InQ on the health–growth nexus between low-income and middle-income developing countries in the region and other continents of the globe.

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Appendix A. The List of SSA Countries Used in This Study

Eswatini, Ethiopia, Congo Rep., Guinea-Bissau, Lesotho, Gabon, Gambia, Ghana, Guinea, Kenya, Madagascar, Mozambique, Mauritius, Mauritania, Namibia, Niger, Rwanda, Senegal, Sierra Leone, Seychelles, Chad, Togo, Uganda, Tanzania, Zimbabwe, South Africa, Sudan, Benin, Burundi, Angola, Burkina Faso, Botswana, Cabo Verde, Cameroon, Central African Republic.

Appendix B. List of Acronyms and Abbreviations

Abbreviations	Extended	Abbreviations	Extended	Abbreviations	Extended
InQ	Institutional quality	RLA	Rule of law	RQT	Regulatory quality
ECG	Economic growth	VA	Voice and accountability	GDP	Gross domestic product
LEX	Life expectancy	INF	Inflation	FDI	Foreign direct investment
CCR	Control of corruption	POP	Population growth	GOV	Government expenditure
GEF	Government effectiveness	PVS	Political stability	IVT	Investment

Appendix C. Variance Inflation Factor (VIF)

Variables	VIF	1/VIF
GDP	2.903	0.344
FDI	2.491	0.401
GOV	2.317	0.432
IVT	1.951	0.513
POP	1.888	0.530
INF	1.575	0.635
LEX	1.507	0.664
CCR	1.370	0.730
GEF	1.243	0.805
PSV	1.154	0.867
RQT	1.131	0.884
RLA	1.076	0.930
VA	1.038	0.963
Mean VIF	1.665	

Appendix D. Correlation Matrix

Variables	(1)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) InGDP(t − 1)	1.000													
(2) L. InGDP(t − 1)	0.997 ***	1.000												
	(0.000)													
(3) InFDI	0.125 **	0.073	1.000											
	(0.014)	(0.170)												
(4) InGOV	0.293 ***	0.287 ***	0.078	1.000										
	(0.000)	(0.000)	(0.127)											
(5) InINT	0.050	−0.070	0.483 ***	0.062	1.000									
	(0.330)	(0.194)	(0.000)	(0.224)										
(6) InINF	−0.055	−0.052	−0.060	−0.106 **	−0.189 ***	1.000								
	(0.282)	(0.336)	(0.240)	(0.037)	(0.000)									
(7) InPOP	−0.538 ***	−0.543 ***	0.034	−0.435 ***	0.234 ***	0.007	1.000							
	(0.000)	(0.000)	(0.502)	(0.000)	(0.000)	(0.891)								
(8) InLEX	0.567 ***	0.573 ***	0.107 **	−0.028	0.091 *	0.009	−0.245 ***	1.000						
	(0.000)	(0.000)	(0.036)	(0.589)	(0.076)	(0.854)	(0.000)							
(9) CCR	0.578 ***	0.579 ***	0.077	0.416 ***	0.116 **	−0.142 ***	−0.528 ***	0.527 ***	1.000					
	(0.000)	(0.000)	(0.131)	(0.000)	(0.023)	(0.005)	(0.000)	(0.000)						
(10) GEF	0.666 ***	0.662 ***	0.081	0.303 ***	0.114 **	−0.163 ***	−0.499 ***	0.619 ***	0.868 ***	1.000				
	(0.000)	(0.000)	(0.111)	(0.000)	(0.025)	(0.001)	(0.000)	(0.000)	(0.000)					
(11) RLA	0.571 ***	0.567 ***	0.033	0.301 ***	0.082	−0.146 ***	−0.487 ***	0.598 ***	0.885 ***	0.935 ***	1.000			
	(0.000)	(0.000)	(0.522)	(0.000)	(0.110)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)				
(12) RQT	0.544 ***	0.546 ***	0.006	0.312 ***	0.040	−0.203 ***	−0.471 ***	0.487 ***	0.807 ***	0.912 ***	0.909 ***	1.000		
(13) PSV	0.573 ***	0.574 ***	0.108 **	0.364 ***	0.107 **	−0.167 ***	−0.437 ***	0.476 ***	0.716 ***	0.721 ***	0.751 ***	0.710v	1.000	
	(0.000)	(0.000)	(0.035)	(0.000)	(0.036)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
(14) VA	0.433 ***	0.431 ***	0.093	0.324 ***	0.090	−0.158 ***	−0.432	0.436 ***	0.716 ***	0.734 ***	0.773 ***	0.748 ***	0.702 ***	1.000
	(0.000)	(0.000)	(0.070)	(0.000)	(0.077)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Values in parentheses are p-values.

Appendix E. Pooled OLS and Fixed Effect (FE) Estimates (Robustness Check)

Variable	Pooled Ols			FE		
	Coef.	Std.Err	*p*-Value	Coef.	Std.Err	*p*-Value
$lnGDP_{(t-1)}$	−0.3329 ***	0.0827	0.000	−0.2062 ***	0.0699	0.003
lnFDI	0.2773 **	0.1137	0.016	0.3239 ***	0.0768	0.000
lnGOV	0.2556 **	0.1076	0.019	0.2423 *	0.1317	0.066
lnINT	0.4449 ***	0.0334	0.000	0.3834 *	0.2002	0.055
lnINF	−0.1422 ***	0.0387	0.000	−0.3609 *	0.2032	0.076
lnPOP	−0.1176 ***	0.0344	0.001	−0.3224 **	0.1442	0.025
lnLEX	0.1422 ***	0.0387	0.000	0.1122 **	0.0459	0.015
CCR	0.0036 *	0.0019	0.052	−0.0877 ***	0.0247	0.000
CCR*LEX	0.0875 *	0.0489	0.076	−0.1251 **	0.0577	0.030
GEF	0.4423 ***	0.0336	0.000	−0.0697 ***	0.0256	0.006
GEF*LEX	0.6626 ***	0.0496	0.000	−0.1084 *	0.0569	0.057
PSV	0.1355 **	0.0546	0.014	−0.0597	0.0521	0.253
PSV*LEX	−0.0975 *	0.0564	0.086	−0.1069	0.1684	0.525
RQT	−0.2850	0.5821	0.625	−0.0718 *	0.0396	0.070
RQT*LEX	0.0266	0.0449	0.554	−0.0512	0.0539	0.343
RLA	−0.7021	0.3477	0.045	0.0859	0.1444	0.552
RLA*LEX	−0.2499 **	0.0829	0.003	−0.2888 ***	0.0813	0.000
VA	−0.0339	0.0436	0.437	−0.0359	0.0556	0.518
VA*LEX	−0.0539 ***	0.0016	0.001	−0.1022	0.1322	0.439
Cons	−2.6180	2.0280	0.198	1.4575	4.7605	0.759
Observations	385			385		
R-Squared	0.3586					
Root MSE	0.3271					
Wald chi2					154.97 ***	
sigma_u					0.1463	
sigma_e					0.56162	
rho					0.1077	

Source: Own computation. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Note

[1] Life expectancy at birth (LE) is defined as "the average duration of life for a specified population" (World Health Statistics 2022).

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