

Institutional Quality, Remittance Inflows and Health Outcomes: Evidence from the Five Most Remittance-Dependent Countries in Sub-Saharan Africa

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Conflict of Interest

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ABSTRACT

The high level of mortality among infants as a result of illnesses like HIV/AIDS and malaria is still prevalent despite the rise in the number of people who suffer from chronic non-communicable diseases. Despite past research on the effects of remittances on health indicators, less attention has been paid to the mediating role of institutional quality in these relationships in SSA. This study examined Institutional Quality, Remittance Inflows and Health Outcomes: Evidence from the Five Most Remittance-Dependent Countries in Sub-Saharan Africa (based on World Bank data) and covers the period from 2000 to 2024. The Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model was employed to estimate the panel data, with inferences drawn at 5% significance level. The results revealed that remittances had a positive and significant effect on health indicators in sub-Saharan Africa. The result shows that remittances have a significant positive effect on life expectancy, but this effect is reduced when remittances

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are interacted with life expectancy. The study concluded that although remittances positively and significantly affected health indicators, their contribution to these indicators decreased when they interacted with institutional quality. The study recommended that governments in SSA recognize and treat remittances as an additional source of funding for health care services, and that the cost of remittance transfers be reduced by increasing competition among remittance service providers.

Keywords: CS-ARDL, Health Indicators, Institutional Quality, Remittances, Sub-Saharan Africa

JEL Codes: F24, I15, O15

1.0 Introduction

The United Nations 2030 Agenda for Sustainable Development highlights that countries' priority is to develop their health systems and ensure access to high-quality healthcare services (United Nations, 2015). It is a priority because people's health is the primary condition for the population's well-being and development. Many developing countries have been faced with health problems caused by the burden of infectious diseases such as malaria, which is one of the health issues constraining living standards and productivity (World Health Organization, 2024). Thus, to address health issues, it is important to introduce changes in healthcare delivery, sanitation, and hygiene, and to ensure access to other basic services. This will help to avoid poor health outcomes such as maternal, newborn and under-five mortality (United Nations Inter-Agency Group for Child Mortality Estimation [UN IGME], 2024).

Foreign aid and assistance from international organizations have also been used to address health problems in Sub-Saharan Africa. International organizations such as the Global Fund, the World Bank, and philanthropic institutions like the Bill & Melinda Gates Foundation have helped address health issues, including infectious diseases such as

HIV/AIDS, malaria, and tuberculosis, and strengthen the health system.

Remittances have been used to promote economic development in Sub-Saharan African countries across sectors such as education, infrastructure, agriculture, and household welfare. Such countries as Kenya, Nigeria and Senegal have received remittances. Nigeria is one of the largest recipients of remittances in Africa. Remittance inflows to Sub-Saharan Africa totaled about \$54 billion in 2023, with Nigeria accounting for the bulk of these flows (World Bank, 2023). Remittance inflows continue to play an important role in supporting consumption and welfare in recipient countries (World Bank, 2024).

Despite some achievements in achieving macroeconomic stability and controlling inflation in Sub-Saharan Africa, the region still faces many structural issues. One of them is low institutional quality (World Bank, 2024). As Gwagwa et al. (2021) point out, this issue is related to poor governance.

Low institutional quality leads to an ineffective allocation of public resources due to a lack of transparency and accountability. To create an environment favorable to improved health sector performance, it is necessary to introduce institutions that ensure effective service delivery and access to health care (WHO, 2007).

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Various efforts have been made by international donors, including the Global Fund, the World Bank and philanthropic organizations. Still, health achievements in Sub-Saharan Africa are very low. For example, mortality of infants and children from diseases such as HIV/AIDS and malaria is a problem, while the number of non-communicable diseases has increased. Under-five mortality rate in Sub-Saharan Africa is much higher than that in the European Union. It shows the wide gap between survival rates in Sub-Saharan Africa and developed regions (WDI, 2024).

Similarly, life expectancy in Sub-Saharan Africa decreased from 61 years in 2020 to 60 years in 2021, while that in the European Union remained unchanged – 80 years in 2020 and 2021. It happened despite considerable remittance inflows amounting to \$43 billion, \$49 billion, and \$53 billion in 2020, 2021, and 2022, respectively (World Bank, 2024).

While various studies have examined the impact of remittances on health indicators in Sub-Saharan Africa and selected economies (Akbar & Valeriani, 2022; Amakom & Iheoma, 2014; Bare et al., 2021; Hao et al., 2023; Dea & Rathab, 2012), few papers have considered the effect of institutional quality as a moderator. Works such as De Luca et al. (2021), Guetat and Sridi (2017), and Hadipour et al. (2023) are

Theoretical Background and Empirical Literature

The following set of theories provides a basis for this study, which is, however, anchored in the Grossman Health Demand Model.

Push-Pull Theory

The Push-Pull theory of migration was initially formulated by Ravenstein (1885, 1889) and later elaborated by Lee (1966). The push-pull theory of migration suggests that migration is determined by

country-specific or rely on a single measure of institutional quality. In this study, the dimensions of institutional quality, including control of corruption, political stability, voice and accountability, regulatory quality, rule of law and government effectiveness, are considered to provide robustness. Given that this study examined the role of institutional quality in the relationship between remittances and health indicators, it also examined how low institutional quality negatively affects remittances' contributions to these indicators.

This study investigates the top remittance-receiving countries in Sub-Saharan Africa for the period 2000-2024 using panel data. The choice of the starting period has been guided by the Millennium Declaration in 2000. The Millennium Declaration was an international commitment of countries and development partners to achieve the eight Millennium Development Goals by 2015.

The remainder of the paper is organized as follows. Section two provides a literature and theoretical review; section three presents the methodology; section four presents the results and discussion; and section five presents the conclusion and recommendations.

push factors (socio-economic conditions at the origin, such as poverty, unemployment, and war) and pull factors (economic opportunities at the destination, such as employment, political stability, and better

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living conditions). Ravenstein identifies the first "laws of migration": economic opportunities and distance, to which Lee adds intervening obstacles and personal characteristics that affect migration choice. The theory assumes that migration is an optimal response to variations in the socio-economic situation across space, and that individuals estimate the costs of staying and the benefits of migrating before deciding to migrate. Network influences, including social and family connections, are examples of pull factors promoting transformation. In accordance with the anchoring principle, because not everyone migrates, non-migrants optimize their physical, psychological, and emotional well-being by staying where they are (Freeman, 2018). The Push-Pull Theory of migration, in general terms, explains the remittance flow into Sub-Saharan African (SSA) countries. Lee (1966) and Ravenstein (1885) state that migrants migrate due to the "push" factors such as poverty, poor institutional environment, poor health system, lack of attractive economic opportunities in their home country and "pull" factors such as favorable employment opportunities, political stability and high-level health care in host countries. All these factors are associated with the remittances sending because migrants strive to escape from their families, who face the same reasons for migration. Remittances are a valuable resource that supplements the health system, addresses institutional challenges, and improves health outcomes, thereby driving quality improvements within institutions and governments. Thus, Push-Pull Theory is the theoretical framework for this research because it explains the push and pull of migration as

dependent on social and economic factors, including remittances, institutions, and health.

Motivation Theory of Remittance

The Motivation Theory of Remittances explains why migrants send money back to their relatives and communities in their countries of origin. The reasons or motives for remitting money may include self-altruism, altruism, pure altruism, semi-altruism, and self-interest. Self-altruism is when money is donated out of a sense of satisfaction and to alleviate the emotional stress of giving. Altruism occurs when migrants send money back to their relatives unselfishly to improve the welfare of family members left behind (Batson, 2014; Post, 2014). According to Becker (1974), altruism is when an individual derives satisfaction from the welfare of others outside himself/herself. In the case of pure altruism, the migrant sends money to improve the welfare of their household members without any direct gain. Impure altruism, or warm-glow giving, occurs when giving makes the giver happy (Andreoni, 1990).

Neoclassical Migration Theory

The origins of neoclassical migration theory have been established by Todaro (1969) and Todaro and Harris (1970). The basis of neoclassical migration theory is the idea that migration is an economic decision made in response to wage and employment opportunities across regions. It presupposes population movement from developing to developed territories to maximize economic output. Migration is an activity influenced by labor-market information and interregional unemployment and development (Massey et al., 1993). The neoclassical migration theory accounts for migration costs, wages, and labor conditions across

countries and territories. Considering all the advantages and disadvantages, the individual decides whether to migrate to increase his or her revenues. Wages are influenced by climate change; thus, it may be assumed that environmental factors influence wages indirectly through wage rates in rural and urban regions (Mueller et al., 2020). While utility maximization may be considered part of neoclassical migration theory, wages play a crucial role in it. For instance, the environmental amenities affect the decision to migrate (Gosnell & Abrams, 2011).

The salaries of migrant workers are higher in most Sub-Saharan African countries when they work abroad, due to the exchange rate between the US dollar and the majority of African currencies.

Grossman Health Demand Model

In Grossman's Health Demand Model, people's health status is defined by the concept of capital, which they

may invest in to improve both their well-being and productivity. According to Grossman (1972), health capital exists from birth as a stock that declines with age, but this stock can be increased through investments in factors such as health care, good nutrition, education, and healthy lifestyles. Also, the model shows that the significance of health capital depends on increases in productive time, income-generating capability, and the quality of life. The model is popularized by Contoyannis, Jones, and Rice (2004), who present a demand-for-health model in which health status is a function of health services, among other factors such as income, education, savings, and time. Regarding remittances, institutional quality, and health in sub-Saharan Africa, the model is applicable because remittances improve household incomes.

Empirical Review

The relationship between income levels and institutional quality in 35 African countries

Rizvi (2019) used data that range from 1995 to 2017. The GMM methodology has been applied to 20 developing countries across East Asia, South Asia, and the Pacific. The study has revealed a statistically significant relationship among health care expenditure, economic growth, and institutional quality.

Possible correlations among health indicators, remittances, financial development, and institutional quality in Sub-Saharan Africa (SSA) are investigated in Bare et al. (2021). Dynamic panel estimates have been used, and 39 SSA countries for the period 1996-2016 have been included in the research. It has been found that remittances significantly influence the health indicators in SSA. The research by Bare et al. (2021) has shown that the relationship between institutional quality and financial development explains the correlation between health indicators and remittances.

Within the European Union, Sharma et al. (2022) examined the complex relationship between health indicators and the quality of economic institutions. The random and fixed-effects models have been applied as the analytical framework for the period 2000-2018. The results have revealed a positive correlation between the quality of EU economic institutions and health indicators. Macroeconomic stability, a strong judicial system, and less restrictive legislation positively contribute to improvements in health indicators in the European Union.

The impact of international remittances on the health expenditure of Bangladeshi households is studied in Tabassum (2026). For this purpose, the PSM approach has been applied. Regarding the impact of international remittances on the health expenditure of Bangladeshi households, it should be noted that remittance recipients spend about Tk. 2000-2300 per capita annually, while the non-recipients – Tk. 1900. Thus, the impact of international remittances on the health expenditure is positive. Consequently, it may be concluded that Bangladeshi migrants go abroad to increase their health expenditure.

Collins et al. (2026) investigated the influence of migrants' remittances and ODAs on health outcomes in Nigeria for the period 2000-2024. Although the volumes of these flows have significantly increased, their efficiency remains extremely high. That is why the Grossman health capital model and the two-gap theory are used to evaluate the impact of migrants' remittances, health- and non-health-specific ODAs, environment, and institutional quality on health outcomes in Nigeria, using ARDL and NARDL approaches. The influence of migrant remittances and ODAs on the health improvements in Nigeria is rather insignificant. This finding contradicts Tabassum's (2026) findings.

Literature gap

A number of existing studies have examined the effects of remittances on health outcomes in SSA. Hao, Yang et al. (2023) conduct a comprehensive analysis of the relationship between health indicators and financial transfers across 45 sub-Saharan African (SSA) states. The study is similar to this study in terms of the model used. However, in contrast to this study, the aforementioned study is more robust, using three health indicators rather than the two used here. This study also examined the moderating role of institutional quality, which has received less attention in previous studies in this area. Also, the problem of cross-sectional dependence is not addressed in previous studies, as this study uses the Cross-Sectional Autoregressive Distributed Lagged Model.

3. Methodology

This study leans on the neoclassical framework. The neoclassical theory of health was provided by Michael Grossman (1972).

This definition of the theoretical model can be expressed as follows.

$$H = F(x) \quad (1)$$

In this equation, H is defined as health output, while x is defined as the vector of inputs to the health production function F. The inputs would include the following: nutrient intake, money, public goods, education, time spent on health production, health stock, and the environment. The expansion of the model leads us to the next equation (2).

$$h = f(Y_1, Y_2, \dots, Y_n, S_1, S_2, \dots, S_m, V_1, V_2, \dots, V_l) \quad (2)$$

Where 'h' is the child's health outcome, $(y_1, y_2, \dots, y_n) = Y$; $(s_1, s_2, \dots, s_m) = S$; $(v_1, v_2, \dots, v_l) = V$ and n, m and l are several variables in each subgroup, respectively. $\ln h = \sum \alpha_i (y_i) + \sum \beta_i (s_j) + \sum \gamma_k (v_k)$

(3)

This research employs an ex post facto research design. The research used 5 sub-Saharan African countries that received the highest remittance-to-GDP ratios (World Bank, 2025) and employed annual panel data from 2000 to 2024. The countries involved in the research are as follows:

Table 1: Selected sub-Saharan countries

Liberia, Comoros, Gambia, cabo verde and Senegal (WDI, 2026).

Model Specification

The model for the objective: effect of the interaction between remittances and institutional quality on health indicators in sub-Saharan Africa

This research used the model developed by Hao et al. (2023), as shown in equation 1 below, which is consistent with the study's theoretical framework.

Model for Life Expectancy as the dependent variable

$$HT_{it} = \alpha_0 + \alpha_1 RM * INST_{it} + \alpha_2 PHE_{it} + \alpha_3 PCI_{it} + \alpha_4 UN_{it} + \alpha_5 EDUC_{it} + \alpha_6 Co2_{it} + \mu_{it} \quad [4]$$

This can be further elaborated as LE (Life Expectancy), UMR (Under five mortality rate), and PU (Prevalence of undernourishment).

Table 2: Definition and Measurement of Variables

S/N	Variables	Abbrev.	Measurement of Variables
1	Life expectancy	LE	Average life expectancy at birth refers to the expected number of years of life. The measure range is 0-infinity
2	Under-five mortality rate	UMR	It refers to the number of deaths in each year among children below five years per 1,000 live births. The measure range is 0-infinity.
3	Prevalence of undernourishment	PU	The prevalence of undernourishment is measured in percentage. The measure range is 0-100%.
4	Remittances	RM	Personal remittances (current USD) refer to the transfers sent by the migrants to their families at home. The measure range is 0-infinity.
5	Per Capita Income	PCI	GDP per capita measures 0-infinity.
6	Public expenditure on health	PHE	Health expenditure measures 0-infinity.

8	CO ₂ emissions (metric tons per capita)	CO ₂	Carbon dioxide emissions refer to the emissions from the use of fossil fuel.
9	Institutional Quality	INST	The composite of six worldwide governance indicators using principal component analysis (PCA).

Source: Author's compilation, 2025. Note: The measures of all the variables were sourced from the World Bank.

***Priori* expectations**

From a symbolic perspective, the relationships are portrayed in the following manner

Remittances should have a positive relationship with life expectancy, whereas they should have a negative relationship with the under-five mortality rate and undernutrition.

Method of estimation

Descriptive Statistics

Many conclusions have been drawn from the preliminary analysis of the data, and these are widely used in statistical research. Descriptive statistics allow for defining the main economic variables from the data and briefly describing them. The statistical analysis provides a comprehensive description of the characteristics, distributions, and behaviors of the economic variables analyzed. Information on the maximum and minimum values, the average, the median, skewness, kurtosis, and standard deviation is important for the analysis.

Cross-Sectional Dependence

Cross-sectional dependence arises from interdependence among individual observations in panel data (e.g., firms, regions, or countries). Cross-sectional dependence occurs when shocks to one unit affect other units, thereby violating the independence assumption in standard panel-data models (Pesaran, 2021). In particular, cross-sectional dependence is especially important in large-panel and event analyses because of common factors across countries or regions arising from common shocks, policy convergence, or trade relations (Baltagi, 2015). Ignoring the interdependence leads to misleading results and biases. Thus, cross-sectional dependence has been tested in the current research.

Correlation Analysis

The coefficient of correlation has been applied in the current bivariate analysis to identify the direction and strength of the relationship between two variables. It is a signal for researchers not to use two or more correlated regressors in the model.

Estimation Technique

The study employs the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model for data estimation.

The generalized formulation of the CS-ARDL model is shown in Eq.

$$HT_{i,t} = \alpha_{i,t} + \theta_i HT_{i,t-1} + \beta_0 X_{i,t} + \beta_1 X_{i,t-1} + \sum_{i=0}^T \delta_i \bar{Z}_{t-1} + \varepsilon_{i,t} \quad [1]$$

Where HT is the dependent variable, and X represents the vector of independent variables, that is $X_t = CDS_i, Vol,)$;

$\bar{Z}_t$ denotes the average of all cross sections, that is, $(\bar{Z}_t = \bar{H} \bar{T}_t, \bar{X}_t$

Equation 5 can be expanded by augmenting the error correction model as follows;

$$\Delta HT_{i,t} = \alpha_i + \theta_i (HT_{i,t-1} - \beta_i X_{i,t-1} - \lambda \bar{H} \bar{T}_{i,t-1} - \lambda \bar{X}_{i,t-1} + \sum_{j=1}^{p-1} k_{i,j} \Delta HT_{i,t-j} + \sum_{j=0}^{q-1} s_{i,j} \Delta X_{i,t-j} + \mu_{1,t} \Delta \bar{H} \bar{T}_t + \mu_{2,t} \Delta \bar{X}_t + \varepsilon_{i,j} \quad [2]$$

Where $\Delta HT_{i,t}$ is the dependent variable, X_{it} Are all the long-run independent variables of the study?

HT_{t-1} and $\bar{X}_{t-1}$ Provide the means of the dependent and independent variables, respectively, in the long run. $\Delta HT_{i,t}$ and $\Delta X_{i,t}$ are dependent and independent variables in the short run. $\varepsilon_{i,j}$ is the error term

CS-ARDL for Objective One

$$\begin{aligned} \Delta HT_{it} = & \alpha_i + \lambda_i (HT_{i,t-1} - \beta_{2i} INST_{i,t-1} - \beta_{3i} PHE_{i,t-1} - \beta_{4i} PCI_{i,t-1} - \beta_{5i} UN_{i,t-1} - \beta_{6i} EDUC_{i,t-1} - \beta_{7i} CO_{2i,t-1}) \\ & + \sum_{j=0}^{p-1} \delta_{1ij} \Delta HT_{i,t-j} \\ & + \sum_{j=0}^{q-1} (\delta_{3ij} \Delta INST_{i,t-j} + \delta_{4ij} \Delta PHE_{i,t-j} + \delta_{5ij} \Delta PCI_{i,t-j} + \delta_{6ij} \Delta UN_{i,t-j} + \delta_{7ij} \Delta EDUC_{i,t-j} \\ & + \delta_{8ij} \Delta CO_{2i,t-j}) + \psi_i \bar{Z}_t + \varepsilon_{it} \end{aligned} \quad ($$

CS-ARDL for Objectives Two

$$\begin{aligned} \Delta HT_{it} = & \alpha_i + \lambda_i (HT_{i,t-1} - \beta_{1i} RM * INST_{it,i,t-1} - \beta_{2i} INST_{i,t-1} - \beta_{3i} PHE_{i,t-1} - \beta_{4i} PCI_{i,t-1} - \beta_{5i} UN_{i,t-1} \\ & - \beta_{6i} EDUC_{i,t-1} - \beta_{7i} CO_{2i,t-1}) + \sum_{j=0}^{p-1} \delta_{1ij} \Delta LE_{i,t-j} \\ & + \sum_{j=0}^{q-1} (\delta_{2ij} \Delta RM * INST_{it,i,t-j} + \delta_{3ij} \Delta INST_{i,t-j} + \delta_{4ij} \Delta PHE_{i,t-j} + \delta_{5ij} \Delta PCI_{i,t-j} + \delta_{6ij} \Delta UN_{i,t-j} \\ & + \delta_{7ij} \Delta EDUC_{i,t-j} + \delta_{8ij} \Delta CO_{2i,t-j}) + \psi_i \bar{Z}_t + \varepsilon_{it} \end{aligned} \quad (4)$$

4.1: Results and Discussion

There is wide variability in the descriptive statistics due to the limited number of observations (N=125), especially for UMR, remittances (RM), public health expenditures (PHE), and per capita income (PCI). Life expectancy averages 64.15 years, with an under-five mortality rate averaging 65.86, suggesting a wide disparity in health status within the sample.

Remittances (RM) and public health expenditures (PHE) are highly positively skewed, with kurtoses exceeding 7, implying the presence of a few extremely high observations, while others are moderately skewed. Thus, there is wide variability in health, economic, institutional and environmental factors in the selected SSA countries.

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Table 1: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
LE	125	64.149	5.495	51.852	76.224	53.045	76.059	.424	2.63
UMR	125	65.86	36.63	11.1	194.9	11.6	181.7	.938	4.048
PU	125	18.422	9.258	4.5	38.4	4.6	38.3	.894	2.693
RM	125	6.120e+08	9.090e+08	7130000	4.340e+09	18300000	4.050e+09	2.295	7.723
INST	125	-.415	.569	-1.582	.755	-1.557	.655	.306	2.297
PHE	125	28.776	43.553	.955	209.043	1.469	208.022	2.305	7.916
PCI	125	322000	290000	565.424	891000	573.371	853000	.212	1.557
UN	125	6.229	3.925	2.079	14.69	2.08	13.976	.741	1.984
EDUC	125	9.29	4.971	1.02	21.79	1.387	21.279	.696	2.948
CO2	125	.547	.509	.133	1.995	.137	1.927	1.576	4.173

Source: Author's compilation, 2026

The Pesaran (2007) CADF and CIPS results indicate a mixed order of integration among the variables. At level, UMR, PU and PHE are stationary, while LE, RM, INST, PCI, UN, EDUC and CO2 are non-stationary. After first differencing, LE, RM, PHE, PCI, UN, EDUC and CO2 become stationary at conventional significance levels. UMR remains weakly non-stationary at first difference at the 5% level, while INST is only marginally significant around the 10% level. Overall, the results mainly indicate a combination of I(0) and I(1) variables, supporting the use of panel estimators that accommodate mixed integration orders and cross-sectional dependence.

Table 2: Unit Root Test

Pesaran (2007) CADF and CIPS panel unit root tests at levels and first difference, lag 1

	CADF_L	p_CADF_L	CIPS_L	p_CIPS_L	CADF_D	p_CADF_D	CIPS_D	p_CIPS_D
LE	-1.72	0.53	0.08	0.53	-4.05	0.00	-5.29	0.00
UMR	-2.68	0.02	-2.12	0.02	-2.38	0.08	-1.43	0.08
PU	-2.71	0.01	-2.19	0.01	-2.87	0.01	-2.57	0.01
RM	-1.36	0.82	0.92	0.82	-3.32	0.00	-3.60	0.00
INST	-1.33	0.84	0.99	0.84	-2.45	0.06	-1.59	0.06
PHE	-2.72	0.01	-2.22	0.01	-4.07	0.00	-5.33	0.00
PCI	-1.95	0.33	-0.43	0.33	-2.89	0.00	-2.61	0.00
UN	-1.71	0.55	0.12	0.55	-2.59	0.03	-1.92	0.03
EDUC	-1.12	0.93	1.46	0.93	-2.68	0.02	-2.13	0.02

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CO2	-1.53	0.70	0.53	0.70	-3.13	0.00	-3.16	0.00
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Source: Author's compilation, 2026

The correlation matrix shows strong positive relationships of life expectancy with public health expenditure ($r = 0.937$), CO₂ emissions ($r = 0.873$), unemployment ($r = 0.629$), and per capita income ($r = 0.563$). Under-five mortality is strongly negatively related to life expectancy ($r = -0.919$), public health expenditure ($r = -0.823$), and per capita income ($r = -0.660$), indicating that improved socioeconomic conditions are associated with lower child mortality. Poverty (PU) is negatively associated with life expectancy ($r = -0.527$) and is particularly strongly associated with lower per capita income ($r = -0.821$). Remittances (lnRM) show generally weak direct correlations with the health outcomes and most explanatory variables, suggesting that their influence may operate through indirect or conditional channels. Overall, the relatively high correlations among some regressors, especially lnPHE and CO₂, suggest that multicollinearity should be examined further using appropriate diagnostic tests before model estimation.

Table 3: Matrix of correlations

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) LE	1.000								
(2) lnRM	-0.000	1.000							
(3) lnPHE	0.937	0.032	1.000						
(4) lnPCI	0.563	0.027	0.537	1.000					
(5) PU	-0.527	0.051	-0.441	-0.821	1.000				
(6) UN	0.629	-0.383	0.662	0.257	-0.385	1.000			
(7) CO2	0.873	0.046	0.905	0.417	-0.313	0.667	1.000		
(8) EDUC	0.418	0.176	0.323	0.320	-0.257	0.010	0.378	1.000	
(9) UMR	-0.919	0.104	-0.823	-0.660	0.661	-0.562	-0.655	-0.309	1.000

Source: Author's compilation, 2026

Table 4: CROSS-SECTIONAL DEPENDENCE TEST RESULTS

The cross-sectional dependence results indicate substantial interdependence among the panel units, although the evidence differs across the alternative tests. The CD and CDw statistics reject the null of weak dependence for several variables, including LE, UMR,

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RM, INST, PHE, PCI and CO₂ , while PU, UN and EDUC show weaker evidence under some specifications. The CDw+ test is significant for all variables, providing strong overall evidence that common shocks and spillover effects exist across the sampled SSA countries. Accordingly, second-generation panel methods that explicitly account for cross-sectional dependence are more appropriate for subsequent estimation.

Table 4.X: Cross-Sectional Dependence Test Results

Variable	CD	p-value	CDw	p-value	CDw+	p-value	CD*	p-value
LE	15.420	0.000	15.420	0.000	64.180	0.000	0.220	0.829
UMR	15.060	0.000	2.760	0.006	50.380	0.000	1.220	0.221
PU	0.350	0.728	-0.160	0.870	11.970	0.000	2.580	0.010
RM	2.480	0.013	-3.220	0.001	18.260	0.000	0.310	0.755
INST	-2.400	0.016	1.000	0.317	15.640	0.000	6.950	0.000
PHE	9.960	0.000	-1.050	0.295	30.450	0.000	0.220	0.824
PCI	6.150	0.000	-1.480	0.139	19.410	0.000	0.410	0.681
UN	-0.080	0.935	4.530	0.000	22.130	0.000	6.550	0.000
EDUC	0.700	0.482	-0.570	0.567	14.900	0.000	1.090	0.276
CO2	12.470	0.000	2.220	0.026	41.650	0.000	1.230	0.218

Note: H0: weak cross-sectional dependence; H1: strong cross-sectional dependence. p-values are reported in separate columns. A p-value below 0.05 indicates rejection of the null hypothesis of weak cross-sectional dependence.

Test references: CD — Pesaran (2015, 2021); CDw — Juodis and Reese (2021); CD* — Pesaran and Xie (2021), using 4 principal components.

Source: Author's computation from Stata output.

Source: Author's compilation, 2026

Table 5: Slope Homogeneity Test

The Pesaran–Yamagata results reject the null hypothesis of slope homogeneity for all three models because both the Delta and adjusted Delta statistics are significant at the 1% level. This indicates that the slope coefficients differ significantly across the sampled SSA countries rather than being identical throughout the panel. Therefore, the effects of remittances and the other explanatory variables on health outcomes are heterogeneous across countries. The finding supports the use of heterogeneous panel estimators, such as CS-ARDL or CCEMG, that allow country-specific responses while accounting for cross-sectional dependence.

Table 5. X: Pesaran-Yamagata Slope Heterogeneity Test Results

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Published on: 30.08.2026

Model	Delta (Δ)	p-value	Adjusted Delta ($\Delta_{adj.}$)	p-value	Decision
Model 1	5.101	0.000	6.679	0.000	Reject H_0
Model 2	5.535	0.000	7.094	0.000	Reject H_0
Model 3	4.681	0.000	6.000	0.000	Reject H_0

Note: H_0 : slope coefficients are homogeneous. H_1 : slope coefficients are heterogeneous. Since the p-values for both the Delta and adjusted Delta statistics are 0.000 in all three models, the null hypothesis of slope homogeneity is rejected at the 5% significance level. This indicates slope heterogeneity across the panel units. Variables partialled out: constant.

Reference: Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*.

Source: Compiled by the author from Stata output, 2026.

Source: Author Compilations, 2026

Note: *** $P < 0.01$, respectively.

Empirical Results

The insignificant short- and long-run coefficients of remittances for life expectancy, under-five mortality and poverty suggest that remittance inflows do not automatically translate into improved health and welfare outcomes among the five leading remittance-receiving SSA countries. This finding may reflect the fact that remittances are private household resources whose effects depend on how they are allocated among consumption, healthcare, education, savings and investment. It contrasts with broader evidence from developing countries that remittances can raise health expenditure and reduce child mortality, but it is consistent with the argument that the development effect of remittances is conditional on complementary socioeconomic structures. The significant role of per capita income in some specifications further indicates that household and national income conditions may be more important than remittance inflows alone in shaping health and poverty outcomes. The significance of education and the persistence of some lagging health indicators also point to the structural determinants of health. Similarly, recent evidence from SSA shows that health outcomes and poverty are strongly connected to domestic financing conditions and the burden of health expenditure, indicating that improvements in household welfare require broader health-financing and socioeconomic policies rather than dependence on remittances alone.

The insignificant interaction between remittances and institutional quality further suggests that, within the present sample, better institutions do not significantly strengthen the effect of remittances on life expectancy, under-five mortality or poverty. This result differs from evidence in other dimensions of development, showing that institutional quality can enhance the benefits of remittances. For example, remittances interacted with governance quality have

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Published on: 30.08.2026

been found to improve food and nutrition security in SSA, while more recent studies show that institutional quality can strengthen remittances' contribution to economic growth, financial development, and other socioeconomic outcomes. The divergence suggests that institutional quality may influence the remittance–health nexus through indirect channels that are not sufficiently strong to produce a direct statistical effect in the five-country sample. The significance of the cross-sectional augmentation terms also indicates that common regional shocks and spillovers are important, supporting the use of estimators such as CS-ARDL and CCEMG that account for cross-country dependence. Overall, the findings imply that remittances should be regarded as a complementary rather than stand-alone instrument for improving health and reducing poverty; their effectiveness is likely to depend on stronger health systems, income growth, labour-market conditions, education and institutional mechanisms that enable households to convert private transfers into sustainable welfare improvements.

Table 6: Results on the effect of remittances on health indicators of top five remittances receiving countries in selected SSA

VARIABLES	(1) LE_UMR_PU	(2) LE_UMR_PU	(3) LE_UMR_PU
D.lnRM	-1.056 (0.756)	-1.869 (1.946)	5.645 (3.740)
D.lnPHE	0.926 (1.130)	2.449 (2.133)	-6.645 (5.611)
D.lnPCI	-2.361 (11.070)	9.792 (7.207)	31.842* (16.947)
D.UN	-0.243 (0.374)	-0.222 (0.272)	-1.969 (1.672)
D.EDUC	-0.049 (0.029)	0.007 (0.064)	0.129 (0.112)
D.CO2	-9.261 (6.559)	5.771 (4.809)	15.211 (19.903)
L.LE	-0.403*** (0.103)		
lnRM	2.367*** (0.182)	535.385 (478.257)	-6.663 (4.786)
lnPHE	-1.725 (2.720)	205.133 (299.747)	9.252 (8.461)

lnPCI	-10.205*** (3.043)	-873.227 (889.892)	3.682 (8.086)
UN	-1.733 (1.719)	-90.567 (89.664)	0.371 (1.363)
EDUC	0.116*** (0.034)	-6.534 (6.037)	-0.229 (0.274)
CO2	19.645*** (6.313)	-257.735 (371.927)	7.991 (20.508)
L.UMR		-0.067* (0.037)	
L.PU			-0.586* (0.315)
Constant	68.258 (48.407)	-292.197 (26,193.397)	75.646 (528.710)
Observations	120	120	120
R-squared	-0.040	-0.233	0.074
Number of groups	5	5	5

Source: Author's compilation, 2026. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

CCEMG robustness test results indicate that most of the independent variables are statistically insignificant for all three dependent variables, such as life expectancy, child mortality, and poverty, which further validates the presence of insignificant direct impact among variables.

Education is the only variable which has a significant negative impact on life expectancy, while unemployment is significant for poverty. Other variables such as institutional quality, health expenditure, GDP per capita and CO₂ emissions do not have any significant impact. In general, robustness test findings confirm our main results.

Table 6: Robustness check using CCEMG for objective 1

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	LE UMR PU	se	LE UMR PU	se	LE UMR PU	se
LE	.	(.)				

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Accepted: 20.08.2026

Published on: 30.08.2026

INST	0.079	(0.476)	-0.374	(6.018)	-0.585	(2.373)
lnPHE	0.484	(1.568)	-4.896	(15.314)	-7.039	(4.527)
lnPCI	6.197	(4.491)	31.264	(44.995)	0.499	(17.580)
UN	-0.683	(0.696)	4.010	(3.503)	-0.592**	(0.273)
EDUC	-0.020**	(0.010)	0.333	(0.344)	0.127	(0.235)
CO2	-2.375	(2.549)	-3.952	(12.415)	-30.624	(39.532)
UMR			.	(.)		
PU					.	(.)
Observations	125		125		125	
R-squared	0.399		0.311		0.426	
Number of groups	5		5		5	

Source: Author's compilation, 2026

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

For Objective 2, which looks at the combined effects of institutional quality and remittances on health variables in Sub-Saharan Africa, it is observed that the interaction between remittances and institutional quality (lnRMINST) has a statistically significant positive effect on life expectancy ($\beta=0.0354$, $p<0.01$) in the long-run, implying that improved institutional quality makes the impact of remittances more effective in increasing life expectancy. On the other hand, the interaction effect between remittances and institutional quality is statistically insignificant for under-five mortality and poverty, indicating that institutional quality does not significantly amplify the impact of remittances on these two variables in the sample countries. Moreover, in the short run, the interaction effect is not statistically significant in all three regressions, whereas education has a slightly negative effect on life expectancy. The statistically significant cross-sectional augmentation effect on life expectancy and under-five mortality suggests the presence of common shocks and inter-country correlation in explaining health variables. Therefore, the result partially supports Objective 2 because institutional quality significantly augments the effect of remittances on life expectancy, but not on under-five mortality or poverty.

Table 7: Objective 2: Effect of institutional quality and remittances on health indicators in SSA

	(1)	(2)	(3)	(4)	(5)	(6)
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Accepted: 20.08.2026

Published on: 30.08.2026

VARIABLES	Model1_LE	SC,Test_LE	Model2_UMR	SC_Test_UMR	Model3_PU	SC_Test_PU
D.lnRMINST	0.0133 (0.120)		0.0428 (0.0867)		-0.512 (0.409)	
D.lnPHE	0.733 (0.619)		1.225 (1.009)		3.966 (6.716)	
D.lnPCI	5.597 (4.987)		-0.140 (6.849)		-30.92 (30.19)	
D.UN	-0.284 (0.496)		-0.354 (0.228)		2.945 (3.560)	
D.EDUC	-0.0223* (0.0124)		-0.0278 (0.0464)		-0.190 (0.114)	
D.CO2	-1.245 (2.668)		6.240 (5.194)		9.432 (16.48)	
LE	1.179*** (0.128)					
lnRMINST	0.0354*** (0.013)		0.211 (1.218)		-108.7 (108.9)	
lnPHE	0.437 (0.693)		33.34 (27.18)		1,503 (1,529)	
lnPCI	3.339 (2.957)		-119.7 (204.8)		5,153 (5,288)	
UN	-0.229 (0.386)		-7.971 (8.419)		50.73 (54.96)	
EDUC	0.00437 (0.0173)		-2.173 (2.339)		-21.15 (21.29)	
CO2	-2.418 (2.441)		106.2 (134.9)		-10,403 (10,405)	
L.__000006		0.459*** (0.0706)		0.868*** (0.0329)		0.00236 (0.0550)
UMR			-0.00184 (0.0967)			

PU					0.538	
					(0.439)	
Constant	-2.160		41,193***		-456.4	
	(66.15)		(1,383)		(664.5)	
Observations	120	115	120	115	120	115
R-squared	0.052	0.227	0.129	0.872	0.060	0.000
Number of groups	5		5		5	

Source: Author's compilation, 2026

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The robustness results show that the interaction between remittances and institutional quality (lnRMINST) remains statistically insignificant for life expectancy, under-five mortality, and poverty. Per capita income has a positive and significant effect on life expectancy ($\beta = 6.983$, $p < 0.05$), indicating that higher income is associated with longer life expectancy. Unemployment has a negative and weakly significant effect on poverty ($\beta = -1.280$, $p < 0.10$), while the other control variables are statistically insignificant across the models. Overall, the results suggest that the conditioning role of institutional quality on remittances is not robust, whereas income and labour-market conditions appear more relevant for specific outcomes.

Table 8: Robustness Check using CCEMG

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	LE UMR PU	se	LE UMR PU	se	LE UMR PU	se
LE	.	(.)				
lnRMINST	0.030	(0.084)	0.262	(0.715)	0.018	(0.319)
lnPHE	0.426	(1.646)	-6.461	(17.793)	-6.597	(4.850)
lnPCI	6.983**	(3.382)	11.637	(34.144)	-0.407	(13.708)
UN	-0.538	(0.638)	3.345	(3.101)	-1.280*	(0.670)
EDUC	-0.013	(0.009)	0.387	(0.273)	0.047	(0.194)
CO2	-1.375	(2.420)	-14.584	(17.803)	-31.468	(39.431)
UMR			.	(.)		

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PU			(.)
Observations	125	125	125
R-squared	0.327	0.294	0.432
Number of groups	5	5	5

Discussion

The findings for Objective 2 reveal that the moderating effect of institutional quality on the remittances-well-being nexus is conditional and selective rather than general and uniform. While the positive and significant long-run coefficient of the interaction effect of remittances and institutional quality on life expectancy ($\beta=0.0354, p<0.01$) suggests that improving institutional conditions can increase the effectiveness of the positive effect of remittance inflows on longevity, this effect does not apply uniformly to all welfare outcomes. More precisely, the insignificant interaction coefficients of under-five mortality and poverty suggest that the institutional quality and remittances combination is not able to generate immediate health gains in this case due to structural reasons that make institutional improvement insufficient. In particular, under-five mortality is shaped by the maternal and child healthcare services, vaccinations, sanitation, nutritional and primary healthcare access while poverty is dependent on employment and income distribution. Therefore, remittance inflows and institutional improvement alone cannot immediately influence these welfare outcomes. Besides, the lack of significant short-run interaction coefficients further demonstrates that the benefits from improving institutional conditions require time to work. Moreover, the significant augmentation terms in the cross-sectional equation of life expectancy and under-five mortality suggest that the health outcomes are determined by regional shocks.

The comparison of this finding with the results of the first objective further clarifies the role of institutional quality. While the first objective revealed that remittances were positively and significantly correlated with life expectancy in the absence of institutional quality in the remittance channel, the interaction specification under the second objective generates a positive but quite small coefficient of 0.0354. Substantively, this implies that the contribution of remittances to life expectancy without accounting for institutional quality may be greater than the additional effect that is provided by the institutional channel. In other words, institutional quality complements rather than dominates the remittance-health link. However, the coefficients obtained under two different specifications should not be compared directly since the coefficient on remittances and the coefficient on interaction represent different marginal effects. Nevertheless, the results suggest that, when accounting for institutional conditions, the additional contribution of institutional quality to life expectancy is small but still statistically significant. This further supports the idea that remittance-driven health benefits arise mainly at the household level and the impact of institutional quality is partial. The insignificance of the interaction coefficients for under-five mortality and poverty further demonstrates that

strengthening institutional quality cannot guarantee welfare improvements across all dimensions in the context of remittance inflows.

Conclusion

This study finds that institutional quality partially moderates the relationship between remittances and health outcomes in selected high-remittance-receiving countries of Sub-Saharan Africa. Specifically, the significant interaction effect on life expectancy indicates that improving the institutional environment can enhance remittances' contribution to life expectancy. However, the insignificant interaction effects on under-five mortality and poverty further demonstrate that the benefits of improved institutional quality are not universal and limited only to certain outcomes. Moreover, the results of this study also reveal that while considering institutional quality, the direct effect of remittances found under the first objective remains significant and the additional health benefit through institutional quality is small but still significant for life expectancy. This implies that the developmental role of remittances cannot be substituted by public health system and social policies. Instead, this depends on the institutional environment that allows the receipt of remittances to translate into health improvement through having an access to proper healthcare services, financial institutions, education, sanitation and employment. The evidence of the significant cross-sectional dependence further demonstrates that the health outcomes in the selected SSA economies are influenced by regional shocks and common socioeconomic conditions.

Recommendations

The government in Sub-Saharan Africa should focus on strengthening the institutional environment that will help the receipt of remittances to translate into sustainable health gains instead of relying on remittances alone. In particular, improvements in healthcare governance, increased transparency in health spending, improved primary healthcare accessibility, financial inclusion, and the efficiency of public institutions are necessary due to their significant interaction effects on life expectancy. At the same time, the lack of a significant interaction effect between under-five mortality and poverty calls for the adoption of specific policies to address these welfare outcomes directly. For instance, the development of maternal and child healthcare services, immunisations, nutrition programmes, sanitation and employment creation, as well as poverty alleviation, is required. Moreover, remittance costs should be reduced, and digital remittance channels should be expanded to enable more resources to reach households.

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