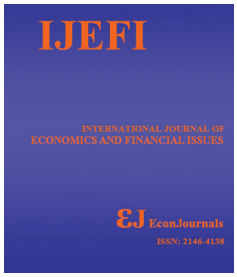

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Remittance, Domestic Savings and Poverty Alleviation: Evidence from sub-Saharan Africa

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ABSTRACT

Remittances and domestic savings are crucial in economic progress, particularly in developing regions like Sub-Saharan Africa. However, the region is often characterised by low-income levels and inadequate savings, which hinder sustainable investment in growth-enhancing activities. To address this gap, international remittances have emerged as a significant source of external financing, complementing domestic savings. This research examines how remittance influences poverty alleviation in Saharan Africa through an extensive analysis of panels categorised by income and geographical criteria from 2004 to 2023. The outcomes from the two-way fixed effect model show that remittance has a significant positive effect on poverty alleviation. These findings remain robust even after employing robustness tests and implementing an instrumental variable approach to address potential endogeneity concerns. Further scrutiny of the underlying mechanism reveals that remittance stimulates domestic savings by enhancing individuals' and households' disposable income and access to funds. The empirical findings emphasise the need for improved governance and policy frameworks to optimise foreign capital utilisation and regional and international collaboration to harness the full potential of remittance to the region.

Keywords: Poverty Alleviation, Remittance, Domestic Savings, Sub-Saharan Africa
JEL Classifications: I32, F24, E21

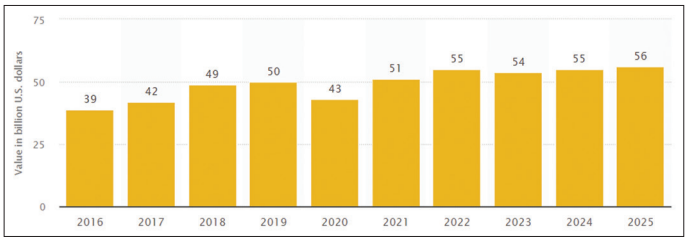
1. INTRODUCTION

Poverty can be regarded as one of the most significant issues in the world today, with developing regions such as Sub-Saharan Africa being affected the most. The World Bank revealed that about 40% of the population in Sub-Saharan Africa lives on <$1.90/day, the highest poverty threshold (Tsaurai, 2018). Most of the population lives in poor economic conditions (Nwani and Osuji, 2020), and people and families find it difficult to escape the poverty trap (Beegle and Christiaensen, 2019; Sachs et al., 2004). Some factors that worsen this poverty include economic instability, low levels of education, and poor healthcare systems.

Remittances, which are defined as the monetary transfers from migrants to their home countries, have become a vital source of financial support for many households in developing countries, including those in sub-Saharan Africa (Acosta, 2011; Anyanwu and Erhijakpor, 2010; Sulemana et al., 2023). The World Bank stated that remittances to Sub-Saharan Africa totalled $44 billion in 2020, which shows the importance of remittances in the region's economic landscape (Blanchflower, 2020); this steady increase in remittance flows has generated much interest in understanding the effect of these transfers on poverty. Figure 1 below depicts the significant increase in remittance in the region, amounting to 56 billion in 2025 (de Best, 2025).

Evidence from the literature shows that remittances positively affect poverty reduction. Based on Masron and Subramaniam (2018), it has been observed that those countries that receive more remittances have lower poverty rates since remittances enhance household income and spending power (Masron and Subramaniam, 2018). Similarly, Khan et al. (2022) have observed

Figure 1: Remittance transfer to sub-Saharan Africa: Source (de Best, 2025) value in billions in US. Dollars



that remittances are a key factor in eradicating poverty in the Middle East and North Africa (MENA) region. While their sample is not limited to Sub-Saharan Africa, their findings are generalisable across the two regions (Khan et al., 2022). Moreover, results of the study conducted by Can and Çiftçi (2022) show that remittances significantly lower the probability of households falling into poverty, thus indicating that these funds are important for economic stability (Can and Çiftçi, 2022).

Although remittances are positively linked to poverty reduction, people have started to raise an issue of overdependence on the money sent. Tsaurai (2018) warns that although remittances can bring immediate relief, they can also discourage local investment and entrepreneurship and hinder economic development in the long run by reducing investment incentives (Tsaurai, 2018). This duality poses a complex problem for policymakers trying to include remittances in the efforts towards sustainable development.

Although Remittances and their effects on economic development have been well-studied, the capacity of remittances as an antipoverty tool is not well established. Current studies have often neglected the role of domestic savings, income levels, and regional differences in shaping the relationship between remittances and poverty. This study focuses on the complex link between remittances, domestic savings, and poverty reduction in Sub-Saharan Africa. Therefore, This study seeks to contribute to this gap by examining the impact of remittances on human development and exploring the viability of remittances as an antipoverty tool and the role of domestic savings and institution quality factors that affect the relationship.

This study aims to fill these gaps by exploring the effects of remittances, income, and domestic savings on poverty reduction in 42 sub-Saharan African countries using the New Economics of Labor Migration (NELM) framework, which posits that migration and remittances as household strategies to diversify incomes and reduce risks in the face of economic uncertainty (Tsaurai, 2018). In addition, the study also uses the permanent income hypothesis and the liquidity constraint model to explore the association. Moreover, the Two-Way Fixed Effects (TWFE) and Instrumental Variable (IV) models are used for robust empirical analysis. The study also explores the mediating role of domestic savings and the moderating roles of government effectiveness and regulatory quality on the effect of remittances on poverty alleviation. Moreover, the study also accounts for regional and economic heterogeneity by dividing the sample into subgroups based on geography (West, East, Central and Southern Africa) and GDP per capita. This research builds on current literature and aims to fill important gaps whilst providing valuable insights to policymakers to formulate and implement effective policies to fully harness the potential of remittances for the sustainable eradication of poverty in the region.

In addition to the introduction (section 1), the remaining portion of our study is structured as follows: literature review and theoretical analysis in section 2, followed by econometric methodology and data in section 3, the empirical results are presented in section 4, the analysis of mechanisms is in section 5, and the conclusion and policy implications are in section 6.

2. LITERATURE REVIEW

2.1. Remittance and Poverty Alleviation Nexus

Remittances have emerged as a vital means of poverty alleviation, a source of support, and a means of enhancing the country's socio-economic development. Stark (1985) made the earliest contribution by conceptualising remittances as altruistic transfers and implicit contractual agreements between migrants and families (Stark, 1985). As mentioned in their study by Anarfo et al. (2020), remittances increase financial inclusion, which is vital in alleviating poverty. They observed that households are better positioned to manage the remittance flows with increased access to financial services, which leads to improved economic stability (Anarfo et al., 2020). This agrees with the results presented by Sulemana et al. in 2022, who observed that remittances positively impact food security, a key determinant of poverty. Their results show that the households that receive remittances may use the money to meet their daily needs and, therefore, improve their standard of living (Sulemana et al., 2022).

Moreover, the effect of remittances on household consumption patterns is quite strong. In their study, Ajefu and Ogebe (2020) showed that remittances affect the expenditure and consumption patterns of households that are behind the poverty line, leading to spending more on education and health (Ajefu and Ogebe, 2020). This is supported by Musakwa and Odhiambo (2020), who observed that remittance receipts have a positive impact on poverty levels in South Africa and, therefore, remittances play a significant role in enhancing the quality of life of the households (Musakwa and Odhiambo, 2020). Furthermore, the article by Kassegn (2021) discusses how the COVID-19 pandemic affected remittance flows and how this may undo the progress made toward poverty reduction, thus revealing the risky situation of households that rely on remittances (Kassegn, 2021).

Notwithstanding, the contextual factors that influence the effectiveness of remittance in the fight against poverty cannot be overlooked. According to Ouedraogo et al. (2018), the general economic situation in the migrants' communities is one of the most important factors affecting remittances' impact on poverty reduction. Their study results show that remittances can help reduce poverty levels. However, their effectiveness depends on the economic situation and the ability of households to use the remittances efficiently (Ouedraogo et al., 2018).

The impact of poverty reduction is also felt in human capital development, as remittances are used to fund education and

vocational training. However, this positive development is partly offset by systemic challenges, including the brain drain of skilled workers. There are also structural barriers that make the efficacy of remittances ineffective. High transaction costs of 7.3% in SSA are far higher than the global average of 6%, thus eroding the significant power of inflows on the region (World Bank, 2024). Remittance overdependence is detrimental to local labour markets and creates unemployment (Chami et al., 2003); this notion is supported by Crush and Ceasar, stating that remittance-reliant households in Lesotho reduced agricultural activity and leading to increased food insecurity (Crush and Ceasar, 2020). These challenges reveal the two faces of remittances in SSA: Though they provide quick solutions to poverty, their effectiveness over time depends on addressing structural inequalities, improving financial inclusion, and reducing over-dependence through savings and investment.

2.2. Theoretical Analysis of Remittance Impact on Poverty Alleviation

2.2.1. Remittance impact poverty alleviation

Several economic theories, including the New Economics of Labor Migration (NELM) by Stark and Bloom (Tsaurai, 2018), explain the theoretical frameworks on the effect of remittances on poverty alleviation. According to Stark and Bloom's (1985) NELM model, migration decisions are made based on the individual's desire and as a household approach to diversify income sources and reduce economic uncertainty risks. This view means that remittances are not only a way of sending money home but also a means of enhancing a household's economic standing (Stark and Bloom, 1985). The relationship between remittances and poverty alleviation in Sub-Saharan Africa reveals that remittances are the most important source of income for many households and play an important role in eradicating poverty (Anarfo et al., 2020). A study conducted by Waglé and Devakota in Nepal illustrates how the migration of workers can boost economic prosperity and decrease poverty within families involved. This aligns with the belief that migration serves as a household strategy to manage risks and enhance security (Wagle and Devkota, 2018). Similarly, Anyanwu and Erhejapor discovered a noticeable decrease in poverty indicators across Africa due to remittances, underscoring the effectiveness of remittances in lowering poverty levels (Anyanwu and Erhijakpor, 2010).

Moreover, Möllers and Meyer pointed out that money sent back home can make a difference in reducing the number of poor people in society, especially in rural areas where those who receive it tend to earn lower incomes (Möllers and Meyer, 2014). This idea is in line with the notion of income theory that suggests people base their spending decisions not only on what they earn now but also consider what they expect to earn over their lifetime. In this way, receiving remittances helps families manage their spending habits over time and ultimately plays a role in lifting them out of poverty over the term (Musakwa and Odhiambo, 2022).

Furthermore, Remittances also strengthen human capital, which is consistent with other aspects of their impact. Huay and Bani (2023) found that remittances are linked with poverty reduction and improved education indicators. Thus, the advantages of remittances are not only in financial support but also in other social and human development areas, as shown by (Huay and Bani, 2023). This is in concurrence with Can and Çiftçi (2022), who noted that remittances are a source of physical and human capital accumulation, which in turn enhances the fight against poverty as revealed by (Can and Çiftçi, 2022).

2.2.2. Remittance, savings and poverty alleviation

The impact of remittances in reducing poverty is explored by some researchers; however, there is little discussion about the role of savings in the impact of remoteness on poverty alleviation, especially the impact of savings on poverty alleviation. Remittances frequently empower families to set aside money that can be used for investing in assets or education to improve their financial security and diminish poverty levels even further.

The permanent income hypothesis explains how remittances affect domestic savings and household spending, thereby contributing to poverty alleviation. This hypothesis is founded on the premise that households smoothen their consumption over time and that remittances are a stable form of income that can be used to even out fluctuations in household economic resources. Lim and Basnet (2017) argued that migrants reinvest the remittances to create future income when the migrants reinstate themselves in the country. In turn, remittances are used to even out earnings and allow households to concentrate on long-term productive spending on education and health (Lim and Basnet, 2017). This idea is also supported by Akim et al. (2021) who argued that remittances can act as a protective mechanism against economic stress, thereby reducing poverty (Akim et al., 2024). This is so because, according to Dharmadasa et al., remittances are important in removing the systemic constraints in the rural families to make investments that are vital for poverty allevation (Dharmadasa et al., 2018; Jallow and Jiang, 2025).

Moreover, the liquidity constraint model postulates that remittances enable households to acquire capital through boosted savings required for business activities. According to Mohammed and Karagöl (2023), remittances enhance financial inclusion by offering the funding required for business investments, which, in turn, boosts local markets and fights poverty, as highlighted by (Mohammed and Karagöl, 2023). This is supported by Adekunle et al. (2020), who state that enhancing the institutional framework will ensure that remittances are utilised to their fullest extent, resulting in improved economic growth and reduced poverty (Adekunle et al., 2020).

2.2.3. The moderation of regulatory quality and government effectiveness

Regulatory quality and government effectiveness are crucial when it comes to remittances and reducing poverty levels in society. The presence of governance and robust institutions plays a key role in optimising the positive impact of remittance inflows. According to Abdih et al., the ability of remittances to boost productivity and stimulate economic growth hinges significantly on the quality of the institutional framework (Abdih et al., 2012), which was supported by the study (Ekanayake and Moslares, 2020).

Additionally, Kharel and Upadhyay's study highlights the role of governance effectiveness in recipient nations in shaping the effects of labour migration on broader economic indicators like

poverty reduction (Kharel and Upadhyay, 2021). In regions with regulatory systems, remittances have a better chance of being directed towards beneficial investments, thus boosting their capacity to alleviate poverty.

Furthermore, Imai et al. 2014 and Huay and Bani, 2018 emphasise that migration can reduce poverty; however, the extent of these impacts is influenced by the efficiency of existing institutions and policies (Huay and Bani, 2018; Imai et al., 2014). Henceforth, it is crucial for decision-makers to prioritise enhancing the quality of regulations and the effectiveness of government to maximise the benefits of remittances in combating poverty.

2.3. Conceptual Framework

The research focuses on the effects of remittances on poverty reduction while addressing domestic savings as a mediating variable and regulatory quality and government effectiveness as moderating variables. The study uses the framework depicted in Figure 2, which is based on the literature synthesis.

3. ECONOMETRIC METHODOLOGY AND DATA

3.1. Method of Data Analysis

The research objective is to assess the effects of remittance and domestic savings on poverty alleviation in 42 sub-Saharan African countries based on the availability of data on key variables for empirical analysis.

The study has been conducted using the two-way fixed effects model with the help of Stata. This sophisticated estimator accounts for both the entity and time-fixed effects in order to control the unobserved heterogeneity. This model included fixed effects for each cross-sectional unit in each period to capture time-invariant characteristics and regular shocks that may lead to biased results.

Moreover, this method can be used for heterogeneous panels with different periods and cross sectional units. Moreover, it uses some statistical tests to check the validity of the fixed effects and the estimator's accuracy. Endogeneity problems were accounted for using the instrumental variable method and TWFE. Furthermore, robustness checks were conducted using feasible ordinary least square (FGLS) and heterogeneity analysis by region and level of economic development. The result of the study was verified using these methods, some statistical inferences were made, and any disparity in the relationship between remittance, Domestic Savings, and Poverty Alleviation was observed according to national differences.

The mechanism of Domestic Savings and the moderating analysis of Regulatory quality and government effectiveness were also employed to analyze the channels through which remittance affects poverty in the region and the role of institutional quality in shaping the relationship.

3.2. Model Specifications

The empirical model used in this model is based on the existing literature as follows, specifically as proposed by Saint (Yang et al., 2020; Ahmad et al., 2019).

$$HDI_{it} = f(REM_{it}, DS_{it}, X_{it}, \varepsilon_{it}) \quad (1)$$

Where HDI_{it} is the human development index, REM_{it} is a remittance, DS_{it} is Domestic Savings, X_{it} is the vector of control variables including Economic growth, Employment in Agriculture, Inflation, Urbanisation and Population,

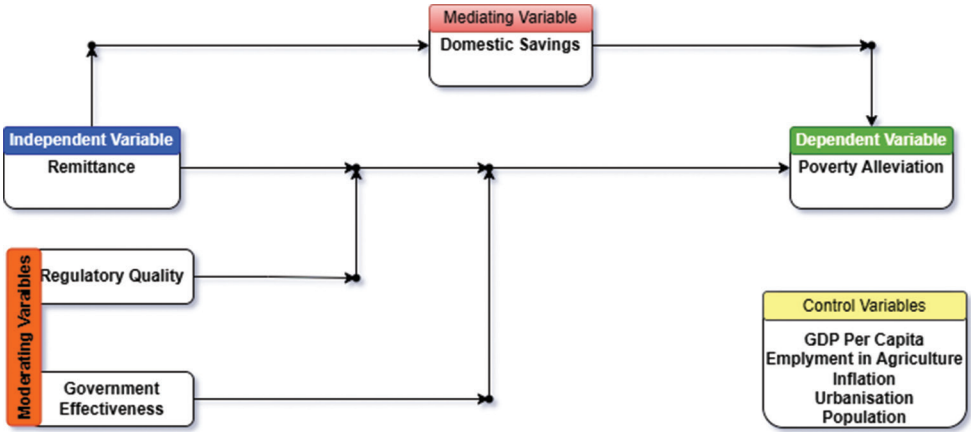
All variables are converted into a natural logarithm except government effectiveness and regulatory quality for more precise estimation (Jallow and Jiang, 2025; Shahbaz et al., 2016). The baseline model specification of our empirical mode is given as follows:

$$\ln HDI_{i\,t} = \alpha + \beta_1 \ln REM_{it} + \beta_2 \ln EG_{it} + \beta_3 \ln EIA_{it} + \beta_4 \ln INF_{it} + \beta_5 \ln URB_{it} + \beta_6 \ln P_{it} + \theta_i + \delta_t + \epsilon_{it} \quad (2)$$

Where t and i denote country and year, lnHDI represents the total human development index. The core explanatory variables are lnREM and remittance. lnEIA lnINF, lnURB, and lnP represent the control variables in this study. θ_t is country-fixed effects, δ_i is time-fixed effects, and εit is an unobserved error term.

To capture the moderating effect of RQ and GE, equation (2) is modified to obtain equations 3 and 4 below for RQ and GE, respectively.

Figure 2: Conceptual framework



$$\ln HDI_{it} = \alpha+\beta_1 \ln REM_{it}+\beta_2 \ln EG_{it}+\beta_3 \ln EIA_{it}+\beta_4 \ln INF_{it}+\beta_5 \ln URB_{it} +\beta_6 \ln P_{it}+\beta_7 \ln REM*RQ_{it}+\theta_i+\delta_t+\epsilon_{it} \quad (3)$$

$$\ln HDI_{it} = \alpha+\beta_1 \ln REM_{it}+\beta_2 \ln EG_{it}+\beta_3 \ln EIA_{it}+\beta_4 \ln INF_{it}+\beta_5 \ln URB_{it} +\beta_6 \ln P_{it}+\beta_7 \ln REM*GE_{it}+\theta_i+\delta_t+\epsilon_{it} \quad (4)$$

To achieve the objective of investigating whether Domestic Savings mediate the impact of remittance on poverty alleviation, the extended form of the baseline model is written as:

$$\ln DS_{it} = \alpha+\beta_1 \ln REM_{it}+\beta_2 \ln EG_{it}+\beta_4 \ln INF_{it}+\beta_5 \ln URB_{it}+\beta_6 \ln P_{it}+\beta_6 UNE_{it}+\beta_7 RQ_{it}+\theta_i+\delta_t+\epsilon_{it} \quad (5)$$

$$\ln HDI_{it} = \alpha+\beta_1 \ln REM_{it}+\beta_1 \ln DS_{it}+\beta_2 \ln EG_{it}+\beta_3 \ln INF_{it}+\beta_4 \ln URB_{it}+ \beta_5 \ln P_{it}+\beta_6 UNE_{it}+\beta_7 RQ_{it}+\theta_i+\delta_t+\epsilon_{it} \quad (6)$$

3.3. Data and Sources

The study uses panel data from 42 sub-Saharan African countries from 2000 to 2023 and adopts nine (9) variables described in Table 1 below.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Summary Statistics, Correlation Matrix and VIF

Table 2 displays the summary statistics of the dataset, providing information on how the data is distributed and how it varies across various metrics. The mean values offer insights into the average values of indicators like a Human Development Index (HDI) of around 0.5075 and urbanisation averaging 1.2095. On the other hand, the standard deviation values indicate variations within the dataset, notably showing dispersion around its mean among the observations. The minimum and maximum stats highlight the range of the data. Moreover, in Table 3, all the variable correlation coefficients are <0.85, suggesting our model is free from multicollinearity among independent variables (Krammer, 2010). The Variance Inflation Factor (VIF) in Table 4 has a maximum VIF of 4.89, while the mean VIF is 2.82, which is very much lower than the threshold value of 10 generally used in academic literature, further confirming no multicollinearity issues in the dataset.

4.2. Baseline Regression and Robustness

Presented in Table 5 are the results from Equations (2),(3), and (4); columns (1) and (2) show results using the fixed and random technique, and columns (3), (4), and (5) show results from the TWFE technique. Limiting focus on the key variables of the study objective remittance, economic growth and the moderating effect of GE and RQ. The results reveal a significant positive impact of remittances on poverty alleviation in SSA nations, measured through the human development index (HDI). Across both models, the coefficients for remittance (lnREM) are positive and highly significant at a 1% level. This implies that a

Table 1: Variable description

Variable category	Variable	Abbreviations	Description	Data source
Dependent variable	Poverty alleviation	HDI	Human development index (value)	UNDP
Independent variable	Remittance	REM	Personal remittances received (% of GDP)	World development indicator
Control variables	Economic growth	EG	GDP per capita (constant 2015 US$)	World development indicator
	Employment in agriculture	EIA	Employment in agriculture (% of total employment) (modeled ILO estimate)	World development indicator
	Urbanisation	URB	Urban population growth (annual %)	World development indicator
	Population	P	Population growth (annual %)	World development indicator
	Inflation	INF	Inflation, consumer prices (annual %)	World development indicator
Moderating variables	Regulatory quality	RQ	Regulatory quality: Estimate	WORLD development indicator
	Government effectiveness	GE	Government effectiveness: Estimate	World development indicator
Mediating variable	Domestic savings	DS	Gross domestic savings (% of GDP)	World development indicator

Table 2: Summary statistics

Stats	lnHDI	lnREM	lnEG	lnEIA	lnINF	lnURB	lnP
Mean	0.5075	0.3196	7.1293	3.7961	1.6974	1.2095	0.7801
SD	0.1053	1.7405	0.9143	0.5363	1.1425	0.5878	0.6135
Min	0.2600	−8.6060	5.5417	1.6385	−3.3054	−4.9993	−6.0788
Max	0.8080	3.9858	9.8772	4.5203	6.3229	2.0287	1.7553
N	958	943	1008	943	887	990	996

Table 3: Correlation analysis

Variables	lnHDI	lnREM	lnEG	lnEIA	lnINF	lnURB	lnP
lnHDI	1						
lnREM	−0.2087*	1					
lnEG	0.8784*	−0.2938*	1				
lnEIA	−0.7884*	−0.0493	−0.8144*	1			
lnINF	−0.0949*	−0.0755*	−0.1283*	0.1290*	1		
lnURB	−0.3793*	0.0405	−0.4396*	0.5265*	0.0342	1	
lnP	−0.4940*	−0.015	−0.5067*	0.6780*	0.0652	0.7531*	1

*shows the coefficients are significant at the 5% significance level

Table 4: Variance inflationary factor

Variable	VIF	1/VIF
lnEIA	4.89	0.2047
lnEG	3.62	0.2763
lnP	3.39	0.2947
lnURB	2.63	0.3795
lnREM	1.36	0.7358
lnINF	1.04	0.9572
Mean VIF	2.82	

Table 5: Baseline results, full sample (Dep Var: lnHdi)

Variables	(1)	(2)	(3)
	Fixed effects	Random effects	Two-way FE
lnREM	0.0107***	0.0146***	0.00445***
	(0.00201)	(0.00211)	(0.00163)
lnEG	0.306***	0.239***	0.178***
	(0.0144)	(0.0134)	(0.0146)
lnINF	0.00421**	0.00455**	0.00599***
	(0.00204)	(0.00221)	(0.00165)
EIA	−0.00553***	−0.00519***	0.000776*
	(0.000416)	(0.000430)	(0.000421)
lnP	0.0112	0.0228**	0.0281**
	(0.00915)	(0.00980)	(0.0114)
lnURB	0.0221***	0.0238***	0.0173**
	(0.00706)	(0.00758)	(0.00715)
Constant	−2.633***	−2.188***	−2.053***
	(0.117)	(0.112)	(0.108)
Overall significance	0.000	0.000	0.000
Hausman test	chi^2 (6)=108.56		
	0.000		
Group-wise	chi^2 (41)=63242		
Heteroscedasticity	0.000		
Observations	760	760	760
R-squared	0.734	0.727	0.978
Country FE			Yes
Year FE			Yes

ln natural logarithm; Panel corrected standard errors in parentheses; ***P<0.01, **P<0.05, *P<0.1

1% increase in remittances is associated with an increase in HDI of 0.0045-0.0146%. Emphasises that remittance substantially contributes to human development by providing direct financial resources to households and improving access to essential services such as healthcare, education, and nutrition, which are key components of poverty reduction and quality of life improvements in sub−Saharan Africa. Similarly, Economic growth shows a significant positive result across all models, indicating that a 1% increase in economic growth is associated with human development by 0.152-0.306%, all at a 1% significant level.

4.3. Endogeneity Test

While the two-way fixed effects model effectively accounts for unobserved heterogeneity across nations, endogeneity issues can still be affected over time due to biases arising from omitted variable bias and measurement error. Even though the empirical approach has managed to accurately consider factors affecting a country's poverty levels, there remains a chance of bias due to missing variables that stem from unobservable elements. The study addressed These problems using the instrumental variable (IV) method. Specifically, the lag of remittance was used as an instrument. This approach addresses the endogeneity problem

Table 6: Instrumental variable approach

Variables	lnHDI	lnHDI
	(1)	(2)
lnREM		0.005**
		(0.002)
L1	0.57543***	
	(0.02795)	
LnEG	−0.18029	0.169***
	(0.22547)	(0.010)
EIA	−0.00144	0.001*
	(0.00738)	(0.000)
LINF	0.00784	0.005***
	(0.03053)	(0.001)
LnURB	−0.08591	0.019***
	(0.099)	(0.004)
LnP	−0.26718*	0.038***
	(0.13759)	(0.006)
Observations	728	728
Country FE	YES	YES
Year FE	YES	YES
First-stage F-statistic	F (1, 660)=423.93	
Cragg-Donald Wald F statistic		423.928
Anderson canon.corr LM Statistics	Chi-sq (1)	Chi-sq (1)
	284.72***	84.72***

Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1

by utilising the exogenous variance in the lagged remittance associated with the present remittance but is uncorrelated with the error term. As column (2) of Table 6 shows, the instrumental variable (IV) estimation results align with those reported in the baseline two-way fixed effects model. This also supports our conclusions and confirms further the significant effect of remittance on poverty alleviation.

4.4. Robustness Checks

4.4.1. Employing the feasible ordinary least square (FGLS) estimation

For robustness analysis, the study employed the generalised least squares (FGLS) of Parks (Parks, 1967) and Kmenta (1986). The Parks and Kmenta FGLS estimation technique is highly suitable for the data with individual effects, heteroscedasticity, serial correlation, and cross-sectional dependence, as pointed out by (Doran and Kmenta, 1986; Kmenta, 1986) and (Hicks, 1994) that is evident from the dataset of this study.

The outcomes presented in Table 7 are reliable, aligning with the results obtained from our baseline regression and the IV method estimation. Our findings show that the stability of our model indicates its reliability and highlights the significant influence of remittance on poverty alleviation.

4.4.2. Lag independent variable and control variables

The research conducted a test to ensure the robustness of our findings by including lagged values of the independent and control variables in the analysis process. This approach aims to reduce the risk of causality and dynamic effects by using lagged values less likely to correlate with the current error term. The results obtained through incorporating lagged variables in Table 8 column align with those from the two-way fixed effects model, reinforcing the reliability and validity of our findings. The consistency of this finding highlights the substantial influence of financial inclusion

on carbon emissions. This influence remains notable when taking into account potential endogeneity and dynamic interactions.

4.5. Mechanism Analysis

This part of the study delves into the connection between remittance and its influence on poverty alleviation via the role of domestic savings. Remittances provide households with additional income that increases their spending and savings capacity. In sub-Saharan African countries, where a significant portion of remittances is allocated toward daily consumption needs and investment via their savings, this financial inflow helps families improve their saving capacity, enabling investment in small-medium businesses in most of the region. By enabling households to have enough disposable income for better food, healthcare, and educational needs,

Table 9, column (1) examines the effect of remittance on domestic savings, showing a positive significant impact of remittance on domestic savings at a 1% level. This indicates that a 1% increase in remittance is associated with an increase in domestic savings of 2.079%. Column (2) shows the regression result of the effect of domestic savings on poverty alleviation; it shows a positive impact of domestic savings on poverty alleviation while controlling for remittance, a similar finding by (Anwar et al., 2023) Indicating a 1% increase in domestic savings associated with alleviated poverty by 0.00555%.

Table 10 shows that the bootstrap results indicate that domestic savings are a significant mediating variable in the relationship between remittances and the human development index (HDI). With a P = 0.009, the indirect effect of remittances on HDI through domestic savings is statistically significant, suggesting that domestic savings play a crucial role in mediating this relationship. The significant mediation implies that the impact of remittances on HDI is partially explained by the increase in domestic savings, which may lead to more significant investment in productive activities, improving overall economic development. This result underscores the importance of domestic savings as a key channel through which remittances contribute to poverty alleviation and development outcomes in Sub-Saharan Africa.

4.6. Moderating Analysis

Table 11 shows the moderating analysis of Regulatory quality and government effectiveness on the influence of remittances on poverty alleviation in models (3) and (4), which are presented in

Table 7: Robustness analysis using FGLS

Variables	FGLS
	lnHDI
lnREM	0.00182**
	(0.000726)
lnEG	0.142***
	(0.00515)
EIA	−0.00383***
	(0.000263)
lnINF	0.000427
	(0.000593)
lnURB	−0.00176
	(0.00303)
lnP	0.00577*
	(0.00345)
Constant	−1.585***
	(0.0491)
Observations	760
R-squared	
Wald Statistic	2246.50
Prob >chi^2	0.0000

Panel corrected Standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1

Table 8: Lag of independent variables regression

Variables	(1)
	lnHDI
L.lnREM	0.00286**
	(0.00141)
L.EG	0.167***
	(0.0144)
L.lnINF	0.00426***
	(0.00163)
L.EIA	0.000777*
	(0.000398)
L.lnURB	0.0231***
	(0.00706)
L.lnP	0.0192**
	(0.00954)
Constant	−1.964***
	(0.107)
Observations	726
R-squared	0.980
Country FE	YES

Robust standard errors in parentheses
***P<0.01, **P<0.05, *P<0.1

Table 9: Mechanism analysis

Variables	(1)	(2)
	lnDS	lnHDI
lnREM	2.079***	0.00555***
	(0.359)	(0.00171)
lnDS		0.000710***
		(0.000171)
lnEIA	8.766**	0.0245
	(3.497)	(0.0156)
lnINF	−1.251**	0.00366*
	(0.563)	(0.00188)
lnURB	−0.631	−0.0195
	(1.254)	(0.0128)
lnP	4.472***	0.0539***
	(1.363)	(0.0167)
Constant	−57.61***	−0.930***
	(14.10)	(0.0622)
Observations	642	638
R-squared	0.832	0.978
Country FE	Yes	Yes

ln natural logarithm; Panel corrected standard errors in parentheses; ***P<0.01, **P<0.05, *P<0.1

Table 10: Bootstrap moderating variable significance analysis

	Bootstrap results				Number of obs=638 Replications=5,000	
Variable	Observed coefficient	Bootstrap standard error	z	P>z	Normal- base 95% confidence interval	
ab	3.94E-06	1.50E-06	2.63	0.009	1.00E-06	6.88E-06

columns (1) and (2). The results indicate that regulatory quality (RQ) and government effectiveness (GE) significantly moderate the effect of remittances (LnREM) on poverty alleviation. The positive and significant coefficient for LnREM*RQ (0.0012**) suggests that better regulatory quality enhances the role of remittances in poverty alleviation by fostering a stable economic environment and encouraging productive investments. Similarly, the positive and highly significant coefficient for LnREM*GE (0.0019**) suggests that with an improvement in government effectiveness, the poverty reduction effect of remittances is enhanced because more effective and efficient policy-making and public service delivery is provided.

Table 11: Moderating analysis of RQ and GE

Variables	(1)	(2)
	TWFE	TWFE
lnREM	0.00454***	0.00591***
	(0.00170)	(0.00177)
lnEG	0.165***	0.152***
	(0.0152)	(0.0155)
lnINF	0.00606***	0.00593***
	(0.00173)	(0.00167)
lnEIA	0.00106**	0.00129***
	(0.000424)	(0.000427)
lnURB	0.0210***	0.0197***
	(0.00711)	(0.00682)
lnP	0.0243**	0.0272**
	(0.0119)	(0.0110)
LnREM*RQ	0.00114**	
	(0.000565)	
lnREM*GE		0.00189***
		(0.000513)
Constant	−1.963***	−1.864***
	(0.114)	(0.116)
Observations	736	736
R-squared	0.979	0.979
Country FE	YES	YES

ln natural logarithm; Panel corrected standard errors in parentheses; ***P<0.01, **P<0.05, *P<0.1

These results suggest that institutional quality plays a vital role in the effectiveness of remittances in furthering development and that policymakers should concentrate on improving governance and regulatory frameworks to seal poverty reduction efforts by fostering institutional quality.

4.7. Heterogeneity Analysis

4.7.1. By region

Sub-Saharan Africa refers to the region of the African continent that lies south of the Sahara Desert. This vast area includes Central Africa, East Africa, Southern Africa, and West Africa; each region listed exhibits a different level of economic development. East Africa, for example, has shown different growth patterns than West and Southern Africa (Amadou and Aronda, 2020). Due to differences in infrastructure, governance and socio-economic conditions, policies for remittance and foreign inflows that work in one region might not be effective in another. Understanding these disparities helps assess how remittances influence poverty alleviation in each region, which is uniquely important in facilitating the design of region-specific interventions.

Columns (1),(2),(3), and (4) in Table 12 show that the inflow of remittances in the western, southern, eastern, and southern regions promotes poverty alleviation, while its influence is insignificant in the central region. Most importantly, remittances' influence on poverty alleviation is more prominent in Eastern Africa than in Southern Africa but much more prominent in Western Africa.

4.7.2. The economic growth heterogeneity

In the analysis in Table 13, the dataset is divided into nations with higher and lower GDPs to assess the effects of remittances on human development across different nations with economic growth. The findings show that there is positive and significant association between remittance and poverty alleviation in higher GDP countries at 1% level and an insignificant relationship in lower GDP countries. The results also show that human

Table 12: Heterogeneity analysis by region

	Two-way fixed			
Variables	(1)	(2)	(3)	(4)
	WA	CA	EA	SA
lnREM	0.0183***	0.00761	0.0164***	0.00587*
	(0.00609)	(0.00808)	(0.00443)	(0.00350)
lnEG	0.282***	−0.00496	0.344***	0.422***
	(0.0287)	(0.0380)	(0.0235)	(0.0291)
lnINF	−0.00312	0.00180	0.0288***	−0.00439
	(0.00300)	(0.00349)	(0.00437)	(0.00409)
lnEIA	−0.00491***	−0.00832***	−0.00287***	−0.00501***
	(0.000564)	(0.00154)	(0.00109)	(0.000812)
lnUBR	−0.0388	−0.337**	−0.00496	0.0279***
	(0.0677)	(0.129)	(0.0217)	(0.00933)
lnP	0.112*	0.245**	0.00248	0.0144
	(0.0637)	(0.105)	(0.0236)	(0.0153)
Constant	−2.532***	0.0131	−2.908***	−3.555***
	(0.223)	(0.307)	(0.210)	(0.232)
Observations	290	113	145	212
R-squared	0.936	0.933	0.942	0.967
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

ln natural logarithm; Panel corrected standard errors in parentheses; ***P<0.01, **P<0.05, *P<0.1

Table 13: Heterogeneity analysis by level of economic growth

Variables	(1)	(2)
	High GDP	Low GDP
	lnHDI	lnHDI
lnREM	0.00797***	−0.00159
	(0.00196)	(0.00232)
lnEG	0.250***	0.0557***
	(0.0146)	(0.0177)
EIA	0.00175***	−0.000280
	(0.000391)	(0.000676)
lnINF	0.00539***	0.00240
	(0.00187)	(0.00201)
lnURB	−0.0275	0.0267***
	(0.0174)	(0.00948)
lnP	0.00614	0.0124
	(0.0235)	(0.00789)
Constant	−2.515***	−1.039***
	(0.0941)	(0.142)
Observations	384	375
R-squared	0.971	0.974
Country FE	YES	YES
Year FE	YES	YES

ln natural logarithm; Panel corrected standard errors in parentheses; ***P<0.01, **P<0.05, *P<0.1

development is a function of remittances in wealthy economies that are in a better position to harness such inflows.

The disparities in the results can be ascribed to the economic context of the nations in question. As pointed out by Bettin and Zazzaro (2012), higher GDP countries normally have more developed financial markets that enable the optimal utilization of remittances (Bettin and Zazzaro, 2012). On the other hand, low income countries are likely to have limited and poor financial services and weak institutions that hinder the effective utilization of remittances as noted by (Azizi et al., 2023).

In addition, Cooray (2012) argues that remittances can enhance the development of financial sector in high-GDP countries (Cooray, 2012), while Fromentin (2018) notes that the effects of remittances are less visible in less advanced economies (Fromentin, 2018). In general, the results presented in this paper support the idea that economic development plays a key role in shaping the relationship between remittances and human development. In countries with lower GDPs, policymakers should work on improving the financial sector to harness the benefits of remittances.

5. CONCLUSION AND POLICY IMPLICATIONS

This study uses an advanced econometric method to investigate how remittance affects human development within 42 remittance-receiving Saharan African nations from 2000 to 2023. The results reveal a clear positive association between remittance and human development.

Our research employs the two-way fixed effect technique followed by the instrumental variable approach for endogeneity treatment following the confirmation of fixed effect by the Hausman test. The further analysis employed in this study includes the Domestic Savings mechanisms on remittance influence on poverty alleviation, the moderating effect of regulatory quality and government effectiveness, robustness tests using the FGLS technique and finally, heterogeneity analysis based on the level of economic development to examine the impact of remittance on human development, thus contributing to the empirical literature. Numerous vital findings emerged from our study. Firstly, remittance leads to the country's poverty alleviation. Secondly, the FGLS robustness checks confirm that the results remain robust and consistent with our significant findings. We also carried out a study on the mechanism. We found that remittance could influence human development through domestic savings by providing households and families with additional income that increases their savings capacity, thus enabling households and families to invest and have enough disposable income to purchase better food, healthcare, and educational materials, remittances directly improve the quality of life, health outcomes, and educational opportunities. The influence of remittance on poverty alleviation is more significant and pronounced in countries with higher economic growth than nations with lower economic growth in sub-Saharan Africa.

The research emphasises the role of remittances in enhancing human development by helping to reduce poverty and improve living standards significantly. These Financial transfers boost domestic savings and enable fundamental human development areas such as healthcare, education, and general living standards to improve, which are all important for human development. The results show that remittances and economic growth could catalyse human progress, especially in regions with limited economic opportunities. This means there has to be some form of institutional framework to leverage the benefits of remittance transfers towards improved human development.

In this paper, we present the following policy implications and recommendations based on the empirical evidence of the study. Remittance receivers need access to credit and other financial services that are stable and dependable; this means that governments and financial organisations have to engage themselves in order to improve the availability of these services. This may mean expanding the banking products, decreasing the service charges on the transactions, and promoting financial education campaigns to help the recipients manage their remittances more effectively by saving and investing them properly. This may, in turn, have a positive impact on human development.

Remittance senders worldwide face obstacles like high costs and regulatory barriers, which policymakers must address through international cooperation. Through initiatives facilitating cross-border payment transfers, governments can offer more support to dependent families and positively impact healthcare, quality education, and general living conditions.

The region's governments and policymakers should seize the remittance opportunity to boost development by launching "Diaspora Bonds" and investment funds, which are tailored to migrant workers and diaspora communities. These bonds would enable migrant workers to invest in healthcare and

education infrastructure directly. Thus helping to foster long-term, sustainable development and providing a secure return on investment. These bonds will attract migrant investors wanting to support their communities because they come with features such as competitive interest rates and partial guarantees. A government-backed diaspora fund would allow people to combine their remittance payments to fund homes and community businesses that benefit from the country's growth.

Establishing Regulatory agencies that monitor these investments will maintain transparency and build trust in the system. Integrating these with national development strategies will guarantee their steady development influence on poverty reduction and economic growth. Remittance sending thus strengthens links between migrants and their countries of origin as it transforms remittances into a powerful force for lasting advancement.

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