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Remittances, Human Capital and Economic Growth in Uganda

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ABSTRACT

This study investigated the effect of remittances and human capital on Uganda's economic growth using quarterly data for the period from 1999 to 2023. Three objectives were particularly investigated: (i) To investigate the effect of personal remittances on Uganda's economic growth, (ii) To investigate the effect of human capital on Uganda's economic growth, and (iii) To examine the combined effect of personal remittances and human capital on Uganda's economic growth. A linear symmetric autoregressive distributed lag (ARDL) model of Pesaran et al. (2001) was adopted in the estimation of the empirical models. Findings from the study have shown that variations in both personal remittances and human capital individually have a positive effect on real GDP per capita in Uganda, both in the short run and in the long run.

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However, the estimates indicate that a unit change in human capital has a larger marginal effect than a unit change in personal remittances in their influence on Uganda's economic growth. Personal remittances and human capital have a positive and statistically significant combined effect on real GDP per capita in Uganda, both in the short run and in the long run. A comparative analysis of the individual and the combined effect reveals that the marginal individual effect of remittances and the marginal combined effect of remittances and human capital are not significantly distant from each other, suggesting that variations in personal remittances have independent effects from the variations in human capital on Uganda's economic growth. Findings suggest that Uganda's economic growth can be enhanced if deliberate policy is directed toward increasing investment in human capital development. Findings also suggest that Uganda's economy can reap some tangible benefits from labor externalization under a streamlined labour migration policy.

Keywords*: Remittances, Human Capital, Real GDP per capita, ARDL, Uganda*

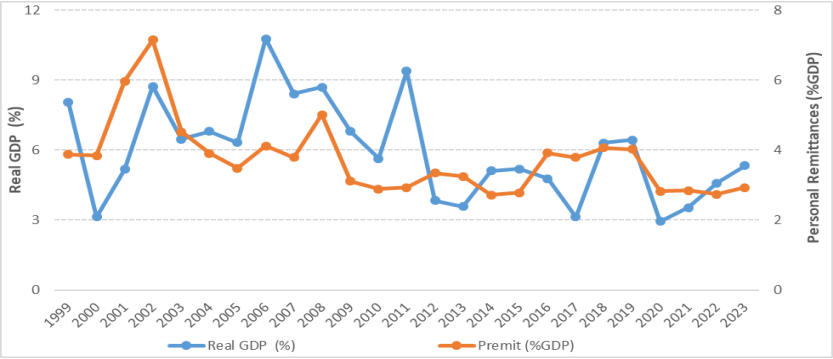
BACKGROUND OF THE STUDY

Economic growth remains a central driver of development worldwide, reducing poverty, creating jobs, and enabling structural transformation (Rizwanul, 2004). External financial inflows, particularly remittances, foreign direct investment (FDI), and official development assistance (ODA), play vital roles in this process (OECD, 2024). Globally, remittances reached $626 billion in 2022, with low- and middle-income countries receiving about 75% (IMF, 2023; WorldBank, 2023a). In many developing economies, remittances have historically surpassed FDI and ODA, providing a stable, countercyclical source of foreign exchange (Barajas, Chami, Gapen, & Montiel, 2009; Ratha, 2013). In Sub-Saharan Africa, remittances support household consumption, financial inclusion, and small-scale investments while acting as a buffer against shocks such as the 2008 financial crisis and the COVID-19 pandemic (World Bank, 2023b; Oteng-Abayie, Adom, & Arthur, 2020).

Remittances contribute to economic growth through several mechanisms: they smooth consumption and reduce poverty by boosting household income; enhance human capital via investments in education and health; stimulate entrepreneurship and small business creation; and stabilize macroeconomic conditions by improving balance of payments and reducing volatility (Chen, 2023). However, their long-term growth impact depends on complementary factors like skilled labor, financial sector development, and strong institutions; otherwise, funds may skew toward consumption rather than productive investment, limiting transformative effects (Azizi, Aftabi, Azizkhani, & Yektansani, 2024; Shirazi, Javed, & Ashraf, 2018).

In Uganda, sustained economic growth, averaging 5-6% annually, has been a national priority for poverty reduction, employment, and structural change despite structural challenges and external vulnerabilities (World Bank, 2023c; World Bank, 2022). Remittances have been a key external inflow, rising from $232.6 million in 1999 to approximately $1.3-1.4 billion in 2023 (WorldBank, 2023a). As a share of GDP, they peaked above 6% (and up to ~7% in some early 2000s estimates) but have declined steadily to about 2.63% by 2023 (Wamala, 2010).

Figure 1: Trends of personal remittances and real GDP growth over time



Source: World Development Indicators

This downward trend in the remittance-to-GDP ratio signals potential concerns: while absolute inflows have grown, their relative contribution to the economy has diminished amid faster GDP expansion and possibly shifting migration patterns or diaspora dynamics (Barro, 1996). This decline may weaken remittances' role as a reliable stabilizer and growth catalyst, especially if they increasingly fund consumption rather than investment, exacerbating vulnerability to external shocks and limiting support for industrialization or productivity gains (Aregbeshola, 2022).

A critical factor influencing remittance effectiveness is human capital. Higher education and skills enable households to channel remittances into productive uses, such as business startups, technology adoption, or industrialization rather than immediate consumption (Chen, 2023; MoES, 2022). Uganda has advanced through programs like Skilling Uganda, Universal Primary Education, and National Development Plans (NPA, 2020) Yet, over 60% of the labor force lacks formal secondary education, constraining access to high-productivity sectors (UBOS, 2021). Persistent brain drain further complicates this: emigration boosts remittances and foreign exchange but depletes skilled domestic labor, potentially hindering the country's ability to absorb and leverage inflows for sustained growth (Adarkwa, 2015; Aregbeshola, 2022; Barro, 1996). This creates a policy paradox: whether diaspora remittances can offset human capital losses or if talent outflows ultimately undermine long-term transformative potential.

Macroeconomic conditions, including gross capital formation, trade openness, FDI, exchange rate stability, inflation, and domestic savings, also mediate remittance impacts (Ralph, et al., 2008; Nyasha & Odhiambo, 2022). Weak financial systems and governance often divert funds from entrepreneurship to consumption (Barajas et al., 2009). This study examines interactions among remittance inflows, human capital, and economic growth in Uganda from 1999 to 2023, integrating key macroeconomic factors. Unlike prior studies treating these elements separately, it assesses how remittances and human capital jointly drive growth and offers evidence-based recommendations to optimize remittance use, bolster skills investment, and strengthen economic resilience and long-term development.

Problem statement

Uganda's economic strategy emphasizes sustained GDP growth to reduce poverty, create jobs, and support structural transformation (NPA, 2020; MoGLSD, 2016). Although the country has averaged about 5–6% annual growth in recent decades, progress remains fragile due to structural constraints such as low industrialization, limited value addition, export concentration, and sectoral productivity gaps (World Bank, 2023b). These weaknesses increase vulnerability to external shocks and commodity price volatility (IMF, 2023). Remittances have historically supported household welfare, foreign exchange earnings, and national income. Their share of GDP peaked at about 7.15% in 2002 and exceeded 6% in the early 2000s, but declined to roughly 2.63% by 2023 despite rising absolute inflows (WorldBank, 2023a). This decline may indicate that overall GDP growth has outpaced remittance growth, potentially reducing their macroeconomic stabilizing role and long-term development impact (Ify, 2024).

At the same time, Uganda faces a significant human capital deficit. Over 60% of the labor force lacks formal secondary education (UBOS, 2021), limiting productivity and access to high-value sectors (Owamah, Egbon, & Ishioro, 2025). Persistent brain drain further weakens the domestic skills base, with Uganda's human flight and brain drain index remaining high at 6.1 in 2023 and 6.0 in 2024 (IMF, 2023).

While migration generates remittances that support short-term consumption and foreign exchange, the loss of skilled labor may constrain the economy's ability to channel these inflows into productive investment (Usman, Ozdeser, Çavuşoğlu, & Aliyu, 2022; Kyeyune & Barungi, 2020). Although prior studies (Nsiah & Fayissa, 2013; Adarkwa, 2015; Shirazi et al., 2018; Oteng-Abayie et al., 2020; Nyasha & Odhiambo, 2022) have examined remittances and human capital separately in relation to growth, limited research explores their interaction in Uganda. This study addresses this gap by analyzing the relationship between remittances, human capital, and economic growth in Uganda from 1999 to 2023, controlling for gross capital formation, foreign direct investment, and trade openness, to inform policies that enhance resilience and inclusive growth.

Objectives

This study investigated the effects of remittances and human capital on Uganda's economic growth from 1999 to 2023. Specifically, it aimed to examine the effect of personal remittances on economic growth, investigate the impact of human capital on economic growth, and analyze the combined effect of personal remittances and human capital on Uganda's economic growth.

METHODOLOGY

This study employed a descriptive and explanatory research design within a non-experimental framework to examine the effects of remittances and educational attainment on Uganda's economic growth (Wooldridge, 2010). A quantitative econometric approach was adopted to investigate both short-run and long-run dynamics using quarterly secondary data from 1999Q1 to 2023Q4, obtained from the World Bank Development Indicators, Uganda Bureau of Statistics, and the Bank of Uganda (World Bank, 2023c; UBOS, 2021).

The main variables included personal remittances, human capital (proxied by the share of the population aged 25+ with at least primary education), an interactive remittance–human capital term, and controls such as gross capital formation, foreign direct investment, and trade openness. Remittances are expected to support growth by boosting consumption, investment, and financial stability, while human capital enhances labor productivity, and the interactive term captures their joint effect (Barro, 1996). Gross capital formation, FDI, and trade openness further influence growth by expanding productive capacity, technology transfer, and integration with global markets (Frankel & Romer, D, 1999). This approach allows rigorous statistical testing of causal relationships and provides robust insights into the role of remittances and human capital in Uganda's economic performance. The theoretical framework for the study was based on the Solow-Swan growth model (Solow, 1956; Swan, 1956) and its augmented version by Mankiw et al. (1992), which includes human capital as an additional factor of production. The Solow-Swan model can be expressed as:

$Y = Af(K, L)$…… (1)

Where Y is output, K is capital stock, L is labor, and A represents exogenous technology. With constant returns to scale, it takes the Cobb-Douglas form:

$Y = AK^{\propto}L^{1-\alpha}$ …… (2)

Where $0<\alpha<1$ represents the capital share in output, or total factor productivity (TFP). The augmented model adds human capital:

$Y = AK^{\propto}$…… (3)

Where $\alpha, \beta \epsilon [0,1]$ and $\alpha + \beta \ \epsilon [0,1]$. The empirical model, based on the augmented Solow framework, was specified as follows:

Model 1 (ARDL for Individual effects assessment)

$$LOG\_RGDPPC_t = \theta + \sum_{i=1}^{p} \beta_i \, LOG\_RGDPPC_{t-i} + \delta_1 \, LOG\_REM_t + \sum_{j=1}^{q1} \delta_j LOG\_REM_{t-j} + \pi_1 HC\_EDUATT_t + \sum_{k=1}^{q2} \pi_k \, HC\_EDUATT_{t-k} + \emptyset_1 \, GKF_t + \sum_{m=1}^{q3} \emptyset_m \, GKF_{t-m} + \varphi_1 \, FDI_t + \sum_{n=1}^{q4} \varphi_n \, FDI_{t-n} + \alpha_1 \, TRADEOPEN_t + \sum_{r=1}^{q5} \alpha_r \, TRADEOPEN_{t-r} + \varepsilon_t \quad \text{(a)}$$

Model 2 (ARDL for combined effects assessment)

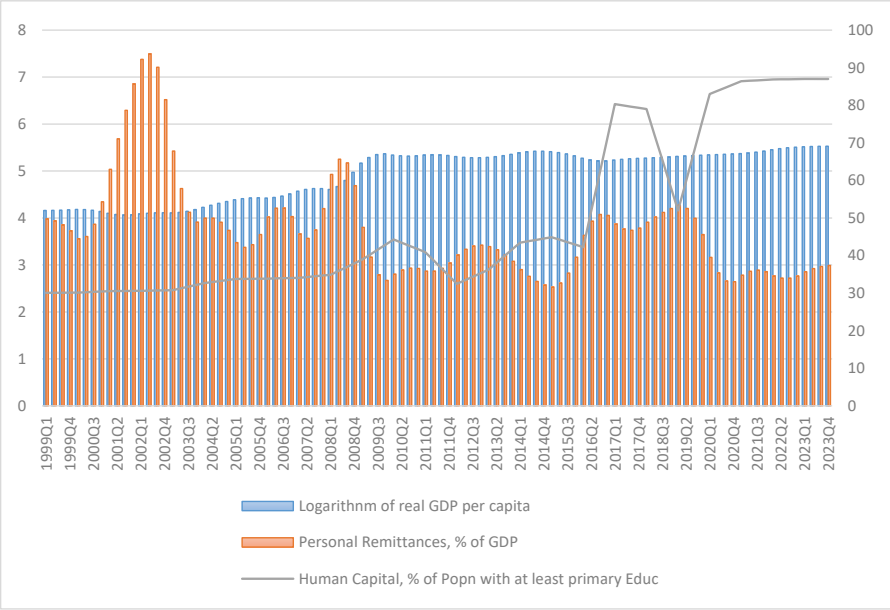
$$LOG\_RGDPPC_t = \phi + \sum_{h=1}^{p} \beta_h \, LOG\_RGDPPC_{t-h} + \sigma_1 LOG\_REM_t * HC\_EDUATT_t + \sum_{m=1}^{q1} \sigma_m LOG\_REM_t * HC\_EDUCATT_{t-m} + + \emptyset_1 \, GKF_t + \sum_{r=1}^{q2} \emptyset_r \, GKF_{t-r} + \varphi_1 \, FDI_t + \sum_{s=1}^{q3} \varphi_s \, FDI_{t-s} + \alpha_1 \, TRADEOPEN_t + \sum_{v=1}^{q4} \alpha_v \, TRADEOPEN_{t-v} + \mathrm{v}_t \quad \text{(b)}$$

Prior to estimation, stationarity of variables was confirmed using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979), and cointegration was checked using Johansen (1995) and Pesaran et al.

(2001) tests. Multicollinearity was assessed through variance inflation factors (VIF) with a threshold of 10 (Hair et al., 2010; Kim, 2019). Post-estimation robustness checks included tests for autocorrelation (Breusch-Godfrey), heteroscedasticity (Breusch-Pagan), parameter stability (CUSUM), and omitted variable bias (Ramsey RESET), ensuring reliable and consistent estimation results.

Trend analysis in the main study variables over the study period: The trend analysis of the main study variables is depicted in figure 2.4 as indicated below;

Figure 1: Trends in the real GDP per capita, personal remittances and human capital over 1999Q1 – 2024Q4



Source: **Generated by author from analysis of raw data**

The trend depicted in Figure **2** above indicates that, over the study period, the variations in the variables of personal remittances and in the human capital proxy were remarkable than the variations in the variables real GDP per capita. The trend depicted in Figure 2 further indicates that, generally, real GDP per capita the human capital proxy (of the percentage population with at least primary education) followed an upward trend over the study period while personal remittances as a percentage of GDP generally followed a downward trend over the study period.

Descriptive statistics in the main study variables: These are the mean, minimum and the standard deviation of the study variables. The descriptive statistics are generated with the initial measurement units. Table 1 displays the summary of the said statistics.

Table 1: Descriptive statistics of interest on the Study variables

Variable Name	N	Mean	Min.	Max.	Std. Dev.	CV(%)
Real GDP Per Capita (current US $)	**100**	**157.45**	**58.25**	**251.89**	**68.38**	**43.43**
Personal Remittances (US $, billions)	**100**	**0.81**	**0.23**	**1.49**	**0.39**	**48.15**
Human Capital (% of pop with primary $educ^{+}$)	**100**	**48.80**	**30.08**	**86.99**	**20.88**	**42.78**
Gross Capital Formation (% of GDP)	**100**	**23.71**	**19.21**	**32.75**	**3.04**	**12.82**
Foreign Direct Investment (% of GDP)	**100**	**3.74**	**1.91**	**6.99**	**1.41**	**37.70**
Trade Openess (ratio of total trade, % of GDP)	**100**	**38.97**	**30.30**	**57.40**	**5.52**	**14.17**

Source: Author's compilation from analysis of data

Table1 above presents the descriptive statistics of key variables over the study period. Real GDP per capita had a mean of USD 157.45 and

a coefficient of variation (CV) of 43.43%, indicating moderate variability, while personal remittances averaged USD 0.81 billion with a higher CV of 48.15%, reflecting larger fluctuations. Human capital showed a mean of 48.8% and a CV of 42.78%, suggesting moderate variation, whereas gross capital formation (mean = 23.71%, CV = 12.82%) and trade openness (mean = 38.97%, CV = 14.17%) were relatively stable. Foreign direct investment averaged 3.74% of GDP with a CV of 37.70%, indicating moderate variability.

Minimum and maximum quarterly values further illustrate these variations: GDP per capita ranged from USD 58.25 to 261.89; personal remittances from 0.23 to 1.49 billion USD; human capital from 30.08% to 86.99%; gross capital formation from 19.21% to 32.75% of GDP; foreign direct investment from 1.91% to 6.99% of GDP; and trade openness from 30.3% to 57.4% of GDP. Standard deviations indicate that all variables are relatively tightly clustered around their means. GDP per capita had an SD of 68.38, remittances 0.39 billion USD, human capital 20.88%, gross capital formation 3.05%, foreign direct investment 1.41%, and trade openness 5.52%. Since the SD values are smaller than the respective means, this suggests low variability and limited presence of extreme values in the data.

Results from the multicollinearity test: In this study, two ARDL models were specified, one examining individual effects and the other combined effects, and multicollinearity was assessed using Variance Inflation Factors (VIFs) and their reciprocals (1/VIF). Following Hair et al. (2010), a VIF of 10 or above indicates serious multicollinearity, 5–10 signals moderate concern, and below 5 suggests low or no multicollinearity. Tables 2 and 3 present the VIF and 1/VIF values for each explanatory variable in Models 1 and 2, respectively, showing that all regressors fall within acceptable limits, indicating that multicollinearity is not a concern in either model.

Table 2: VIF values per regressor in Model 1 (Model 1 assess individual effects)

Regressor	Notation	VIF	1/VIF
Logarithm of Personal Remittances	*LOG_REM*	8.50	0.117601
Human capital	*HC_EDUCATT*	4.37	0.229003
Gross Capital Formation	*GKF*	2.69	0.371217
Foreign Direct Investments	*FDI*	1.45	0.687291
Trade Openness	*TRADEOPEN*	1.69	0.591028
Mean VIF		**3.74**	

Source: Author's compilation

Table 3: VIF values per regressor in model 2 (Model 2 assesses combined effects)

Regressor	Notation	VIF	1/VIF
Logarithm of Product of Personal Remittances and Human Capital	*LOG_REM*HC_EDUATT*	7.29	0.137251
Gross Capital Formation	*GKF*	1.94	0.515777
Foreign Direct Investments	*FDI*	1.46	0.686403
Trade Openness	*TRADEOPEN*	1.48	0.677870
Mean VIF		**3.04**	

Source: Author's compilation

The multicollinearity tests for both ARDL models indicate no serious concerns. In Model 1, all individual VIFs and the mean VIF (3.74) are below the threshold of 10, while in Model 2, the individual VIFs and mean VIF (3.04) are also below 10. These results suggest that severe multicollinearity is not present in either model, even with all explanatory variables included as specified in equations a and b.

Stationarity test results: The inquiry implemented the Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1979) unit root method for stationarity assessment of factors in each of the specified models for empirical estimation. The null hypothesis tested is of non-stationarity. Lag order has been determined by the Akaike's Information Criteria (AIC). The stationarity test summary values are indicated in Table 4 and Table 5 as indicated below;

Table 4: Stationarity results and order of integration of the variables in model 1(Model 1 assess individual effects)

	Levels			First Differences			
Variable	**Lags**	**ADF Z(t) Stat.**	**Prob. for Z(t)**	**Lags**	**ADF Z(t) Stat.**	**Prob. for Z(t)**	**OOI**
Logarithm of real GDP per capita	3	-1.059	0.7311	2	-4.86 ***	0.0000	I(1)
Logarithm of Personal Remittances	4	-1.726	0.4180	4	-3.423**	0.0102	I(1)
Human Capital	4	0.150	0.9693	4	-4.29***	0.0005	I(1)
Foreign direct investment	3	-5.37***	0.0000	–	–	–	I(0)
Gross capital formation	4	-1.66	0.4506	3	-5.70	0.0000	I(1)
Trade Openness	3	-4.77***	0.0000	–	–	–	I(0)

Source: Author's compilation. ***P<0.01; ** P<0.05; OOI =Order of Integration

Table 5: Stationarity test results and order of integration of the variables in model 2(Model 2 assesses combined effects)

Variable	Levels			First Differences			
	Lags	**ADF Z(t) Stat.**	**Prob. for Z(t)**	**Lags**	**ADF Z(t) Stat.**	**Prob. for Z(t)**	**OOI**
Logarithm of real GDP per capita	3	-1.059	0.3764	2	-3.57***	0.0064	I(1)
Logarithm of product of Personal Remittances and Human Capital	2	0.181	0.9712	1	-4.05***	0.0012	I(1)
Foreign direct investment	3	-5.37***	0.0000	–	–	–	I(0)
Gross capital formation	4	-1.66	0.4506	3	-5.70	0.0000	I(1)
Trade Openness	3	-4.77***	0.0000	–	–	–	I(0)

Source: Author's compilation. ***P<0.01; OOI =Order of Integration

The stationarity tests for both models show mixed orders of integration. In Model 1, LOG_RGDPPC, LOG_REM, HC_EDUCATT, and GKF are non-stationary in levels but become stationary after first differencing (I(1)), while FDI and TRADEOPEN are stationary in levels (I(0)). Similarly, in Model 2, LOG_RGDPPC, LOG_REM*HC_EDUATT, and GKF are I(1), typically exhibiting trending behavior over time, reflecting structural changes, capital accumulation processes, and sustained macroeconomic growth dynamics. Their non-stationarity at levels suggests that shocks to these

variables may have persistent, long-term effects. whereas FDI and TRADEOPEN are I(0) implying that they fluctuate around a stable long-run mean, possibly due to policy adjustments, regulatory frameworks, or external constraints that limit prolonged divergence from equilibrium levels.

Results from the Johansen's (1995) cointegration tests: This study implemented the Johansen (1995) cointegration as an a priori test. According to Nkoro & Uko (2016), the Johansen (1995) cointegration may be used on multivariable regressions with potential of having at least two cointegration vectors irrespective variable order of integration, but cointegration in such regressions exists among the I(1) variables (Kripfganz, 2014). Table 7.4 gives a summary of the Johansen's cointegration test outcomes for Model 1 and Model 2.

Table 6: Johansen's cointegration test results in model 1 and model 2

	Model 1 [Model 1 assesses individual effects]			**Model 2** [Model 1 assesses combined individual effects]		
Max. rank	Eigen Value	Trace statistic	Critical value at 5percent	Eigen Value	Trace statistic	Critical value at 5percent
0	–	120.8827	94.15	–	167.0838	68.52
1	0.35139	78.8887	68.52	0.61529	73.4680	47.21
2	0.28686	**46.0951***	47.21	0.32840	34.4543	29.68
3	0.27092	15.4462	29.68	0.26055	**4.8731***	15.41
4	0.10941	4.2069	29.68	0.04031	0.8408	3.76
5	0.04032	0.2150	3.76	0.00854	–	–
6	0.00221	–	–	n/a	n/a	n/a

The Johansen cointegration results confirm the existence of stable long-run relationships among the variables in both specifications (Johansen, 1991). In Model 1, the test identified two cointegrating vectors (r = 2), implying that although the variables are individually non-stationary, there are two distinct linear combinations that are stationary. This suggests the presence of two independent long-run equilibrium relationships linking economic growth, remittances, human capital, and the control variables (Johansen, 1991).

In Model 2, three cointegrating vectors (r = 3) were detected, indicating a more complex long-run structure when the interaction term between remittances and human capital is introduced (Johansen, 1991). The presence of three stationary linear combinations implies that multiple equilibrium relationships jointly govern the dynamics of the system. Overall, these findings suggest that the variables in each model move together over time and adjust toward long-run equilibrium paths despite short-run fluctuations (Johansen, 1991).

Results from regressions: This study specified two ARDL models (Model 1 & Model 2) for empirical estimation.

Table 7: ARDL (2 0 0 2 0 3) regression estimates of model 1: (Objective 3 of the Study)

Dep. var.: (Logarithm of real GDP per capita)$_t$			
Variable	**Coef.**	**Std. Err.**	**P-value**
ECT (-1)	-0.0708***	0.013325	0.000
Short run Estimates			
Δ(Logarithm of real GDP per capita)$_{t-1}$	0.7765 ***	0.060279	0.000
Δ(Logarithm of Personal Remittances)$_t$	0.0255**	0.010689	0.019
Δ(Human Capital)$_t$	0.0046**	0.001605	0.005
Δ(Gross Capital Formation)$_t$	0.0213***	0.005262	0.000
Δ(Gross Capital Formation)$_{t-1}$	-0.0229 **	0.005185	0.000
Δ(Foreign Direct Investment)$_t$	0.0011	0.001297	0.403
Δ(Trade Openness)$_t$	-0.6153**	0.247551	0.015
Δ(Trade Openness)$_{t-1}$	0.7266 *	0.368732	0.052
Δ(Trade Openness)$_{t-2}$	-0.2116**	0.250309	0.400
Constant	-0.3711**	0.168312	0.030
Long run Estimates			
(Logarithm of Personal Remittances)$_{t-1}$	0.3597***	0.113366	0.002
(Human capital) $_{t-1}$	0.0656***	0.023971	0.008
(Gross Capital Formation) $_{t-1}$	0.0837***	0.014726	0.000
(Foreign Direct Investment) $_{t-1}$	0.0154	0.018230	0.402
(Trade Openness) $_{t-1}$	1.3111	0.813813	0.111
Post-estimation cointegration test Pesaran et al. (2001) bounds test: **Robustness test results**	P>F=0.000 & P>t=0.000 for I (0) variables P>F =0.002 & P>t =0.003 for I (1) variables 0.8447 p > chi.sq. = 0.118		

Adjusted R-square : B–G LM test for serial correlation: B–P test for heteroskedasticity: RESET test for omitted variables: CUSUM parameter stability test:	p > chi.sq. = 0.376 p > F = 0.119 Recursive stat.=0.298 ;critical value=0.948

Source: Author's compilation after ARDL regression. *P<0.1; **P<0.05; *** P< 0.01

Table 8: ARDL (2 0 2 0 1) regression estimates of model 2: (Objective 3 of the Study)

Dep. var.: (Logarithm of real GDP per capita)$_t$			
Variable	**Coef.**	**Std. Err.**	**P-value**
ECT (-1)	-0.0741***	0.012183	0.000
Short run Estimates			
Δ(Logarithm of real GDP per capita)$_{t-1}$	0.7313***	0.054357	0.000
Δ(Logarithm of Personal Remittances*Human Capital)$_t$	0.0277***	0.004761	0.000
Δ(Gross Capital Formation)$_t$	0.0202***	0.005148	0.000
Δ(Gross Capital Formation)$_{t-1}$	-0.0220***	0.005143	0.000
Δ(Foreign Direct Investment)$_t$	0.00756	0.001269	0.553
Δ(Trade Openness)$_t$	-0.14897	0.112425	0.189
Constant	-0.4880***	.0826596	0.000
Long run Estimates			
(Logarithm of Personal Remittances*Human Capital)$_{t-1}$	0.3738***	0.031039	0.000
(Gross Capital Formation) $_{t-1}$	0.0725***	0.010921	0.000

(Foreign Direct Investment) $_{t-1}$	0.010198	0.017045	0.551
(Trade Openness) $_{t-1}$	1.9512	0.659362	0.004
Post-estimation cointegration test Pesaran et al. (2001) bounds test: **Robustness test results** Adjusted R-square : B–G LM test for serial correlation: B–P test for heteroskedasticity: RESET test for omitted variables: CUSUM parameter stability test:	p>F=0.000 & P>t=0.000 for I (0) variables p>F=0.000 & P>t=0.000 for I (1) variables 0.8403 p > chi.sq. = 0.135 p > chi.sq. = 0.452 p > F = 0.096 Recursive stat.=0.577 ;critical value=0.948		

Source: Author's compilation after ARDL regression. *P<0.1; **P<0.05; *** P< 0.01

Assessment of the robustness test results: Before interpreting the ARDL regression results, the robustness of the model coefficients was assessed. The adjusted R-squared values were 0.844 for Model 1 and 0.8403 for Model 2, indicating that both models explain about 84% of the variation in the dependent variable. The minimal difference between the two values suggests similar overall fit, though Model 1 performs slightly better. Overall, both models demonstrate a high degree of explanatory power, supporting their reliability for analyzing the relationships among the variables and drawing policy-relevant conclusions.

The robustness checks for both ARDL models indicate that the estimated coefficients are reliable. The Breusch-Godfrey (B–G) LM test shows no evidence of serial correlation in the residuals, with P-values of 0.118 for model 1 and 0.135 for model 2. The Breusch-Pagan (B–P) test confirms homoscedasticity, with P-values of 0.376 for model 1 and 0.452 for model 2, indicating constant variance in the errors. The Ramsey RESET test suggests no omitted variable bias (P = 0.119 for model 1; P = 0.096 for model 2), and the CUSUM test confirms

parameter stability, with recursive statistics of 0.298 (model 1) and 0.577 (model 2) both below the critical value of 0.948. Overall, these results indicate that the ARDL models are well-specified, stable, and suitable for drawing reliable policy conclusions.

DISCUSSION OF THE FINDINGS: INDIVIDUAL EFFECTS OF PERSONAL REMITTANCES AND HUMAN CAPITAL

The ARDL estimates show that personal remittances have a positive and significant effect on Uganda's economic growth in both the short run and long run. Specifically, a 1% increase in remittances raises real GDP per capita by approximately 0.03% in the short run and 0.36% in the long run, indicating that economic growth responds inelastically to changes in remittances, though the long-run effect is stronger. Similarly, human capital, measured by the proportion of the population with at least primary education, also positively and significantly affects GDP per capita. A 1% increase in human capital raises GDP per capita by about 0.46% in the short run and 6.56% in the long run. Comparatively, human capital has a larger marginal contribution to growth than remittances, highlighting it as a more sustainable driver of long-term economic growth.

Combined effect of personal remittances and human capital

The interaction of personal remittances and human capital also has a positive and significant effect on Uganda's GDP per capita in both the short run and long run. In the short run, the combined effect (0.0277) is similar to the individual effect of remittances alone (0.0255), while in the long run, the combined effect (0.3738) is close to the long-run effect of remittances (0.3597). This suggests that the impact of remittances on economic growth largely operates independently of human capital, and while the interaction slightly enhances the overall effect, human capital does not significantly change the marginal contribution of remittances.

Individual effects of personal remittances and human capital on Uganda's economic growth

The study found that personal remittances have a positive and statistically significant effect on Uganda's economic growth in both the short run and long run, leading to the rejection of the null hypothesis (HO1). This aligns with theoretical expectations that remittances increase household income, consumption, and investment, thereby boosting aggregate demand and economic growth (World Bank, 2016; Barajas, Chami, Gapen, & Montiel, 2009). The findings also suggest that remittances are utilized more for productive investments than merely consumption, contrary to claims that remittances can cause inflation or dependency (Azizi, Aftabi, Azizkhani, & Yektansani, 2024).

Human capital, proxied by primary education attainment, also displayed a positive and significant impact on economic growth, leading to the rejection of HO2. The results indicate that a more educated workforce enhances productivity, innovation, and adaptability, consistent with endogenous growth theory (Lucas, 1988; Romer, 1990). The study further noted that the marginal contribution of human capital to growth is greater than that of remittances, highlighting domestic human capital development as a more sustainable driver of long-term growth. These findings align with previous studies in Uganda (Kyeyune & Barungi, 2020) and support national development priorities such as Vision 2040 and Uganda's NDPs (NPA, 2020).

Combined effect of personal remittances and human capital

The combined effect of remittances and human capital, assessed through an interactive term, was also positive and statistically significant, leading to the rejection of HO3. However, the marginal effect of the combined term was similar to that of personal remittances alone, suggesting that the impact of remittances on growth operates independently of human capital, and the interaction slightly diminishes the marginal effect of human capital. These findings broadly support the theoretical view that interactions between variables can amplify the

overall effect, though in this context, the combined effect primarily reflects the influence of remittances (Ratha, 2013).

CONCLUSION

The analysis considered both the individual and joint associations of remittances and human capital with economic growth. The findings indicate that changes in personal remittances and human capital are significantly associated with variations in Uganda's economic growth in both the short and long run. Furthermore, the interaction term suggests a complementary relationship, where the combined presence of remittances and stronger human capital is positively linked to growth outcomes. Nonetheless, given the observational time-series design, these results reflect long-run equilibrium relationships and predictive associations rather than definitive causal effects.

Arising from these findings, policy efforts should focus on strengthening domestic absorptive capacity to better harness remittance inflows for productive transformation. This includes increasing investment in high-quality, market-relevant education; expanding technical and vocational training aligned with industrial and technological needs; and improving institutional and financial systems that channel remittances toward entrepreneurship and investment rather than predominantly consumption. By reinforcing human capital formation and improving the domestic environment for productive investment, policymakers can better address the underlying paradox whereby migration generates foreign exchange inflows while simultaneously constraining the skilled labor base needed for sustained structural transformation.

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