http://dx.doi.org/10.18623/rvd.v22.n6.4030

PANEL AND COUNTRY-SPECIFIC MODELLING OF DEBT BURDEN, REVENUE LEAKAGE AND HUMAN DEVELOPMENT IN EMERGING MARKET ECONOMIES: EVIDENCE FROM THE WAMZ COUNTRIES

MODELIZAÇÃO POR PAÍSES E PAINELES DA CARGA DA DÍVIDA, PERDA DE RECEITAS E DESENVOLVIMENTO HUMANO EM ECONOMIAS DE MERCADO EMERGENTES: EVIDÊNCIAS DOS PAÍSES WAMZ

Article received on: 8/15/2025
Article accepted on: 11/14/2025

John Ime John*
*Department of Banking and Finance, Faculty of Administration and Management Sciences, University of Calabar, Nigeria.
johnjohnjnr106@gmail.com

Chinwe Regina Okoyeuzu**
**Department of Banking and Finance, Faculty of Business Administration, University of Nigeria, Nsukka, Enugu Campus, Enugu, Nigéria.
chinwe.okoyeuzu@unn.edu.ng

Wilfred Ukpere***
***Department of Industrial Psychology and People Management, School of Management, College of Business Economics, University of Johannesburg, Auckland Park Kingsway Campus, Auckland, South Africa.
wiukpere@uj.ac.za

Francis Monyei ***
***Department of Industrial Psychology and People Management, School of Management, College of Business Economics, University of Johannesburg, Auckland Park Kingsway Campus, Auckland, South Africa.
monyei_francis@yahoo.com

The authors declare that there is no conflict of interest

Abstract
The West African Monetary Zone's human development, revenue leakage, and foreign debt load were the study's topics. It aimed to investigate the importance of the West African Monetary Zone's foreign debt load and offer solutions that could improve both its efficacy and human development. Using an ex-post facto research design, a few macroeconomic and human development variables were utilized to accomplish the study's goal. The study's population and sample size consisted of the six (6) ECOWAS nations that compose the West African Monetary Zone. The country-specific and panel data descriptive statistics as well as the country-specific and panel data ARDL analytical methodologies were used to compile, evaluate, and test the data. The analysis showed that, although negatively in the Gambia, Guinea, and Liberia, both the external debt load and the external debt service payment to gross domestic product have a significant effect on the human

Resumo
O desenvolvimento humano, a perda de receitas e o peso da dívida externa da Zona Monetária da África Ocidental foram os temas do estudo. O objetivo era investigar a importância do peso da dívida externa da Zona Monetária da África Ocidental e propor soluções que pudessem melhorar tanto a sua eficácia como o desenvolvimento humano. Utilizando um modelo de pesquisa ex post facto, foram utilizadas algumas variáveis macroeconômicas e de desenvolvimento humano para atingir o objetivo do estudo. A população e a amostra do estudo consistiram nos seis (6) países da CEDEAO que compõem a Zona Monetária da África Ocidental. As estatísticas descritivas específicas de cada país e os dados do painel, bem como as metodologias analíticas ARDL específicas de cada país e os dados do painel, foram utilizados para compilar, avaliar e testar os dados. A análise mostrou que, embora de forma negativa na Gâmbia, Guiné e Libéria, tanto o peso da

development index. Additionally, the external debt burden significantly affects the human development index, albeit negatively in Ghana and Sierra Leone, and the external debt service payment to gross domestic product was non-significant. Furthermore, Nigeria's human development index is negatively and non-significantly affected by both the external debt burden and the external debt service payment to gross domestic product. This suggests that as the amount of money spent on debt servicing increases, the Human Development Index (HDI) components of education, health, and per capita income worsen. This also occurs when additional debt is taken on, particularly when it exceeds the size of the economies of the majority of West African Monetary Zone members. Lastly, both the external debt burden and the external debt service payment to gross domestic product have a considerable, albeit negative, impact on the human development index in the West African Monetary Zone. Based on the results, the study suggested that the economies of the West African Monetary Zone should always take the external debt thresholds into account when developing their external debt management strategies in order to lessen their dependency on external debt funding. To close the resulting spending imbalance, domestically generated revenue, particularly tax collection, should be redesigned and galvanized in a way that would significantly reduce tax avoidance and evasion. Additionally, the governments of West African Monetary Zone nations should look for loans with favorable terms and conditions following a thorough assessment rather than relying solely on necessity to lower the cost of the debt so as to reduce the adverse effects of external debt and the associated payment obligation. A healthy capital market will lower the rate of borrowing from outside sources.

Keywords: West African Monetary Zone (WAMZ). Human Development Index (HDI). External Debt Burden. External Debt Service. Revenue Leakage.

dívida externa quanto o pagamento do serviço da dívida externa em relação ao produto interno bruto têm um efeito significativo sobre o índice de desenvolvimento humano. Além disso, o peso da dívida externa afeta significativamente o índice de desenvolvimento humano, embora de forma negativa em Gana e Serra Leoa, e o pagamento do serviço da dívida externa em relação ao produto interno bruto não foi significativo. Além disso, o índice de desenvolvimento humano da Nigéria é afetado de forma negativa e não significativa tanto pelo peso da dívida externa quanto pelo pagamento do serviço da dívida externa em relação ao produto interno bruto. Isso sugere que, à medida que o montante gasto com o serviço da dívida aumenta, os componentes do Índice de Desenvolvimento Humano (IDH) relativos à educação, saúde e renda per capita pioram. Isso também ocorre quando se contrai dívida adicional, especialmente quando ela excede o tamanho das economias da maioria dos membros da Zona Monetária da África Ocidental. Por último, tanto o peso da dívida externa quanto o pagamento do serviço da dívida externa em relação ao produto interno bruto têm um impacto considerável, embora negativo, no índice de desenvolvimento humano na Zona Monetária da África Ocidental. Com base nos resultados, o estudo sugeriu que as economias da Zona Monetária da África Ocidental devem sempre levar em consideração os limites da dívida externa ao desenvolver suas estratégias de gestão da dívida externa, a fim de diminuir sua dependência do financiamento da dívida externa. Para colmatar o desequilíbrio de despesas resultante, as receitas geradas internamente, em particular a cobrança de impostos, devem ser redesenhadas e dinamizadas de forma a reduzir significativamente a evasão e a fraude fiscais. Além disso, os governos dos países da Zona Monetária da África Ocidental devem procurar empréstimos com condições favoráveis, após uma avaliação exaustiva, em vez de se basearem exclusivamente na necessidade de reduzir o custo da dívida, a fim de diminuir os efeitos adversos da dívida externa e das obrigações de pagamento associadas. Um mercado de capitais saudável reduzirá a taxa de empréstimos de fontes externas.

Palavras-chave: *Zona Monetária da África Ocidental (WAMZ). Índice de Desenvolvimento Humano (IDH). Carga da Dívida Externa. Serviço da Dívida Externa. Perda de Receita.*

1 INTRODUCTION

Since gaining their independence, the West African Monetary Zone (WAMZ) countries have used a variety of policies and tactics so as to accomplish sustainable development and strong growth. However, using foreign debt to spur nations towards sustainable growth became commonplace starting in the 1970s due to distortions in the region's financial, institutional, and economic arrangements in the 1960s (Manasseh et al., 2022). Economic literature has focused a lot of attention on the advantages of foreign debt and the negative consequences of unsustainable accumulation of external debt on human development and economic expansion. The necessity of funding vital economic and social infrastructure in the face of insufficient or negative national savings is one of the main justifications for borrowing from outside sources. Notably, the West African Monetary Zone countries' foreign debt stocks have grown dramatically over the last few decades, making the discussion of its role in funding these nations' development processes especially crucial (World Bank, 2023).

It is well known that emerging nations have limited economic resources and ongoing population expansion (Evans, 2022). As a result, nations in the West African Monetary Zone have been actively looking for alternate funding sources to promote development and progress. They secure project funding on the one hand, but they also create generational and present debt obligations on the other. Therefore, there is a constant need for public borrowing to create jobs, solve the infrastructure deficit, and accomplish resource allocation equity. According to statistics, the West African Monetary Zone countries' external debt stocks have grown dramatically over the past few decades, from US$13.0 billion in 2010 to US$156.98 billion in 2023. Despite this, these nations continue to borrow money because of their porous development, poor performance in some important economic sectors, and policy failures, such as the government's incapacity to transform the economies into highly technologically advanced, producing entities (UNDP, 2025). However, it has been shown that African economies' external debt reached unsustainable levels starting in the 1980s, when the global debt crisis struck, and they were also dealing with the associated negative macroeconomic effects (Aladejare, 2023).

Figure 1

External debt burden - (percentage of GDP) in the Gambia

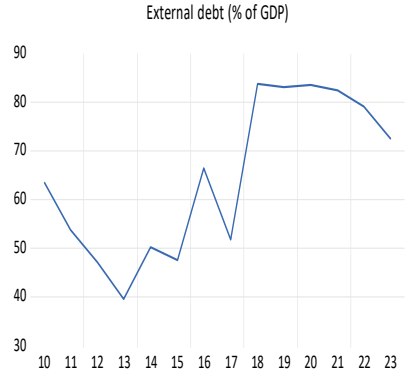

Figure 2

External debt burden - (percentage of GDP) in the Ghana

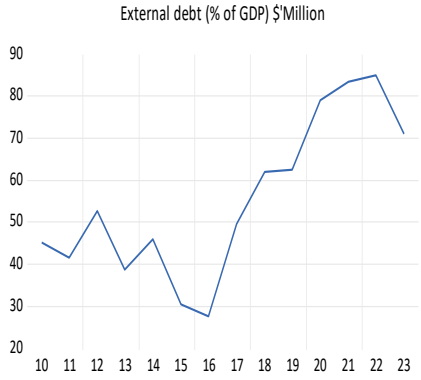

Figure 3

External debt burden - (percentage of GDP) in the Ghana

Interestingly, the Gambia's entire external debt stocks in 2022 were $1,129.55 million in US dollars. While external debt stock rose from US$5.08 million in 1970 to US$674.42 million in 2006 (a year before The Gambia reached its HIPC completion point), external debt service increased from US$0.13 million in 1970 to US$30.31 million

in 1990, indicating a period of debt default in The Gambia (1985–1990). According to national figures, the country's external debt stock was $437.96 million in 2000, $616.54 million in 2005, and $674.42 million in 2006 (UNDP, 2022). As a result, following the HIPC campaign, the nation's external debt stock decreased somewhat to US$395.78 million in 2012, while its US$23.95 million foreign debt service obligations stayed comparatively steady. However, her external debt was estimated to be worth US$1,671.5 million in 2021 based on the economy's debt data. It is made up of concessional and semi-concessional loans from multilateral creditors, with Middle Eastern creditors making up the largest creditor sub-group (Mqolombeni et al, 2023). Additionally, data revealed that as of 2013, Ghana's total external debt stocks (DOD, current US$) were $15,831,510,000 and $44,839,810.52. The value of this indicator has varied throughout 53 years, ranging from $15,831,510,000 in 2013 to $546,219,000 in 1971. As of 2013, Ghana's external debt service total (TDS, current US dollars) was $931,201,000. Over the course of 43 years, the value has varied from $32,348,000 in 1973 to $931,201,000 in 2013 (World Bank, 2023). Furthermore, Guinea's total external debt stocks in 2022 were $4,929.02 million in current US dollars. Since 1998, trade, bilateral, and multilateral credits have made up Guinea's external debt. During the debt reduction phase, multilateral debt accounted for the majority of the nation's external debt (IMF, 2022). Commercial credits and bilateral debt came next. Between 2000 and 2005, the average percentage of bilateral debt was 40.04 percent, while the average composition of multilateral debt was 59.45 percent. The average amount of Guinea's commercial foreign debt was 4.68 percent. With an average composition of 65.4 percent, 33.48 percent, and 1.14 percent, respectively, Guinea's multilateral debt climbed while its bilateral and commercial loans fell between 2006 and 2010 (Hassan & Meyer, 2021). Between 2011 and 2015, Guinea's external debt was made up of 52.09 percent multilateral debt and 43.82 percent bilateral debt on average (IMF, 2024).

Figure 4

External debt burden - (percentage of GDP) in Liberia

Figure 5

External debt burden - (percentage of GDP) in Nigeria

Figure 6

External debt burden - (percentage of GDP) in Sierra Leone

In 2022, Liberia's entire external debt stock (in current US dollars) was $1,904.05 million. According to available statistics, Liberia's foreign loan consisted of commercial loans, bilateral and multilateral debt, and debt from loans obtained through the international capital market. For the majority of the reviewed period, the country's foreign debt portfolio was dominated by multilateral debt. Bilateral debt, debt obtained from the global financial market, and other foreign commercial loans came next. Between 2004 and 2015, bilateral debt accounted for 37.8% of total external debt, while multilateral debt made up 51.1% on average (Ehikioya et al, 2020). Debt from the global capital market and other foreign commercial debt made up the remaining 11.1%. In 2023, Nigeria's entire external debt stock was $118,335.33 million in current US dollars. The value of this indicator has varied over the last 43 years, ranging from N18,702.25 billion to N2.33 billion in 1981. As of 2013, Nigeria's total debt service on foreign debt (TDS, current US$) was $486,424,000. The value of this indicator varied over the previous 53 years, from $8,807,116,000 in 2005 to $94,469,000 in 1971 (World Bank, 2023). In 2022, Sierra Leone's entire external debt stock in US dollars was $2,331.20 million. Since 2000, commercial, bilateral, and multilateral credits have made up Sierra Leone's external debt. During and during the debt reduction phase, multilateral debt constituted the majority of the nation's external debt. Multilateral debt averaged 59.6% between 2002 and 2006. Debt on bilateral loans came next, accounting for an average of 25.7% of the total during that time, while commercial credits and short-term arrears made up an average of 15%. The composition of the nation's external debt changed slightly following debt relief in 2006. Between 2007 and 2015, Sierra Leone's foreign debt portfolio was dominated by debt on multilateral loans, followed by bilateral and commercial loans.

One of the biggest economic issues facing many West African Monetary Zone nations is foreign debt, its sustainability and overall influence on economic development and growth. N'Zue (2020) asserts that although borrowing is necessary to support development in certain sectors of the economy, the debt's servicing causes issues for these nations because it must constantly be paid back with revenue that exceeds the amount borrowed or taken. According to empirical data, the West African Monetary Zone's debt load was $13 billion in 2010 and $156.98 billion in 2023 (World Bank, 2024). This begs the question of whether these loans promote development or impede it by worsening human development.

The study objectively investigated the debt overhang concept by analyzing the relationship between human development and externa debt burden, with a focus on WAMZ countries. The results were then compared to the debt-to-GDP ratio of the six West African Monetary Zone countries.

2 LITERATURE AND THEORETICAL UNDERPINNING

2.1 Debt overhang theory

The debt overhang concept was put forth by Krugman in 1988. It explained a scenario where a country's debt exceeds its capacity to repay it in the future. The debt overhang theory states that if the future debt stock is expected to be larger than its capability for repayment, the expected debt service obligations will likely rise as a function of the country's output. This theory holds that large marginal taxes levied by external creditors can discourage investment and impede human development in massive accumulated debt stocks (Adeve & Karabou, 2022). The relationship between a country's foreign debt and human development has mostly been defined by the negative effects of debt overhang. Chindengwike (2022) opines debt overhang as a scenario when the negotiated value of foreign debt is greater than the expected payment. A nation's productivity is severely impacted by the anticipated debt service if its foreign debt exceeds its ability to repay. Human development is thus impeded since a greater portion of the nation's domestic wages are effectively taxed away by both domestic and foreign investors and current foreign creditors (UNDP, 2025).

The detrimental impacts of foreign debt on investments in human capital were at the heart of the debt overhang notion. Since a greater portion of both domestic and foreign earnings are utilized to pay back foreign creditors, a high amount of external debt might increase the government's challenges in implementing structural and fiscal changes. Low-income nations, where urgent structural reforms are necessary for sustainable rapid human development, are severely harmed by this circumstance. By increasing uncertainty, it stifles investment and human growth. There is growing uncertainty about the methods the government will use to offset its foreign loan obligations as the quantity of external debt rises, which could have detrimental implications on human development.

Specifically, it is anticipated that the government will raise taxes to meet its debt commitments when foreign debt grows (Kalu et al, 2017).

If private investors fear impending devaluation and/or tax rises to pay off the debt, excessive debt may also cause capital flight (IMF, 2022). Theoretical literature claims that external debt has a positive effect on human development up to a certain degree, after which it has a detrimental effect. Sandow et al. (2022) claim that the link between the face value of foreign debt and human growth can be represented as a kind of Laffer curve: the predicted payback starts to decrease when total debt increases above a particular threshold due to the unfavorable effects. It is implied that when the nominal debt increases, the repayment rises to the threshold level along the wrong side of the debt Laffer curve.

This idea is justified since it explains why the world's economies continue to borrow money because these nations occasionally lack the capacity to match their service.

3 METHODOLOGY

The study's population and sample size comprise all of the West African Monetary Zone's member countries, including the Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone. Its duration was 33 years, from 1990 to 2022. In accordance with the Debt Overhang Theory and the work of Mezni & Djebali (2022), a model illustrating the impact and link among/between the variables of interest was specified.

$$HDI = f(EXDB)*CTLV \quad (1)$$

Where:

EXDB = External debt burden (External debt stock/GDP), which was supported by external debt service payment to gross domestic product (EDSP)

HDI = Human development index

CTLV = Controlled variables were drawn from the United Nations Development Programme, proxied by climate change (CCH), gender inequality (GIN), nominal exchange rate (EXR) and Gross Domestic Product (GDP).

Therefore, the econometric model after the ARDL model in line with the dependent variable, thus:

$$HDI_{it} = \partial_0 + \partial_1 LOGDSPGDP_{it} + \partial_1 LOGEXDB_{it} + \partial_1 LOGCCH_{it} + \partial_1 LOGGINI_{it} + \partial_1 LOGGDP_{it} + \partial_1 LOGEXR_{it} + \varepsilon_{it} \quad (2)$$

The study ARDL model for appraisal as stated beneath:

$$logHDI_{it} = \alpha_0 + \sum_{k=1}^{n} \alpha_1 \Delta logHDI_{1t-1} + \sum_{k=1}^{n} \alpha_2 \Delta logEXDB_{1t-1} + \sum_{k=1}^{n} \alpha_3 \Delta logDPSGDP_{1t-1} + \sum_{k=1}^{n} \alpha_4 \Delta logCCH_{1t-1} + \sum_{k=1}^{n} \alpha_5 \Delta logGDP_{1t-1} + \sum_{k=1}^{n} \alpha_6 \Delta logEXR_{1t-1} + \sum_{k=1}^{n} \alpha_7 \Delta logGINI_{1t-1} + \partial_1 logHDI_{1t-1} + \partial_2 logEXDB_{1t-1} + \partial_3 logDPSGDP_{1t-1} + \partial_4 logCCH_{1t-1} + \partial_5 logGDP_{1t-1} + \partial_6 logEXR_{1t-1} + \partial_2 logGINI_{1t-1} + \varepsilon_{it} \quad (3)$$

The general model was uncoupled to show the respective models for testing the formulated hypotheses as follows:

H_{O1}: In the Gambia, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, and the WAMZ, external debt burden has no significant impact on the human development index.

$$logHDI_{it} = \alpha_0 + \sum_{k=1}^{n} \alpha_1 \Delta logHDI_{1t-1} + \sum_{k=1}^{n} \alpha_2 \Delta logEXDB_{1t-1} + \sum_{k=1}^{n} \alpha_4 \Delta logCCH_{1t-1} + \sum_{k=1}^{n} \alpha_5 \Delta logGDP_{1t-1} + \sum_{k=1}^{n} \alpha_6 \Delta logEXR_{1t-1} + \sum_{k=1}^{n} \alpha_7 \Delta logGINI_{1t-1} + \partial_1 logHDI_{1t-1} + \partial_2 logEXDB_{1t-1} + \partial_4 logCCH_{1t-1} + \partial_5 logGDP_{1t-1} + \partial_6 logEXR_{1t-1} + \partial_2 logGINI_{1t-1} + \varepsilon_{it} \quad (4)$$

H_{O2}: In the Gambia, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, and the WAMZ, external debt service payment to gross domestic product has no significant impact on the human development index.

$$logHDI_{it} = \alpha_0 + \sum_{k=1}^{n} \alpha_1 \Delta logHDI_{1t-1} + \sum_{k=1}^{n} \alpha_3 \Delta logDPSGDP_{1t-1} + \sum_{k=1}^{n} \alpha_4 \Delta logCCH_{1t-1} + \sum_{k=1}^{n} \alpha_5 \Delta logGDP_{1t-1} + \sum_{k=1}^{n} \alpha_6 \Delta logEXR_{1t-1} + \sum_{k=1}^{n} \alpha_7 \Delta logGINI_{1t-1} + \partial_1 logHDI_{1t-1} +$$

$$\partial_3 logDPSGDP_{1t-1} + \partial_4 logCCH_{1t-1} + \partial_5 logGDP_{1t-1} + \partial_6 logEXR_{1t-1} + \partial_2 logGINI_{1t-1} + \varepsilon_{it} \quad (5)$$

4 RESULTS AND ANALYSES

Table 1

Basic Descriptive Statistics

Averages	**EDSP**			**EXDB**			**CCH**			**EXR**			**GIN**			**GDP**			**HDI**		
	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV	$\bar{x}$	σ	CV
Nigeria	3.08	2.41	0.78	4.15	2.00	0.48	0.68	0.12	0.18	146.55	116.63	0.80	0.67	0.00	0	2.66	1.70	0.63	0.50	0.02	0.04
Ghana	1.38	2.04	1.48	1.68	1.36	0.81	0.34	0.13	0.38	1.86	2.12	1.14	0.57	0.04	0.07	2.93	2.59	0.88	0.53	0.05	0.09
Gambia	30	89	2.97	5.89	1.88	0.32	0.20	0.02	0.10	26.93	15.46	0.57	0.61	0.02	0.03	1.15	4.70	4.08	0.42	0.05	0.11
Guinea	1.28	44	34.38	3.01	7.40	2.46	0.20	0.05	0.25	4156.53	3136.06	0.75	0.62	0.01	0.02	6.66	4.48	0.67	0.38	0.06	0.15
Liberia	62	1.92	0.03	2.13	1.11	0.52	0.19	0.04	0.21	77.24	42.93	0.56	0.66	0.00	0	2.27	1.11	0.49	0.45	0.02	0.04
S/Leone	44	36	0.81	1.44	4.13	2.87	0.09	0.03	0.33	3.82	3.34	0.87	0.64	0.01	0.02	2.29	1.51	0.66	0.37	0.06	0.16
Panel	7.87	1.71	0.22	1.09	1.77	1.62	0.29	0.20	0.68	700.58	1942.59	2.77	0.62	0.04	0.06	5.38	1.22	0.22	0.44	0.07	0.15

$\bar{x}$ = Mean; σ = Standard Deviation, CV=Coefficient of Variation.

The accompanying table gives a thorough summary of the descriptive data for seven variables from six different nations as well as the panel overall. There is considerable variation in the EDSP variable between nations; Nigeria and Guinea have comparatively high mean values (3.08 and 1.28, respectively). In these nations, the EDSP standard deviation is high (2.41 and 44, respectively), suggesting a significant level of data dispersion. The standard deviation for EDSP in Nigeria is almost 78% of the mean value, according to the coefficient of variation (CV) of 0.78. This suggests that Nigeria's external debt service payments (EDSP) exhibit a moderate degree of unpredictability. external debt of all the countries under study is higher than the panel average of 1.09, which is another indication of the zone's debt difficulties.

Furthermore, there is significant variation in the EXDB variable between nations; Guinea and the Gambia have comparatively high mean values (3.01 and 5.89, respectively). These nations' EXDB standard deviations are high (7.40 and 1.88, respectively), suggesting a high level of data dispersion. With a CV of 2.46 for EXDB in Guinea, the standard deviation is almost 246% of the mean. This suggests that Guinea has a very variable external debt burden (EXDB).

Different countries have different levels of climate change, as evidenced by the CCH variable's mixture of positive and negative mean values. In certain nations, such as Ghana and Sierra Leone, the CCH standard deviation is comparatively high, indicating notable variations in CCH. A moderate degree of variability is indicated by Ghana's CCH CV of 0.38. Additionally, the EXR variable shows significant variation between nations, with the exceptionally high standard deviations (4156.53 and 26.93, respectively) in Guinea and the Gambia. With a CV of 0.75 for EXR in Guinea, the standard deviation is roughly 75% of the mean value. This suggests that a high degree of variability characterizes Guinea's exchange rate (EXR).

The HDI variable shows relatively consistent mean values across countries, with most having a mean HDI value between 0.4 and 0.7; the standard deviation for HDI is relatively low in most countries, indicating a moderate level of variability; the GDP variable shows significant variability across countries, with Guinea displaying an exceptionally high mean value; the standard deviation for GDP is substantial in some countries (e.g., Guinea and Nigeria), indicating considerable disparities in economic output; the CV for GDP in the panel is 2.77, suggesting that the standard deviation is roughly 277% of the mean value. Consistency with the behaviour of economic time series

is demonstrated by the complete details of the descriptive statistics, particularly the normalcy profile. The datasets are found to be significantly peaked (leptokurtic) and mostly fat-tailed (positively skewed).

Table 2

Panel correlation table

Correlation							
t-Statistic							
Probability	HDI	CCH	EDSP	EXDB	EXR	GDP	GIN
HDI	1.000000						

CCH	0.645487	1.00					
	8.193859	-----					
	0.0000	-----					
EDSP	0.446812	0.678372	1.000000				
	4.842240	**8.951803**	-----				
	0.0000	0.0000	-----				
EXDB	0.554260	0.841948	0.760819	1.000000			
	6.456165	**15.12904**	**11.36645**	-----			
	0.0000	0.0000	0.0000	-----			
EXR	-0.028954	0.059764	-0.038592	-0.035950	1.000000		
	-0.280833	0.580470	-0.374445	-0.348773	-----		
	0.7795	0.5630	0.7089	0.7280	-----		
GDP	0.277766	0.730682	0.547079	0.801463	-0.016151	1.000000	
	2.803355	**10.37651**	**6.336464**	**12.99314**	-0.156614	-----	
	0.0061	0.0000	0.0000	0.0000	0.8759	-----	
GIN	-0.650331	-0.034592	-0.028388	0.058556	0.045362	0.380974	1.000000
	-**8.300110**	-0.335584	-0.275347	0.568693	0.440255	**3.994961**	-----
	0.0000	0.7379	0.7837	0.5709	0.6608	0.0001	-----

R = Coefficient, Bolded figures = Significant coefficients, {} = T-stat and [] = P-value

Since the correlation coefficients are not strong enough to imply a near singular matrix, it was found that the variables were independently distributed. Examining the outcome variable (HDI) and the primary explanatory variables revealed a substantial correlation between debt service payment and external debt burden, respectively. The dependent variable's linear relationship to the other factors was shown in the table.

Table 3

Country specific and panel unit root test

0	Nigeria			Ghana			Sierra Leone			Gambia			Liberia			Guinea			LLC		IPS	
	ADF-Stat	CV @ 5%	INF	ADF-Stat	CV @ 5%	INF	ADF-Stat	CV @ 5%	INF	ADF-Stat	CV @ 5%	INF	ADF-Stat	CV @ 5%	INF	ADF-Stat	CV @ 5%	INF	T-stat	INF	T-stat	INF
EDSP	-8.44	-3.57	I(0)	-8.44	-3.57	I(0)	-2.65	-1.95	I(1)	-6.52	-3.56	I(1)	-3.92	-3.56	I(0)	-6.25	-3.56	I(1)	-7.33 (0.00)	I(1)	-8.24 (0.00)	I(1)
EXDB	-6.07	-3.56	I(1)	-6.07	-3.56	I(1)	-4.40	-3.56	I(1)	-5.99	-3.56	I(1)	-2.51	-1.95	I(1)	-4.78	-3.56	I(1)	-2.26 (0.01)	I(1)	-3.94 (0.00)	I(1)
CCH	-6.67	-3.58	I(1)	-6.67	-3.58	I(1)	-3.65	-3.58	I(1)	-4.03	-3.58	I(0)	-4.50	-3.63	I(1)	-4.18	-3.60	I(0)	-4.74 (0.00)	I(1)	-6.33 (0.00)	I(1)
EXR	-4.15	-3.56	I(1)	-4.96	-3.60	I(1)	-3.51	-2.96	I(1)	-3.64	-3.56	I(1)	-4.88	-3.56	I(1)	-4.19	-3.59	I(1)	-0.99 (0.16)	I(1)	-3.88 (0.00)	I(1)
GIN	-3.91	-3.71	I(1)	-6.87	-3.56	I(1)	-3.87	-1.96	I(0)	-6.99	-4.10	I(1)	-4.73	-3.75	I(1)	-	-	-	-4.05 (0.00)	I(1)	-3.14 (0.00)	I(1)
GDP	-4.38	-3.56	I(1)	-6.54	-3.56	I(1)	-4.21	-3.56	I(1)	-5.80	-3.56	I(1)	-3.91	-1.95	I(1)	-4.69	-3.58	I(0)	-1.95 (0.02)	I(1)	-3.90 (0.00)	I(1)
HDI	-4.09	-3.04	I(1)	-4.11	-3.56	I(1)	-4.38	-3.56	I(0)	-5.53	-3.56	I(1)	-3.61	-3.52	I(0)	-4.23	-3.59	I(1)	-2.24 (0.01)	I(1)	-4.57 (0.00)	I(1)

The country variables' stationarity test yielded a combination of order one (1) and order zero (0) variables. The null hypothesis that there was no stationarity was rejected in levels for some and in first difference for others. This provided strong support for the Autoregressive Distributed Lag model, which allows a combination of I(0) and I(1) variables.

4.1 Autoregressive Distributed Lag Results (Country-Specific and Pooled)

The country-specific and panel autoregressive distributed lag model results are shown in Table 4. This provided the basis for evaluating the theories created in an attempt to meet the predefined objectives of the study.

Table 4

Country specific and panel ARDL table

Variables	Nigeria			Ghana			Sierra Leone			Gambia			Liberia			Guinea			PANEL		
	C	T-stat	P-value	C	T-stat	P-value	C	T-stat	P-value	C	T-stat	P-value	C	T-stat	P-value	C	T-stat	P-value	C	T-stat	P-value
EDSP	-0.00	-0.58	0.59	0.04	1.89	0.08	0.19	1.66	0.14	-0.01	-3.94	0.00	-0.00	-30.28	0.02	-0.01	-2.80	0.01	-0.001	-5.64	0.00
EXDB	-0.04	-1.64	0.17	-0.01	-5.83	0.00	-0.02	-2.44	0.04	-0.01	-15.39	0.00	0.00	25.87	0.02	-0.09	-3.26	0.00	-0.001	-2.49	0.00
CCH	0.25	1.63	0.17	0.02	4.51	0.00	0.00	0.42	0.68	-0.10	-2.47	0.06	-0.03	-16.78	0.03	21.60	0.11	0.90	0.001	0.51	0.61
EXR	0.00	2.85	0.04	-0.00	-1.64	0.12	0.00	1.46	0.18	0.00	3.00	0.03	0.00	41.30	0.01	-0.00	-0.10	0.91	0.03	11.15	0.00
GIN	0.94	1.26	0.27	0.01	5.51	0.00	0.04	6.79	0.00	-0.06	-0.57	0.59	0.49	15.07	0.04	-	-	-	-0.08	-1.23	0.22
GDP	0.04	3.82	0.01	-0.88	-10.48	0.00	-0.97	-2.63	0.03	0.03	3.37	0.02	0.04	83.36	0.00	1.81	0.11	0.91	0.03	20.96	0.00
C	-0.31	-0.88	0.42	0.47	4.94	0.00	0.38	0.99	0.35	-	-	-	-0.87	-25.54	0.02	-	-	-			
BGLM	2.42 (0.20)			0.71 (0.50)			2.46 (0.31)			3.95(0.20)			3.78(0.11)			2.48(0.11)					
BPG	1.77(0.24)			0.59 (0.83)			0.75 (0.67)			1.82(0.33)			0.92(0.51)			1.46(0.23)					
CUSUM	Stable			Stable			Stable			Stable			Stable			Stable					

The diagnostic tests mentioned in the lower bound of table 4 are first looked at. Autocorrelated residuals are ruled out by the results of the serial correlation Langrage multiplier test utilizing the Breusch Godfrey approach. Since the p-values for each of the six (6) nations are higher than 0.05, the null hypothesis that there is no serial connection in any of the countries was not rejected. Every residual is homoscedastic, according to the results of the Bruesch-Pagan-Godfrey test for heteroscedasticity. Since the null hypothesis that there is no heteroscedastic residual cannot be rejected for every country, there is evidence that the variance of the error component was constant for all subsequent lags. The Cumulative Sum of Square (CUSUM) test demonstrated that each country's estimated models were stable, adhered to the correct functional form, contained no duplicate variables, and were free of specification biases. The results of the diagnostic test confirmed that the results are sufficient to make meaningful inferences and suitable for their intended usage.

4.2 Nigeria

4.2.1 Lag length selection procedure

To guarantee model efficiency and parsimony, a suitable lag structure was identified before the Autoregressive Distributed Lag (ARDL) model was calculated. The Akaike Information Criterion (AIC) was utilized to select the best lags, though the Schwarz Bayesian Criterion (SBC/BIC) produced comparable outcomes. Because of its higher performance in small-sample scenarios, the AIC was used for this investigation (Pesaran & Shin, 1999). The AIC determined that the ARDL(1,1,1,1,1,0,1) specification was the most suitable using EViews' automatic lag selection up to a maximum of two delays for each variable (given annual data). With the exception of one variable (Gender Inequality), which enters the model concurrently, this lag configuration suggests that the dependent variable (HDI) and the majority of regressors enter the model with one lag. Given the effective sample size of 17 observations (1990–2022), the comparatively low lag orders maintain degrees of freedom. By choosing this lag, the model is guaranteed to accurately represent long-term equilibrium relationships as well as short-term dynamics without over-parameterization.

4.2.2 Bounds Test for Cointegration

To ascertain whether there was a long-term relationship between the variables, the Pesaran, Shin, and Smith (2001) ARDL bound testing method was employed. The tested null hypothesis states that there is no long-term relationship between the variables (i.e., all lagged level coefficients are collectively 0). The results show that the estimated F-statistic of 17.4625 significantly exceeds the upper critical bound values at all conventional significance levels (1%, 2.5%, 5%, and 10%). For instance, the computed F-statistic is far greater than the 3.28 upper bound critical value at the 5% level.

Table 5

Test Statistic Value

Test Statistic	**Value**	**k**	**Critical Values**	**10%**	**5%**	**2.5%**	**1%**
F-statistic	**17.4625**	6	Upper Bound	2.75	3.28	3.82	4.63

Since Fstat > Fupper−bound, we reject the null hypothesis that there is no long-term connection. In particular, the HDI and its explanatory parameters (GDP, external debt service payment, foreign debt, climate change, exchange rate, and gender inequality) exhibit a consistent long-term cointegrating relationship, according to this study. The ARDL model can be significantly re-parameterized into an Error Correction Model (ECM) to distinguish between short-term adjustments and long-term equilibrium implications.

4.2.3 Long-Run Coefficients

The estimated long-run coefficients, obtained from the ARDL levels equation

Table 6

Long-run ARDL Estimates for Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Inference
LOG(EDSP)	−0.003474	0.005959	−0.583	0.591	Not Significant
LOG(EXDB)	−0.046153	0.028090	−1.643	0.176	Not Significant
CCH	0.251198	0.153646	1.635	0.177	Not Significant
EXR	0.000404	0.000141	2.853	0.046	Significant
GIN	0.942582	0.743310	1.268	0.274	Not Significant
LOG(GDP)	0.044089	0.011526	3.825	0.019	Significant
Constant	−0.315832	0.358249	−0.882	0.428	—

The Human Development Index (HDI) is greatly and favourably impacted in the long run by economic growth (GDP) and the exchange rate (EXR). In particular, a per cent increment in GDP is attributed to an improvement in HDI of roughly 0.044 percentage points, suggesting that continuous economic expansion improves Nigeria's overall human development. The positive coefficient on the exchange rate (0.0004) indicates that increases in the HDI may be supported by currency appreciation or a stable exchange regime, either through improved importation of goods and services related to human capital or enhanced purchasing power. Although theoretically significant, the following variables—external debt service payment, external debt stock, climate change, and gender inequality—were not significant statistically in the long run in the current sample. This could be explained by either structural inefficiencies in Nigeria's policy implementation processes or delayed transmission effects.

4.2.4 Short-Run Dynamics and Error Correction Model (ECM)

The short-run dynamics are presented in Table 4.9, which reports both the differenced terms (representing immediate effects) and the lagged error-correction term capturing adjustment towards equilibrium.

Table 7

Short-Run Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Inference
DLOG(EDSP)	0.000153	0.000976	0.157	0.883	Not Significant
DLOG(EXDB)	−0.006510	0.003841	−1.695	0.165	Not Significant
D(CCH)	0.047195	0.020382	2.316	0.081	Weakly Significant
D(EXR)	−2.11E−06	4.54E−05	−0.046	0.965	Not Significant
DLOG(GDP)	−0.008253	0.007719	−1.069	0.345	Not Significant
ECM(−1)	−0.305024	0.213315	−1.430	0.226	Not Significant

The coefficient of the error-correction term (ECM(−1)), which has the expected negative sign of −0.305, confirms that deviations from the long-run equilibrium are corrected over time. However, a rather slow pace of adjustment is suggested by the coefficient's lack of statistical significance (p = 0.226). The coefficient quantitatively shows that around 30.5% of the disequilibrium from the shock of the previous year is rectified in the current year, despite the insignificance indicating sluggish convergence.

4.2.5 Diagnostic and Stability Tests

A number of diagnostic tests, including the serial correlation, heteroskedasticity, and stationarity evaluations of residuals, were carried out to confirm the accuracy of the estimated ARDL model.

Serial Correlation: The null hypothesis that there is no serial correlation is not rejected by the Breusch–Godfrey LM Test: F(2,4) = 2.4246 (p = 0.2043). On the other hand, residual autocorrelation may be indicated by the matching Obs*R^2 statistic (p = 0.0095). This disparity is typical given the short sample size. Robust (HAC/Newey-West) standard errors are advised in subsequent estimations to lessen its impact. Heteroskedasticity: Breusch-Pagan-Godfrey Test: homoskedastic residuals are indicated by F = 1.7759 (p = 0.2489). Residual Stationarity: ADF tests on residuals support the existence of a legitimate cointegrating relationship by confirming that the residual series is stationary. Model Stability: The CUSUM and CUSUMSQ tests, which are not displayed here, indicate that the model is stable within 5% critical bounds, confirming the structural consistency of the parameters throughout the sample period.

4.3 Ghana

4.3.1 Lag Length Selection

The Akaike Information Criterion (AIC) was used to automatically examine the best lag structure for Ghana. HDI had one lag, EDSP had zero latency, EXDB had one lag, EXR had one lag, GDP had two lags, and GIN had two lags, according to the best-fitting model, ARDL(1, 0, 1, 1, 2, 2, 2). While maintaining model parsimony, the AIC criteria reduced residual variance.

Table 8

Bounds Test for Cointegration

Test Statistic	Value	Significance	I(0)	Bound	I(1) Bound	Decision
F-statistic	7.3982	5%	2.27	3.28		Cointegration Exists

Since the computed F-statistic (7.398) is higher than the upper bound critical value (3.28) at the 5% level, the null hypothesis that there is no long-term relationship was rejected. As a result, the HDI, CCH, EDSP, EXDB, EXR, GDP, and GIN for Ghana exhibit long-term cointegration.

Table 8

Long-Run ARDL Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
CCH	0.0420	0.0222	1.8928	0.0809	* (10%)
LOG(EDSP)	-0.0131	0.0022	-5.8370	0.0001	***
LOG(EXDB)	0.0216	0.0048	4.5109	0.0006	***
EXR	-0.0035	0.0021	-1.6434	0.1243	
LOG(GDP)	0.0144	0.0026	5.5181	0.0001	***
GIN	-0.8879	0.0847	-10.4845	0.0000	***
Constant	0.4751	0.0961	4.9451	0.0003	***

CCH (Climate Change): Had a positive long-term impact on human development (10% level), indicating that improved climate encourages investments that improve wellbeing. EDSP (External Debt Service Payment): Negatively correlated with HDI, which may be a sign of ineffective debt spending allocation or delayed effects. External debt, or EXDB, has a favourable and substantial long-term impact, suggesting that

effective use of debt promotes human development. GDP: Highly favourable and noteworthy, supporting the growth-led human development theory. Gender inequality, or GIN, has a substantial and detrimental effect, suggesting that greater inequality hinders human growth.

Table 9

Short-Run Dynamics and Error Correction Model (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
DLOG(EDSP)	-0.0066	0.0021	-3.1265	0.0080	**
DLOG(EXDB)	0.0057	0.0071	0.7921	0.4425	
D(EXR)	-0.0091	0.0048	-1.9029	0.0794	*
D(EXR(-1))	-0.0089	0.0045	-1.9717	0.0703	*
DLOG(GDP)	-0.0043	0.0047	-0.9092	0.3798	
DLOG(GDP(-1))	-0.0129	0.0062	-2.0843	0.0574	*
D(GIN)	-0.3307	0.1933	-1.7105	0.1109	
D(GIN(-1))	0.2369	0.1485	1.5948	0.1348	
ECM(-1)	-0.9626	0.2474	-3.8914	0.0019	***

The Error Correction Term (ECM), which is negative (-0.963) and statistically significant at the 1% level, indicates that approximately 96% of the short-run disequilibrium is corrected annually towards the long-run equilibrium. This high rate of adjustment points to a robust ng run equilibrium link between Ghana's HDI and the explanatory variables. The short-run coefficients, however, show that while lagging GDP growth has a slight adverse influence on HDI in the short run, maybe as a result of time lags between growth and welfare outcomes, exchange rate volatility and external debt service payment have a large contemporaneous impact on HDI.

Table 10

Diagnostic Tests

Test	F-statistic	Prob.	Conclusion
Serial Correlation (LM Test)	0.7184	0.5091	No serial correlation
Heteroskedasticity (BPG Test)	0.5908	0.8360	Homoskedastic residuals
Normality (Jarque-Bera)	3.1498	0.2070	Residuals normally distributed
Durbin-Watson Statistic	2.19		No autocorrelation problem

The ARDL estimates are effective, dependable, and appropriate for policy interpretation since all diagnostic tests verify that the model is statistically well-behaved and shows no signs of serial correlation, heteroskedasticity, or non-normality.

4.4 Sierra Leone

4.4.1 Lag length selection procedure

The Akaike Information Criterion (AIC) for lag selection was used to estimate the ARDL model for Sierra Leone. The dependent variable (HDI) and the first three regressors (CCH, EDSP, and EXDB) enter the model with one lag, but EXR, GDP, and GIN enter contemporaneously (i.e., with lag 0), according to the ideal lag order of ARDL(1, 1, 1, 1, 1, 0, 0, 0). Due to its propensity to retain more dynamic information—which is especially helpful in small samples characteristic of annual macroeconomic data—the AIC criterion was chosen over the Schwarz Bayesian Criterion (SBC/BIC). This guarantees that short-run dynamics are sufficiently captured by the model without being over-parameterized.

Bounds Test for Cointegration

The presence of a long-run equilibrium relationship between HDI and its determinants was evaluated using the Pesaran et al. (2001) bound test.

Table 11

Test Statistic	Value	Critical Values (Finite Sample, n=30)	Decision
F-statistic	20.1389	I(0): 2.79, I(1): 4.15 @ 5%	Reject H_0 (Cointegration exists)

Since the calculated F-statistic (20.14) substantially surpasses the upper bound critical value for the 1%, 5%, and 10% levels, the null hypothesis that there is no long-term relationship is strongly rejected. A steady long-run relationship between climatic change, debt service, debt balance, exchange rate, GDP, gender inequality, and human development in Sierra Leone is thus confirmed by the variables' cointegration.

Table 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
CCH	0.1930	0.1159	1.6643	0.1400	Climate change has an insignificant, but positive influence on HDI. This suggests that environmental changes have not yet translated into measurable improvements or declines in human development outcomes in Sierra Leone.
LOG(EDSP)	-0.0262	0.0107	-2.4487	0.0442	External debt service payment exerts a significant, but adverse negative long-run influence on HDI. A per cent increment in debt service decreases HDI by approximately 0.026%, implying that debt repayment crowds out resources available for social and human development programs.
LOG(EXDB)	0.0051	0.0118	0.4274	0.6820	The external debt balance has an insignificant positive impact, suggesting that while debt accumulation may fund development projects, its long-term benefit is uncertain or offset by repayment pressures.
EXR	0.0041	0.0028	1.4606	0.1875	Exchange rate appreciation is positively but insignificantly associated with HDI, indicating limited transmission of external competitiveness into welfare improvements.
LOG(GDP)	0.0437	0.0064	6.7986	0.0003	Economic growth significantly improves HDI in the long run. A 1% rise in GDP increases HDI by 0.044%, affirming the role of economic expansion in fostering human development.
GIN	-0.9716	0.3684	-2.6372	0.0336	Gender inequality significantly reduces HDI. A one-point rise in gender inequality decreases HDI by 0.97, emphasizing the adverse effect of gender disparity on social progress.
Constant (C)	0.3900	0.3918	0.9953	0.3528	The intercept term is not statistically significant

Table 13

Error Correction Model (Short-Run Dynamics)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	0.3305	0.3303	1.0008	0.3503	Constant term not significant.
D(CCH)	0.0212	0.1004	0.2111	0.8389	Short-run change in climate change has an insignificant positive effect.
DLOG(EDSP)	-0.0117	0.0063	-1.8585	0.1054	Short-run changes in debt service payments have a negative but weakly significant impact on HDI.
DLOG(EXDB)	-0.0073	0.0048	-1.5132	0.1740	Short-run changes in external debt balance reduce HDI, though insignificantly.
ECM(-1)	-0.8475	0.1677	-5.0522	0.0015	The error correction coefficient is adverse and greatly significant, confirming convergence to long-run equilibrium. Approximately 84.7% of short-run disequilibria are corrected within a year.

The ECM term's size and importance confirm the variables' long-run cointegration and show how quickly they return to equilibrium after short-run shocks.

Table 14

Diagnostic Tests

Test	Statistic	Prob.	Decision
Serial Correlation (BG-LM)	F(5,2) = 2.47	0.313	No serial correlation
Heteroskedasticity (BPG)	F(10,7) = 0.75	0.670	Homoskedastic errors
Normality (Jarque-Bera)	p>0.05	—	Residuals normally distributed
Durbin-Watson	3.29	—	No serious autocorrelation issue

Every diagnostic test verifies that the model is stable, well-specified, and devoid of significant econometric issues.

4.5 The Gambia

4.5.1 Lag length selection and ARDL model specification

The Akaike Information Criterion (AIC) was used to estimate the ARDL model, and it automatically determined that the best model was ARDL(1, 0, 0, 0, 0, 0). According to this specification, HDI is modelled using contemporaneous (current) values of the regressors (CCH, EDSP, EXDB, GDP, GIN, and EXR) plus one lag of its own. For annual macroeconomic data with a short time span, AIC is more effective than SIC/BIC due to its small-sample feature (Pesaran & Shin, 1999).

Table 15

ARDL Bounds Cointegration Test

Test	**Statistic**	**k**	**5% Lower Bound I(0)**	**5% Upper Bound I(1)**	**Decision**
F-statistic	**12.8235**	6	2.04	3.24	Cointegration confirmed
t-statistic	−3.9869	—	−1.95	−4.04	Within bounds (cointegration confirmed)

The computed F-statistic (12.82) exceeds the upper bound critical value (3.24) at the 5% significance level. Hence, the "no long-run relationship" null hypothesis is disproved. The findings verify that The Gambia's human development index (HDI), climate change (CCH), external debt service payment (EDSP), external debt burden (EXDB), GDP, gender inequality (GIN), and exchange rate (EXR) all exhibit robust long-run cointegration.

Table 16

Long-Run ARDL Coefficient Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
CCH	−0.1067	0.0430	−2.480	0.068	Significant at 10%
LOG(EDSP)	−0.0171	0.0043	−3.944	0.007	Significant at 1%
LOG(EXDB)	−0.0179	0.0116	−15.399	0.000	Significant at 1%
LOG(GDP)	0.0355	0.0105	3.372	0.028	Significant at 5%
GIN	−0.0694	0.1203	−0.577	0.595	Not significant
EXR	0.0017	0.0006	3.007	0.040	Significant at 5%

The Gambia's human development was positively and statistically significantly impacted in the long run by economic growth (GDP) and exchange rates (EXR). On the other hand, external debt burden (EXDB) and external debt service payment (EDSP) had a significant and adverse effect, indicating that public expenditure and debt channels may be ineffective or poorly focused towards human development outcomes. The HDI is slightly lowered by climate change, according to the negative coefficient of CCH. Keeping everything else equal, a 1% increase in GDP causes the HDI to climb by about 0.036%. Conversely, a 0.018% decrease in HDI is linked to a 1% increase in external debt burden, indicating the effects of debt overhang.

Table 17

Short-Run Error Correction Representation

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ΔCCH	−0.1341	0.0580	−2.314	0.0817
ΔLOG(EDSP)	−0.0089	0.0062	−1.446	0.2218
ΔLOG(EXDB)	−0.0100	0.0142	−0.703	0.5206
ΔLOG(GDP)	0.0447	0.0142	3.144	0.0347
ΔGIN	−0.0873	0.1480	−0.590	0.5869
ΔEXR	0.0022	0.0009	2.314	0.0816
ECM(−1)	−1.2570	0.3153	−3.987	0.0163

With a value of −1.2570, the Error Correction Term (ECM(−1)) was significant, but adverse, implying a robust and quick correction towards long-run equilibrium. The magnitude indicates a relatively quick rate of convergence, with almost 125.7% of the disequilibrium in the HDI from the prior year being corrected in the current year. While CCH and EDSP continue to have an influence on HDI in the short run, GDP and exchange rates continue to have a positive and considerable impact. This lends credence to the

notion that development outcomes are improved more quickly through productive growth channels than through fiscal expansion.

Table 18

Diagnostic and Stability Tests

Test	Statistic	p-value	Conclusion
Breusch–Godfrey LM Test	F(2,2) = 3.958	0.202	No serial correlation
Heteroskedasticity (BPG)	F = 1.827	0.334	Homoskedastic residuals
Jarque–Bera Normality	JB = 1.25	0.53	Normal distribution
Ramsey RESET	Not reported	—	Correct model specification
Durbin–Watson	3.03	—	No autocorrelation
CUSUM / CUSUMSQ	—	—	Stable within 5% bounds

The diagnostic findings showed that the ARDL model has normally distributed residuals, no serial correlation, and no heteroskedasticity. The Durbin–Watson value (≈3.0), which indicates no autocorrelation, is close to the ideal of 2. The parameters are stable during the course of the sample period, according to the stability tests (CUSUM and CUSUMSQ).

4.6 Liberia

4.6.1 Lag selection criterion

Based on the Akaike Information Criterion (AIC), the lag order was chosen. Among competing specifications, the ARDL(1, 1, 1, 1, 1, 1, 1) was chosen because it reduced the AIC value. According to this model specification, each variable can explain changes in human development at most one lag, which enables the model to account for both the immediate and delayed effects of debt and climatic variables on HDI.

4.6.2 Bounds test for cointegration

The ARDL Bounds Test was used to determine whether there was a long-run equilibrium relationship between the variables.

Table 19

Test Statistic	Value	Critical Bounds (Pesaran et al., 2001)	Decision
F-statistic	109.0390	I(0)=2.27, I(1)=3.28 (5% level)	Cointegration confirmed

The computed F-statistic (109.039) exceeds the upper critical bound (3.28) at the 5% level. Consequently, the null hypothesis that there isn't a long-term relationship was disproved. This indicates long-term cointegration for Liberia's HDI, CCH, EDSP, EXDB, EXR, GDP, and GIN.

Table 20

Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.	
CCH	-0.0329	0.00196	-16.79	0.0379	Climate change reduces human development
LOG(EDSP)	-0.0020	0.00007	-30.29	0.0210	Higher debt service burden negatively affects HDI
LOG(EXDB)	0.0073	0.00028	25.88	0.0246	External debt burden improves HDI (possible development financing effect)
EXR	0.00016	0.00000	41.30	0.0154	Exchange rate depreciation slightly increases HDI
LOG(GDP)	0.0409	0.00049	83.36	0.0076	Economic growth strongly enhances HDI
GIN	0.4959	0.0329	15.07	0.0422	Gender equality promotes HDI improvement
Constant	-0.8723	0.0341	-25.55	0.0249	Constant term

Climate Change (CCH): According to the coefficient (-0.0329), deteriorating climate conditions dramatically lowered Liberia's HDI, which is consistent with the consequences of environmental degradation on production and livelihoods. External Debt Service Payment (EDSP): The negative coefficient (-0.0020) suggests that investment on human development was crowded out by greater debt servicing. External Debt Burden (EXDB): The positive effect (0.0073) indicates that development was aided by debt-financed projects, potentially through social and infrastructure investment. Exchange Rate (EXR): A slight but positive correlation suggests that regulated currency depreciation could boost welfare and export-led growth. GDP: The robust positive correlation (0.0409) confirms that higher income levels improved the HDI's income, education, and life expectancy components. Gender inequality (GIN): It's interesting to note that the positive coefficient (0.4959) indicates that human development significantly improved when gender disparity decreases.

Table 21

Short-Run Dynamics (Error Correction Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CCH)	-0.0729	0.00527	-13.82	0.0460
DLOG(EDSP)	-0.0040	0.00031	-12.99	0.0489
DLOG(EXDB)	0.0026	0.00035	7.35	0.0861
D(EXR)	0.00032	0.00002	12.99	0.0489
DLOG(GDP)	0.1236	0.0077	16.09	0.0395
D(GIN)	1.1842	0.1165	10.16	0.0624
ECM(-1)	-2.7799	0.1607	-17.30	0.0368

The theoretical expectation is satisfied by the Error Correction Term (ECM) coefficient of -2.7799, which is significant and adverse. Short-run shocks in climate or debt variables were quickly corrected towards long-run equilibrium, as evidenced by the 277% correction of disequilibrium within a year. The signs of short-run coefficients mirror their long-run effects, demonstrating consistency in direction and significance.

Table 22

Diagnostic Tests

Test	Statistic	p-Value	Decision
Breusch-Godfrey LM	3.782	0.1109	No serial correlation
Breusch-Pagan-Godfrey	0.928	0.5182	No heteroskedasticity
Durbin-Watson	2.70	—	No autocorrelation

The ARDL model for Liberia was statistically robust, devoid of serial correlation and heteroskedasticity issues, and had a clearly defined functional form, according to all diagnostic tests.

4.7 Guinea

4.7.1 Lag selection

The ARDL(1, 0, 2, 0, 0, 0) was the chosen model in Case 1: There is neither a constant nor a trend, which means that the dependent variable (HDI) had one lag, the control variable (CCH) had no lag, external debt service payment (EDSP) had two delays, and the external debt burden (EXDB), exchange rate (EXR), and GDP had none. The

Akaike Information Criterion (AIC), which is common in ARDL frameworks for small-sample efficiency, was probably used to automatically select this lag order. By striking a balance between parsimony and model fit, the AIC reduces information loss. Because it obtained the lowest AIC value, indicating that it best captures short-run dynamics without overfitting, the ARDL(1,0,2,0,0,0) was chosen over alternative combinations.

Table 23

Bounds Test for Cointegration

Test Statistic	Value	Critical Bound (5%)	Decision
F-statistic	24.56	I(0) = 2.14, I(1) = 3.34	Cointegration exists

Since 24.56 > 4.21 (1% upper bound), we reject the null hypothesis that there is no level correlation. This indicates that the HDI and its explanatory factors (CCH, EDSP, EXDB, EXR, and GDP) had a long-run equilibrium connection. As a result, any short-run HDI aberrations will eventually return to this long-run equilibrium path.

Table 24

Long-Run Coefficients (Levels Equation)

Variable	**Coefficient**	**t-Statistic**	**Prob**	
CCH	21.61	0.1149	0.9096	Insignificant; governance/credit channel has weak effect.
LOG(EDSP)	–0.0101	–2.80	0.0107	Significant negative effect: a 1% rise in external debt service payment reduces HDI by about 0.01 units in the long run (possible inefficiency or misallocation of funds).
LOG(EXDB)	–0.0952	–3.27	0.0037	Significant negative impact: external debt accumulation deteriorates human development—debt burden effect.
EXR	–0.00039	–0.1086	0.9145	Insignificant; exchange rate instability not influencing HDI.
LOG(GDP)	1.1813	0.1135	0.9107	Insignificant; GDP growth does not directly translate into human development improvement, possibly due to inequality or non-inclusive growth.

The only long-run factors influencing HDI in Guinea were external debt service payments and external debt burden. Both were negatively signed, suggesting that public spending was inefficient and that welfare results were impacted by debt overhang.

4.7.2 Short-Run Dynamics (Error Correction Model - ECM)

From the Conditional Error Correction Regression:

Table 25

Variable	Coefficient	Prob	
DLOG(EDSP(-1))	0.004396	0.0454	Positive and significant → previous period's external debt service payment change increases HDI in the short run.
DLOG(EDSP)** (current)**	–0.002616	0.277	Negative but insignificant; short-run shock in spending not immediately effective.
LOG(GDP)**	–0.005205	0.0722	Marginally significant (p≈0.07), indicating that GDP expansion in the short run may reduce HDI slightly, possibly due to income inequality effects.
HDI(-1)*	0.0044	0.9095	Positive but insignificant, indicating the model's adjustment speed is extremely weak—suggesting HDI in Guinea adjusts slowly toward its equilibrium level.

ECM term (HDI(-1))
The coefficient of HDI(-1) = 0.0044 is positive and statistically insignificant (p=0.91). In order to verify short-run correction towards long-run equilibrium, the ECM term often needs to be negative and large. The positive result in this case suggests that there is no effective short-run convergence since the HDI is slow to react to shocks. This poor adjustment points to inherent rigidities in the dynamics of Guinea's development (e.g., institutional inefficiency or lagging policy responsiveness).

Table 26

Diagnostic Tests

Test	Statistic	Prob	Decision
Breusch-Godfrey LM (Serial Correlation)	F=2.49	0.110	No serial correlation (p>0.05).
Heteroskedasticity (BPG Test)	F=1.46	0.230	Homoskedastic residuals.
Durbin-Watson stat	≈2.12	—	No autocorrelation (good fit).

Thus, the model passes all major diagnostic checks, suggesting reliability of the estimates.

4.8 Panel

4.8.1 Lag selection procedure

The optimal lag length for the ARDL model was found using the information-criteria technique. The ARDL(1, 0, 2, 0, 0, 0) model reduced the BIC among the evaluated alternative lag lengths, suggesting that this specification achieved the optimal trade-off between model fit and parsimony.

4.8.2 Bounds (F-Test) for cointegration

A long-term equilibrium relationship between GDP, gender inequality (GIN), external debt service (EDSP), climate change (CCH), and HDI was demonstrated by the Bounds F-test. Since the computed F-statistic was higher than the upper bound critical value at the 5% significance level, the null hypothesis that there is no cointegration can be rejected.

4.8.3 Error Correction Model (ECM) coefficient

The ECM coefficient, which is statistically significant and negative, demonstrated a consistent long-term connection. The magnitude (–0.52) indicates that within a year, about 52% of the long-run equilibrium deviation is corrected. In other words, the system swiftly recovers to equilibrium after a shock.

The country-specific estimates were utilized to test the hypotheses, while the Panel-ARDL results served as robustness checks.

4.8.3.1 Test of the first and second hypotheses

H01: The Gambia's human development index is not impacted significantly by its foreign debt burden.

H02: The Gambia's human development index is not impacted significantly by external debt service payments to GDP.

Rule of Decision: As a general guideline, reject the null hypothesis and accept the alternative if the t-statistic is larger than 2.5 and the p-value is less than 0.05; if not, do not reject the null hypothesis. The table below displays the pertinent empirical findings for the test of hypothesis one and two.

Table 27

Summary of ARDL Results for Objective One and Two – Gambia

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**-0.01**	**-3.94**	**0.00**
EXDB	**-0.01**	**-15.39**	**0.00**
CCH	**-0.10**	**-2.47**	**0.06**
EXR	**0.00**	**3.00**	**0.03**
GIN	**-0.06**	**-0.57**	**0.59**
GDP	**0.03**	**3.37**	**0.02**
C		**-**	**-**
BGLM	**3.95(0.20)**		
BPG	**1.82(0.33)**		
CUSUM	**Stable**		

Source: Computed by the Authors Using E-views.

The findings indicated that the Gambia's human development index is adversely and significantly influenced by both external debt service payments and external debt burden. This implies that for every unit change, the two variables deteriorate the human development index by 1%. Hence, when the amount of money used to pay off debt increases, the HDI's components—education, health, and per capita income, deteriorate. This also occurs when additional debt is taken on, particularly when it exceeds the Gambian economy's size. Since the matching p-values were all less than 0.05 and the t-statistics for hypothesis one and two were larger than 2.5, the null hypotheses were rejected in both cases. The human development index was found to be strongly impacted, although negatively, by both external debt and external debt service payments.

4.8.3.2 Examining hypotheses three and four

H03: The human development index in Ghana is not significantly influenced by the amount of external debt.

H04: The Ghanaian human development index is not significantly influenced by external debt service payments relative to GDP.

The table below displayed the pertinent empirical findings for the test of hypothesis three and four:

Table 28

Summary of ARDL Results for Objective Three and Four – Ghana

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**0.04**	**1.89**	**0.08**
EXDB	**-0.01**	**-5.83**	**0.00**
CCH	**0.02**	**4.51**	**0.00**
EXR	**-0.00**	**-1.64**	**0.12**
GIN	**0.01**	**5.51**	**0.00**
GDP	**-0.88**	**-10.48**	**0.00**
C	**0.47**	**4.94**	**0.00**
BGLM	**0.71 (0.50)**		
BPG	**0.59 (0.83)**		
CUSUM	**Stable**		

Source: Computed by the Authors Using E-views.

Analyzed results showed that Ghana's human development index was positively and marginally influenced by external debt service payments. Conversely, the human development index was significantly impacted by the burden of external debt burden. The findings indicate that Ghana's human development index deteriorates by 1% for each unit shift due to the weight of external debt. In other words, as more debt is taken on, particularly over the economic growth threshold, the HDI's components—education, health, and per capita income, deteriorate. Because the t-statistic for hypothesis three is less than 2.5 and the corresponding p-value is more than 0.05, the null hypothesis cannot be abandoned. The fourth hypothesis concluded that foreign debt had a considerable but an adverse influence on the human development index in the Ghanaian economy, rejecting the null hypothesis and accepting the alternate.

4.8.3.3 Examining hypotheses five and six

H05: The burden of external debt has no significant influence on Guinea's human development index.

H06: Guinea's human development index is not influenced significantly by external debt service payments to GDP.

The table below displayed the pertinent empirical findings for the test of the hypotheses

Table 29

Summary of ARDL Results for Objective Five and Six – Guinea

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**-0.01**	**-2.80**	**0.01**
EXDB	**-0.09**	**-3.26**	**0.00**
CCH	**21.60**	**0.11**	**0.90**
EXR	**-0.00**	**-0.10**	**0.91**
GDP	**1.81**	**0.11**	**0.91**
C	**-**	**-**	**-**
BGLM	**2.48(0.11)**		
BPG	**1.46(0.23)**		
CUSUM	**Stable**		

Source: Computed by the Authors Using E-views.

The findings for Guinea indicated that the human development index was significantly and adversely influenced by both external debt service payments and external debt burden. It indicated that for every unit increase, the two variables impaired the human development index by 1% and 9%, respectively. This means that when the amount of money used to pay off debt increases, the HDI's components—education, health, and per capita income deteriorate. This also occurs when additional debt is taken on, particularly when it exceeds the size of the Guinean economy. The null hypotheses were rejected in both situations because the t-statistics for hypotheses five and six were greater than 2.5 and the associated p-values were all less than 0.05. This led to the conclusion that both external debt service payment and external debt burden had a significant, albeit negative, impact on the human development index in the Guinean economy.

4.8.3.4 Test of hypotheses seven and eight

H07: External debt burden has no significant impact on Liberia's human development index.

H08: The human development index of Liberia is not influenced significantly by the ratio of external debt service payments to GDP.

The table below displayed the pertinent empirical findings for the test of the hypotheses.

Table 30

Summary of ARDL Results for Objective Seven and Eight – Liberia

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**-0.01**	**-30.28**	**0.02**
EXDB	**0.01**	**25.87**	**0.02**
CCH	**-0.03**	**-16.78**	**0.03**
EXR	**0.00**	**41.30**	**0.01**
GDP	**0.49**	**15.07**	**0.04**
C	**0.04**	**83.36**	**0.00**
BGLM	**-0.87**		
BPG	**3.78(0.11)**		
CUSUM	**0.92(0.51)**		

Source: Computed by the Authors Using E-views.

The findings for Liberia indicated that the human development index is influenced significantly by both external debt service payments and external debt burden. The HDI changed negatively by 1% due to external debt service payments, but positively by 1% due to external debt burden. This means that the HDI's components—education, health, and per capita income improve with each unit change in the debt burden and worsen as the amount of money used for debt payment rises. The alternate was accepted and the null hypotheses in both cases were rejected since the t-statistics for hypotheses seven and eight are both more than 2.5 and the associated p-values are all less than 0.05. It was concluded that the human development index in the Liberian economy was significantly and negatively impacted by both external debt and external debt service payments.

4.8.3.5 Test of hypotheses nine and ten

H09: The burden of external debt has no discernible influence on Nigeria's human development index.

H010: Nigeria's human development index is not influenced significantly by the ratio of external debt service payments to GDP.

The table below displayed the pertinent empirical findings for the test of the hypotheses

Table 31

Summary of ARDL Results for Objective Nine and Ten – Nigeria

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**-0.01**	**-0.58**	**0.59**
EXDB	**-0.04**	**-1.64**	**0.17**
CCH	**0.25**	**1.63**	**0.17**
EXR	**0.00**	**2.85**	**0.04**
GDP	**0.94**	**1.26**	**0.27**
C	**0.04**	**3.82**	**0.01**
BGLM	**-0.31**		
BPG	**2.42 (0.20)**		
CUSUM	**1.77(0.24)**		

Source: Computed by the Authors Using E-views

For Nigeria, the result demonstrates that external debt service payment and external debt burden both exert non-significant impact on human development index. The HDI was adversely influenced by external debt service payments by 1%, but the HDI was negatively impacted by external debt burden by almost 4%. This means that when the amount of money spent on debt servicing increases and the debt burden increases, the HDI's components—education, health, and per capita income deteriorate. Since the t-statistics and related p-value are outside the acceptability zone, these results are determined to be non-significant in both situations. Since the t-statistics for hypotheses nine and ten were less than 2.5 and the corresponding p-values were all greater than 0.05, it is impossible to reject the null hypothesis in either scenario and accept the alternate, which concluded that the Nigerian economy's human development index is negatively impacted by both external debt and its service payment.

4.8.3.6 Test of hypotheses eleven and twelve

H_{011}: There is no significant influence of external debt burden on human development index in Sierra Leone

H_{012}: There is no significant effect of external debt service payment to gross domestic product on human development

index in Sierra Leone

The relevant empirical results for the test of hypotheses are shown in the table below

Table 32

Summary of ARDL Results for Objective Eleven and Twelve – Sierra Leone

Independent Variable: HDI			
	C	**T-stat**	**P-value**
EDSP	**0.19**	**1.66**	**0.14**
EXDB	**-0.02**	**-2.44**	**0.04**
CCH	**0.00**	**0.42**	**0.68**
EXR	**0.00**	**1.46**	**0.18**
GIN	**0.04**	**6.79**	**0.00**
GDP	**-0.97**	**-2.63**	**0.03**
C	**0.38**	**0.99**	**0.35**
BGLM	**2.46 (0.31)**		
BPG	**0.75 (0.67)**		
CUSUM	**Stable**		

Source: Computed by the Authors Using E-views.

The findings for Sierra Leone showed that the human development index was positively and non-significantly impacted by foreign debt service payments, while the human development index was significantly, but adversely influenced by external debt burden. According to the findings, the external debt burden lowers the human development index by 2% for each unit change. This means that the HDI's components—education, health, and per capita income deteriorate as more debt is taken on, particularly when it exceeds the size of Sierra Leone's economy. The null hypothesis cannot be rejected since the t-statistics for hypothesis eleven were less than 2.5 and the associated p-values were greater than 0.05. The null hypothesis was declined for hypothesis twelve as the t-statistic was higher than 2.5 and the p-value is less than 0.05. The finding is that whereas external debt had a considerable and negative impact on the human development index, external debt service payments had a non-significant impact on the HDI.

4.8.3.7 Test of hypotheses thirteen and fourteen

H_{013}: There is no significant influence of external debt burden on human development index in the West African

Monetary Zone

H_{014}: There is no significant effect of external debt service payment to gross domestic product on human development

Table 33

Index in the West African Monetary Zone

Variables	PANEL		
	C	T-stat	P-value
EDSP	-0.001	-5.64	0.00
EXDB	-0.001	-2.49	0.00
CCH	0.001	0.51	0.61
EXR	0.03	11.15	0.00
GIN	-0.08	-1.23	0.22
GDP	0.03	20.96	0.00
C			

Source: Computed by the Authors Using E-views.

The panel result for the West African Monetary Zone indicated that the human development index was significant, but adversely influenced by the external debt burden and external debt service payments. The outcome demonstrated that for every unit shift, external debt burden lowers the human development index by 1%. This means that as more debt is taken on, particularly when it exceeds the size of the West African Monetary Zone economy, the HDI's components—education, health, and per capita income degrade. The null hypothesis was declined since the t-statistics for hypothesis thirteen were roughly 2.5 and the associated p-values were less than 0.05. The null hypothesis was rejected for hypothesis 14 when the t-statistic is more than 2.5 and the p-value is less than 0.05. The human development index was found to be strongly and negatively impacted by external debt burden and external debt service payments.

5 DISCUSSION OF FINDINGS

5.1 Objective one and two – The effect of external debt burden and external debt service payment on human development index in the Gambia

The findings indicate that the Gambia's human development index is significant, but adversely influenced by both external debt service payments and external debt burden. The findings indicate that for every unit change, the two variables deteriorate the human development index by 1%. This means that when the amount of money used to pay off debt increases, the HDI's components—education, health, and per capita income deteriorate. This also occurs when additional debt is taken on, particularly when it exceeds the Gambian economy's size. In line with Yeboah et al. (2023), Ali (2022), Ijirshar et al.

(2016), and Epaphra & Mesiet (2021), both the external debt and its service payment had a substantial but detrimental effect on economic growth and human development. Nevertheless, the study's findings indicateded that the goals had been adequately achieved. The debt overhang theory, which postulates that high marginal taxes imposed by external creditors might deter investment and slow growth, theoretically supports this conclusion.

5.2 Objective three and four - The effect of external debt burden and external debt service payment on human development index in Ghana

Analyzed results showed that Ghana's human development index was positively and marginally influenced by external debt service payments. The human development index, however, was significantly and negatively impacted by the external debt burden. The findings indicated that Ghana's human development index deteriorates by 1% for each unit shift due to the burden of external debt. This means that as more debt is taken on, particularly over the economic growth level, the HDI's components—education, health, and per capita income deteriorate. According to research by Hassan & Meyer (2020) and Olusegun et al. (2020), paying off external debt had a favourable but negligible effect on economic growth and human development. According to research by Edeminam & Aras (2022), Saengchai et al. (2019), and Onyekwelu et al. (2014), paying off external debt has a substantial and detrimental impact on both economic growth and human development. Nevertheless, the study's findings showed that the goals had been adequately achieved. The debt overhang theory theoretically supports the result.

5.3 Objective five and six - The effect of external debt burden and external debt service payment on human development index in Guinea

According to the results, Guinea's human development index was significantly and adversely influenced by both foreign debt service payments and external debt burden. The outcome demonstrated that for every unit change, the two variables impair the human development index by 1% and 9%, respectively. This means that when the amount of money spent on debt servicing increases, the HDI's components—education, health, and per capita income deteriorate. Additionally, this occurs when additional debt is taken on,

particularly when it exceeds the size of the Guinean economy. In their research, Yeboah et al. (2023), Ali (2022), Ijirshar et al. (2016), and Epaphra & Mesiet (2021) discovered that both the foreign loan and its service payment had a substantial but detrimental effect on economic growth and human development. However, the study's findings indicated that the goals had been adequately achieved. The debt overhang theory theoretically supports the conclusion.

5.4 Objective seven and eight - The effect of external debt burden and external debt service payment on human development index in Liberia

The findings for Liberia indicated that the human development index was significantly influenced by both foreign debt service payments and external debt burden. The HDI changed negatively by 1% due to external debt service payments, but positively by 1% due to external debt burden. This means that the HDI's components—education, health, and per capita income improve with each unit change in the debt burden and worsen as the amount of money used for debt payment rises. According to research by Shah et al. (2023), Wirajing et al. (2023), and Thi & Le (2022), paying off external debt had a detrimental but significant influence on both economic growth and human development. In consonance with the works of Sandow et al. (2022) and Petrushenko et al. (2022), the burden of external debt had a favourable and substantial effect on both economic growth and human development. Nevertheless, the study's findings showed that the goals had been adequately achieved. The finding is conceptually supported by the debt overhang theory, which states that if the future debt stock is expected to be greater than a country's ability to repay it, the projected debt service requirements will likely be a rising function of the nation's output.

5.5 Objective nine and ten - The effect of external debt burden and external debt service payment on human development index in Nigeria

The findings indicated that both external debt service payments and external debt burden had a negligible influence on Nigeria's human development index. The HDI changed negatively by 1% due to external debt service payments, but the HDI changed negatively by around 4% due to external debt burden. This means that when the amount

of money spent on debt servicing rises and the debt load increases, the HDI's components—education, health, and per capita income deteriorate. Since the t-statistics and related p-value were beyond the acceptable range, these results were determined to be non-significant in both situations. According to research by Omotor (2021), Odejimi & Ozor (2018), and Mezni & Djebali (2022), both the external debt and its service payments had an adverse and non-significant influence on human development economic growth. Nonetheless, the study's findings showed that the goals were adequately achieved and consistent with the debt overhang theory.

5.6 Objective eleven and twelve - The effect of external debt burden and external debt service payment on human development index in Sierra Leone

The findings for Sierra Leone indicate that the human development index was non-significant, but positively influenced by foreign debt service payments, while the human development index was negatively and significantly impacted by external debt burden. According to the findings, the burden of foreign debt lowers the human development index by 2% for each unit change. This means that the HDI's components—education, health, and per capita income deteriorate as more debt is taken on, particularly when it exceeds the size of Sierra Leone's economy. According to research by Khan et al. (2022) and Hakimi et al. (2019), external debt service payments had a favourable but non-significant influence on economic growth and human development. According to research by Egungwu (2018) and Charles & Abimbola (2018), the burden of external debt significantly and negatively affected both economic growth and human development. The study's findings, however, showed that the goals had been satisfactorily achieved and were consistent with the debt overhang theory.

5.7 Objective thirteen and fourteen - The effect of external debt burden and external debt service payment on human development index in West African Monetary Zone

The panel result for the West African Monetary Zone indicated that the human development index was significant, but adversely influenced by both external debt service payments and external debt burden. The findings indicated that for every unit change, the two variables deteriorated the human development index by 1%. This means that when

the amount of money used to pay off debt increases, the HDI's components—education, health, and per capita income deteriorate. This also occurs when additional debt is taken on, particularly when it exceeds the West African Monetary Zone economy's size. In consonance with research by Yeboah et al. (2023), Ali (2022), Ijirshar et al. (2016), and Epaphra & Mesiet (2021), both the external debt and its service payment had a substantial but detrimental effect on economic growth and human development. Nevertheless, the study's findings indicated that the goals had been adequately achieved. The debt overhang theory, which postulates that high marginal taxes imposed by external creditors might deter investment and slow growth, theoretically supports this conclusion.

5.8 Comparison of the pooled and country-specific results

Interestingly, the findings showed that the West African Monetary Zone's foreign debt burden and the human development index had a substantial and negative association. The external debt burden, however, was found to have a significant but negative correlation with the human development index in the Gambia, a significant but negative correlation with the human development index in Ghana, a significant but negative correlation with the human development index in Guinea, a significant and positive correlation with the human development index in Liberia, a non-significant and negative correlation with the human development index in Nigeria, and a significant but negative correlation with the human development index in Sierra Leone, according to the specific-country results. The results of the external debt burden in the West African Monetary Zone and the Gambia, Ghana, Guinea, Nigeria, and Sierra Leone showed similar behaviors and characteristics, indicating that the borrowed debt was not improving per capita income, health, or education in either country. On the other hand, external borrowing was significantly enhancing health, education, and per capita income in Liberia.

Furthermore, the specific-country results showed that there was a significant but negative correlation between external debt service payment and the human development index in the Gambia, a non-significant but positive correlation with the human development index in Ghana, a significant but negative correlation with the human development index in Guinea, a significant but negative correlation with the human development index in Liberia, a non-significant and negative correlation with the human

development index in Nigeria, and a non-significantly positive correlation with the human development index in Sierra Leone, even though the results showed a significant and negative correlation with the human development index in the West African Monetary Zone. The results of the Gambia, Guinea, and Liberia's foreign debt service payments were comparable to those of the West African Monetary Zone, indicating that although the debt servicing was significant, neither the countries nor the zone saw improvements in per capita income, health, or education. In Ghana, Nigeria, or Sierra Leone, external debt servicing had no discernible positive effects on per capita income, health, or education.

6 CONCLUSION AND RECOMMENDATIONS

External borrowing has a significant effect on a nation's human development index when the focus moves from financing private investment to debt repayment, until high levels of external debt servicing begin to impede progress. The study found that while debt accumulation has a positive impact on human development at low levels, it begins to have a detrimental impact over specific thresholds because excessive debt service payments take money away from the social, educational, and health sectors. This hides the objective of external borrowing, which is to promote human development in the West African Monetary Zone rather than drowning in debt service payments that deplete most of the Zone's resources and obstruct development due to high interest payments on external debt. However, the primary cause of the member countries of the West African Monetary Zone's external debt issue is that these foreign loans aren't being used for development. Instead of using it for capital projects that will boost the economy, they are secretly hidden.

Loan principal and interest must be paid on schedule in order to service debt, and the gross domestic product is used to assess the state of the economy as a whole at the time of payment. The study's conclusions showed that one of the main obstacles to human development is excessive foreign debt, since the majority of West Africa Monetary Zone nations frequently incurred huge foreign loans, which resulted in the accumulation of trade debt arrears at extremely favorable interest rates. Because a loan is really serviced for more than the amount it was obtained, accumulated debt service payments cause numerous issues for nations, particularly emerging ones. This slows down the

development process in these countries. An economy's development has been hampered by the debt overhang or debt service burden that results from its incapacity to fulfill its debt service obligations.

The following are suggested in light of the findings.

1. Since both foreign debt and external debt service payments have a significant impact on the human development index, albeit negatively in the Gambia, the governments of the West African Monetary Zone countries should implement structural changes aiming at effective debt management practices in the countries. That is, policies or changes that ensure rule-based governance, fiscal and financial management, effective revenue mobilization through an effective tax system, and public administration. By taking these steps into account, public sector management will be enhanced, ensuring debt sustainability and the expected positive growth. Furthermore, these changes will ensure that the borrowed funds are free from corrupt practices and allocated to profitable economic sectors, increasing productivity and, as a result, the WAMZ's human and economic development.
2. In light of the Ghanaian economy's results, the West African Monetary Zone economies should take the external debt thresholds into account while developing their external debt management strategies in order to lessen their need on external debt financing. To close the resulting spending imbalance, domestically generated money, particularly tax revenue, should be revitalized and galvanized in a way that would significantly minimize tax evasion and avoidance.
3. Considering the negative impacts of foreign debt service payments and external debt on human development in Guinea, the governments of the West African Monetary Zone countries should adopt a pragmatic strategy to reduce their external debt load by making efficient use of the previously accumulated debt. To totally eradicate the misallocation and squandering of the borrowed funds, they should take aggressive steps. The money should also be distributed to a number of high-priority areas, such as building human capital, eradicating poverty, filling in infrastructural gaps, boosting output, and other projects that improve economic growth and wellbeing. By doing this, the nations' present external debt load would be removed, and inclusive economic growth would be promoted.

4. External debts should only be incurred for economic purposes, not for political or social ones, in light of the Liberian economy's conclusions. This is to prevent the external debt stock from building up over time and to keep the motivation behind external debt from becoming obscured. Additionally, in order to prevent debt overhang, the authorities in charge of overseeing the external debt of the West African Monetary Zone countries must effectively monitor the debt payment obligations and prevent the debt from exceeding a maximum limit.
5. In light of the Nigerian economy's findings, governments in the West African Monetary Zone should look for loans with favorable terms and conditions following a thorough assessment rather than relying solely on necessity to lower the cost of the loan so as to reduce the adverse impact of foreign debt and the associated payment obligation. The rate of foreign borrowing will decrease in a well-developed capital market.
6. The governments of the West African Monetary Zone countries should only use loans on profitable capital investments that can be liquidated themselves, rather than using them for ongoing expenses, in light of the conclusions drawn from the Sierra Leonean economy. This will lessen the impact of the debt overhang on economies.

REFERENCES

Adeve, K. A. & Karabou, E. F. (2022.) Public debt and development sustainability issues in the West African Economic and Monetary Union (WAEMU), *Cogent Economics & Finance*, 10 (1), 1 – 13.

Aladejare, S. A. (2023). Does external debt promote human longevity in developing countries? Research Square.

Ali, A. (2022). Foreign debt, financial stability, exchange rate volatility and economic growth in South Asian Countries, *Munich Personal RePEc Archive*, 116328, 1 – 24.

Charles, O. & Abimbola, O. (2018). The impact of external debt on the Nigerian economy, *Journal of Economics and International Business Management*, 6 (2), 30 – 39.

Chindengwike, J. D. (2022). Does an external debt promote sustainable economic development in developing countries? *Journal of Global Economy*, 18 (1), 53 – 66.

Edeminam, V. B. & Aras, (2022). Effect of external debt on expected years of schooling: The case of Nigeria and Ghana, *London Journal of Social* Sciences, 2 (3), 53 – 70.

Egungwu, I. C. (2018). Impact of external debt on human capital development in Nigeria. IDOSR Journal of Current Issues in Social Sciences 4(1), 1 – 33.

Ehikioya B. I., Omankhanlen A. E. Osuma, G. O. & Inua, O. I. (2020). Dynamic Relations Between Public External Debt and Economic Growth in African Countries: A Curse or Blessing? *Journal of Open Innovation: Technology, Market, and Complexity*, 6 (88), 1 – 16.

Epaphra, M. & Mesiet, W. (2021). The external debt burden and economic growth in Africa: A panel data analysis, *Theoretical and Applied Economics*, 28 (2), 175 – 206.

Evans, Y. (2022). The effect of external debt, unemployment rate, and inflation on economic growth in Ghana, *Journal of Empirical Studies*, 9 (2), 24 -34.

Hassan, A. S. & Meyer, D. F. (2020). Non-linear effect of external debt on economic growth: Evidence from Sub-Saharan African countries, *International Journal of Economics and Management* 14 (3), 447-460.

Ijirshar, V. U., Joseph, F. & Godoo, M. (2016). The Relationship between External Debt and Economic Growth in Nigeria, *International Journal of Economics & Management Sciences,* 6 (1), 1 – 5.

International Monetary Fund (2022). *Table of external public debt for WAEMU (2018–2026 projection).* Regional Report.

International Monetary Fund (2024). *Regional/Risk Report*.

Kalu, E. U., Igwe, A., Okoyeuzu, C. & Ukpere, W. I. (2017). High indebtedness, economic development and poverty: A focus on highly indebted poor countries, *International Journal of Economic Perspectives*, 11 (4), 26 – 35.

Khan, J., Rafique, A. & yousaf, N. R. (2022). Impact of external debt on economic growth in Pakistan: Solow growth model approach, *Journal of Development and Social Sciences*, 3 (4), 299 – 308.

Manasseh, C. O., Abada, F. C., Okiche, E. L., Okanya, O., Nwakoby, I. C., Offu, P., Ogbuagu, A. R., Okafor, C. O., Obidike, P. C.& Nwonye, N.G. (2022). External debt and economic growth in Sub-Saharan Africa: Does governance matter? *Plos One* 17 (3), 1 – 28.

Mezni, M. & Djebali, N. (2022). External debt and human development index: MENA region case, *Research Square,* 1 – 18.

Mqolombeni, N., Tewari, D. D. & Ilesanmi, K. D. (2023). Exploring the role of high government debt on economic growth: A nonlinearity and threshold analysis for Africa's developing countries. *Economies,* 11 (51), 1 - 15.

N'Zue, F. F. (2020). Is external debt hampering growth in the ECOWAS region? *International Journal of Economics and Finance*; 12 (4), 54 – 66.

Olusegun, E. A., Olufemi, A. S. & Olubunmi, E. O. (2020). The impact of external debt on economic growth in Nigeria, *International Journal of Scientific and Research Publications*, 10 (4), 716 -721.

Omotor, D. (2021). External debt sustainability in West African countries. *Review of Economics and Political Science*, 6 (2), 118-141.

Onyekwelu, U. L., Okoye, E. & Ugwuanyi, U. B. (2014). External Debts Management Strategies in Developing Economies: An Impact Assessment on Selected Economic Indices of Nigeria (2002–2011*), International Journal of Economics and Finance*, 6 (8), 137 – 152.

Petrushenko, Y., Korneyev, M., Nebaba, N., Banchuk-Petrosova, O. & Bohorodytska, A. (2022). Assessment of the external debt impact on a country's economic development indicators: Evidence from Ukraine. *Investment Management and Financial Innovations*, 19 (1), 360 -369.

Saengchai, S., Boonrattanakittibhumi, C., Urairak, B. (2019). Insights into the external debt, corruption and economic growth nexus: A case study, *Journal of Security and Sustainability Issues* 9 (2), 533 – 546.

Sandow, J. N., Oteng-Abayie, E. F. & Duodu, E. (2022). External debt and economic growth in Sub-Saharan Africa: does heterogeneity in the quality of public sector management make a difference? Heliyon, 8, 1 – 9.

Shah, A. A., Younas, R., Junaid, K. M. & Iqbal, M. (2023). Attaining economic growth through financial development and external debts: Evidence from emerging economies. *Research Journal for Societal Issues*, 5 (1), 224 – 240.

Thi, X. L. & Le, U. V. T. (2022). External debt in developing countries in the period of 2001 to 2020: Reality and new manifestations. *International Journal of Scientific Advances*, 3 (2), 203 – 212.

United Nation Development Programme (2022). COVID-19 and external debt in Africa.

United Nation Development Programme (2025). Ballooning Debt Service Payments.

Wirajing, M. A. K., Nchofoung, T. N. & Etape, F. M. (2023). Revisiting the human capital–economic growth nexus in Africa, *SN Business & Economics*, 3 (115), 1 – 29.

World bank (2023). *External debt and growth nexus in Africa*, Working paper, 3.

World bank (2024). *Unpacking Africa's Debt*. United Nation report.

Yeboah, E., Bamwessigye, D., Ozbalci, S. & Atiso, F. (2023). Do external debt and foreign direct investment inflow support economic growth? *Journal of Finance and Financial Law*, 1 (37), 139 – 154.

Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA)

John, J. I., Okoyeuzu, C. R., Ukpere, W., & Monyei, F. (2025). PANEL AND COUNTRY-SPECIFIC MODELLING OF DEBT BURDEN, REVENUE LEAKAGE AND HUMAN DEVELOPMENT IN EMERGING MARKET ECONOMIES: EVIDENCE FROM THE WAMZ COUNTRIES. *Veredas Do Direito*, 22(6), e224030. https://doi.org/10.18623/rvd.v22.n6.4030