Does External Debt Promote Human Longevity in Developing Countries?

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Research Article

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Abstract

This study assessed the impact of external debt on longevity in developing countries, particularly in West Africa, from 1981 to 2020. Longevity was proxied by life expectancy at birth, while the external debt effect was evaluated from the perspective of sustainability, liquidity, and solvency. Furthermore, outcomes from macroeconomic volatility were controlled through inflation and exchange rate variability. Methodological robustness was ensured by adopting panel unit root, cointegration, and estimation procedures incorporating panel dataset cross-sectional dependency and heterogeneity in their estimation process. Robust inferences for the study were derived by comparing estimated outcomes from the cross-sectional augmented autoregressive distributed lag, dynamic common correlated Effects, and the Driscoll-Kraay method. Empirically, the study showed that unsustainable, illiquid, and insolvent external debt and macroeconomic volatility shorten longevity in West African countries. Hence, longevity will decline when weak external debt management promotes poverty in West Africa and other developing countries.

Keywords: External debt; Life expectancy; Quality of life; Development; West Africa; Developing countries.
JEL Classification: H53, H63, I31.

1. Introduction

Every nation's government is tasked with ensuring human dignity, sustenance of enterprises (either private or public), job creation, and curtailing poverty through efficient economic policies. However, the actualisation of the aforementioned is not completely realisable—even in the developed countries despite their enormous physical, human, institutional, and financial wealth (Addison et al., 2020). It is common knowledge that developing countries have constant population growth and limited economic resources. Hence, the continuous need for public borrowing to augment infrastructure deficit, create jobs and pursue equity in resource allocations. Although public borrowings can provide the deficit funds, they are not without cost and could even be detrimental if not efficiently utilised for productive ventures that guarantee easy repayment. Poor debt utilisation can erode future infrastructural development, job creation, limit future access to credit, and hinder the overall development of a country.

In developing countries, poor resource management, food insecurity, an undiversified economy, and over-reliance on primary exports can render the government's efforts to improve longevity through better quality of life ineffective. Hence, the dream of a dignified life through access to quality healthcare, education, sanitation, water, security, jobs, etc., often appears like a mirage. As a remedy, developing countries often rely on external borrowing to fund critical infrastructures required for spurring economic growth and development (Aladejare, 2021). The reason is that the fiscal space needed to increase resources is constrained in many of these countries (OECD, 2020). For instance, the International Monetary Fund (IMF) observed that in 59 nations tagged as low-income developing economies, the median public debt per GDP rose from 38.7% in 2010-2014 to about 46.5% in 2017 and had failed to improve substantially any further (IMF, 2018). Furthermore, their debt servicing had constituted 12.2% of government revenue in 2018, growing from 6.6% in 2010 (Griffiths et al. 2020).

African governments are gradually becoming overwhelmed by the size and cost of their long-term external indebtedness, evident by the growing calls for debt cancellations and

rescheduling by stakeholders within and outside the continent. Specifically, West African countries' long-term external debt-to-GDP from 1981 to 2020 averaged around 69% (see Table 2), far above the 40% benchmark for developing and emerging countries even though most countries in the region had benefited from debt relief initiatives at different intervals due to their categorisation as heavily-indebted poor countries (HIPC) and belonging to the multilateral debt relief initiative (MDRI). Similarly, external debt-to-export averaged about 312.6% (see Table 2) despite the small size of most West African countries' economies and limited exportable commodities; indicating that over three times of West African exports are required for debt obligation.

Significant factors for external debt accumulation in West Africa include sensitivity of debt burden indicators to growing inflation rate, exchange rate volatility, the quest for import substitution and industrialisation, etc. For instance, the overwhelming economic shock brought about by the coronavirus pandemic in 2020 will further aggravate the debt burden in most West African economies. Many countries had to spend their way out of the pandemic to avoid economic recession. Before the pandemic, countries in the region grappled with poor longevity, as reflected in the low life expectancy of about 53.4 years (see Table 1). Despite the many years of external borrowing to fund infrastructural development in health, education, manufacturing, construction, transportation, etc., poor access to quality healthcare and inadequate social and economic amenities suggest a less useful impact of governments' borrowed funds over time.

Therefore, this study evaluates the significance of external debt in enhancing longevity in developing countries, with particular reference to West Africa. For this purpose, longevity was measured using total life expectancy at birth. External debt impact was assessed using sustainability, liquidity, and solvency indicator. At the same time, inflation rate and exchange rate variability proxied for macroeconomic volatility, which served as an interactive measure in the external debt-longevity nexus. Empirical outcomes from this research revealed that the more external debt is unsustainable, illiquid, and insolvent, the lower longevity becomes. Hence, further failure to timely adopt efficient utilisation of external borrowings portends the likelihood of a debt overhang crisis, with a lethal stagnating effect on development and further worsens longevity in developing countries. A shortage of this particular study on developing countries exists in the literature. Likewise, studies with specific reference to West Africa are scant. Most extant studies have been more interested in the effects of external indebtedness in developing countries on economic growth (see Chowdhury, 1994; Fosu, 1996 and 1999; Iyoha, 1999; Mohd Daud and Podivinsky, 2012; Dogan and Bilgili, 2014; Senadza et al. 2017, etc.). This makes this study a vital contribution to extant knowledge since it views the impact of external indebtedness from the dimension of longevity enhancement in developing countries.

The rest of the research is structured as follows: Section two has a brief literature review, Section three describes the study data and methodology, Section four contains the empirical findings, and Section five captures the concluding remarks.

2. Literature Review

2.1 Theoretical Review

Atique and Malik (2012) noted that external debt covers an enormous portion of the public debt structure in developing countries. Dependence on external public borrowing is justified because excessive domestic public debt can create financial instability in the economy and crowd out the private sector (Panizza et al., 2010). Furthermore, as Todaro and Smith (2006) noted, developing countries rely on external borrowing in their primary development stages due to the inadequacies of domestic capital for investment. However, these demand by

developing countries has led to an expanded global debt crisis. The world financial community (fronted by the IMF) has recommended tight monetarist policies that emphasise different characteristics.

The monetarist proponents' first and most crucial demand is that developing countries should cut down on their level of participation in the national political economy, mainly as it concerns state production and planning (Nelson, 1988; and Biersteker, 1990) through the initiation of various austerity measures. As a follow-up measure, the global financial community emphasised accruable growth and development dividends to accompany the adoption of a capitalist system by developing countries. That is if, as a pre-condition, they agree to open their economies to foreign investments, adhere to IMF prescriptions, and consistently ensure trade liberalisation. Third, although the IMF and World Bank are aware of the accompanying rigour and initial painful impact these policies may exert, they contend that such measures will enable developing countries to offset their debts and reap long-term development through the "trickle-down" effect. For instance, the World Bank submitted that structural adjustment policies would typically yield gainers and losers since such programs' stabilisation elements are often detrimental to welfare (Bradshaw and Wahl, 1991). Nevertheless, the World Bank and IMF argued that structural adjustment would enhance the quality of life in the long term.

On the other hand, dependency-oriented scholars (such as; Dos Santos, 1970; Sekhri, 2009; Tausch, 2010; Kay, 2011; Farny, 2016; etc.) have emphasised the harmful impacts of IMF policies on the actualisation of significant economic and social development in developing countries. For example, the deleterious roles foreign trade and external investment play in developing countries have been well documented in empirical dependency theory studies (Bradshaw and Wahl, 1991). External indebtedness is believed to exacerbate the dependence of developing countries on their developed counterparts through repayments of disbursed loans and interests. Likewise, the call on developing countries to strictly comply with IMF's western-oriented monetarist policies by cutting down on government subsidy programs meant to advance the quality of life. Hence, dependency-oriented scholars have suggested that attempts to adopt structural adjustment programs must be evaluated from the perspective of protecting or enhancing human dignity. Most developing countries are increasingly aligning with the dependency arguments since they feel 'enslaved' to the international financial institutions that now determine their future without having an in-depth understanding of their peculiarities (Bradshaw and Wahl, 1991). Thus, developing countries are confronted with either accepting the IMF-imposed conditionality; or accessing lesser international credit in the future.

To sum up this succinct theoretical exposition, it is important to stress that the monetarist argument favours structural adjustment programs in developing countries. They believe it will help achieve economic expansion, ensure debt repayment and access to future international credit, and long-term guarantee improvement in quality of life. In contrast, dependency-oriented scholars hold the view that structural adjustments and dependency via external debt will impede overall growth and development in developing countries by hindering economic expansion and retarding quality of life enhancement. Although this study aligns with the dependency-oriented theory, it is crucial to state that weak economic governance in developing countries is likely responsible for their poor debt management and quality of life.

2.2 Empirical Literature

As prior noted, empirical studies on the effects of external indebtedness on longevity (life expectancy) in developing countries are scant. Nevertheless, extant studies have dwelled on

the related subject matter as contained in this review. The shortage of studies on the debt-longevity nexus constitutes a significant contribution of this study to existing literature.

2.2.1 Effect of external debt on life expectancy

By conducting a study on 62 developing countries and adopting the Ordinary Least Square (OLS) technique, Bradshaw and Wahl (1991) found no substantial effect of external debt on life expectancy, except for Sub-Saharan Africa (SSA) countries where external debt improves life expectancy. Nevertheless, the study aligned with the dependency-oriented assertion that structural adjustment programs hinder economic development in developing countries. They noted that despite IMF conditionality not having a significant immediate effect on life expectancy, their long-term impact significantly impeded it.

In a related study, Loko et al. (2003) adopted the generalised method of moment (GMM) approach in assessing external debt's role in influencing poverty levels in 67 low-income countries. The study suggests that external debt triggers poverty through high debt servicing costs, which crowds-away funds for public social spending on education, health, water and sanitation, and social safety. Furthermore, it was observed that high debt servicing and external debt harm life expectancy, infant mortality and education enrolment rate, with the impact being more significant on life expectancy.

Saungweme and Mufandaedza (2013) studied the effect of external debt on poverty mitigation in Zimbabwe by adopting the OLS approach. The study indicated that external debt deprives the country of resources, which could have helped improve infrastructure, considerably in the health and education sectors. Infant mortality was thus significantly compromised by growth in external debt repayment. Another country study conducted by Smrcka and Arltova (2014) adopted the ARDL technique in evaluating the effect of debt on the standard of living for the Czech Republic. The study observed that public and household debt contribute substantially to the standard of living in the country.

In a reverse study, Abbas et al. (2020) used the panel fixed effect (FE) and system GMM technique to conclude that life expectancy contributes to rising external debts in South Asian countries of Sri Lanka, Bangladesh, Pakistan, Nepal, and India. Similarly, Abd Rahman et al. (2021) investigated the effect of an ageing population on the external indebtedness of 36 upper-middle-income countries. By applying the system GMM approach, the study concluded that having a growing ageing population can aggravate external debt since more will have to be budgeted for healthcare, pensions and social security, and age-friendly infrastructure.

Bese and Friday (2021) assessed the nexus between life expectancy and external debt for Turkey using the autoregressive distributed lag (ARDL) model. The empirical outcome of the study showed that while long-term external indebtedness positively impacted life expectancy in the long term, the short-term effect was, however, negative.

On the other hand, Ma et al. (2022) tried to establish the effect of external indebtedness on health outcomes in the emerging economies of Sri Lanka, Bangladesh, India, Thailand, Malaysia, China and the Philippines. The study employed the panel ARDL methodology and concluded that external debt aggravates infant mortality and diminishes life expectancy in the examined countries in the long term. Furthermore, public health spending promotes life expectancy and lowered the infant mortality rate in the emerging economies.

2.2.2 Other related studies

Gupta et al. (2002) assessed the impact of the HIPC initiative on beneficiary countries' health spending. However, the study noted that specific emphasis should be placed on improving the outlay on water and sanitation, education (particularly among women of childbearing age), and nutrition. Such measures, they noted, tend to improve society's general health status and welfare. Furthermore, the study concluded that redirecting health expenditures, particularly to these core areas, will ensure efficient use of health expenditure and promote equity in the distribution of health resources.

By adopting a panel OLS approach, Fosu (2008) explored the effects of foreign debt-servicing on health outlay in 35 SSA countries. The study's result suggests that the external debt-servicing burden in SSA countries always moves against public health spending. Fosu showed that the share of debt-servicing was a significant determinant of health spending allocations in the budget. The study further noted that SSA countries would be expending lesser amounts on healthcare without debt reliefs and rescheduling.

Clayton and Linares-Zegarra (2014) assessed the nexus between household debt and health outlay for OECD countries by adopting the GMM model. The study found that the more household debt accumulates, the poorer the household's general health condition. Furthermore, the study established a significant link between debt maturity and household health conditions. In this light, long-term household debt adversely impacted life expectancy; and accelerated the premature mortality rate. However, the reverse was observed with short and medium-term debt effects on life expectancy. Similarly, Arber et al. (2014) indicated that unemployment, poor education, low social class and income, which could arise from a high debt burden, are related to degenerating public health.

Shabbir and Yasin (2015) examined the impact of external debt on social expenditure in some selected Asian developing countries; through the GMM approach. The study's findings showed that external debt and debt servicing substantially impacted the development plans and social spending (particularly in health and education sectors) decisions in the selected countries adversely.

The effect of foreign health aid on life expectancy was investigated by Herzer and Nagel (2015) for 42 countries. By applying panel cointegration analysis, the study found an adverse long-run impact of health aid on life expectancy. Furthermore, long-run causality from health aid to life expectancy was also confirmed, while health aid was reported to boost life expectancy only in the short term significantly.

Zaghdoudi and Hakimi (2017) evaluated the causal effect of external debt on poverty. Methodologically, the study applied the panel cointegration method to 25 developing countries. The outcome of the study showed that a higher incidence of poverty usually accompanies a higher external debt burden. Specifically, the study observed that as more resources are committed to debt-servicing, a social expenditure that impacts the poor (such as health and education) shrinks significantly. Hence, high external indebtedness compromises investment in the health and education sector and promotes poverty in the long term.

Similarly, Pickbourn and Ndikumana (2018) studied the impact of foreign health aid on diarrhoea mortality in children under-five in 47 SSA economies. After controlling for fixed effects and endogeneity in the panel dataset, the study concluded that foreign health aid and government health outlay reduce diarrhoea mortality in children under five. Also, foreign

health aid triggered public health outlay, implying that foreign health aid could have more aggregate diminishing effect on diarrhoea deaths than its direct effect.

Herzer (2019) investigated the association between foreign aid and population health in developing countries. By applying the panel cointegration and causality approach, the study submitted that foreign aid has an adverse long-term impact on health, especially in SSA countries. A unidirectional causality was also found from foreign aid to health. However, foreign aid was reported to have an insignificant effect on health in Latin American and Caribbean countries.

Similarly, Idrees and Abu Bakar (2019) also explored the nexus between foreign direct investment (FDI) and population health proxied by life expectancy in Pakistan. Inference derived from the adopted ARDL technique shows that life expectancy is enhanced by the increase in FDI inflows to Pakistan. Bese and Kalayci (2021) further tried to determine the relationship between FDI and life expectancy in Turkey using the symmetric and asymmetric ARDL approach. The study result validated the long-run impact of FDI on life expectancy.

Tasleem (2021) showed that the increase in debt servicing in the South Asian association for regional cooperation (SAARC) countries of Sri Lanka, Bangladesh, Pakistan, and India negatively impacted government health and education expenditure. Findings from the study were derived by applying the panel FE model. The study opined that as the external debt burden rises and the servicing cost grows, governments in the SAARC countries find it easier to cut down on social sector expenditure for debt servicing.

Chaudhry et al. (2022) examined the asymmetric impact of FDI and population health proxied by life expectancy for Pakistan. The study adopted the non-linear ARDL and asymmetric causality technique. Inferences derived from the study are that a rise in public outlay and improved investment in healthcare promote life expectancy in Pakistan.

3. Data and Methodology

3.1 Data

This study's empirical analysis utilised panel data from 14 of the 16 West African countries spanning from 1981 to 2020. These countries are Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra-Leone, and Togo. Liberia and Saint Helena are the only countries in the region that dropped from the analysis due to data unavailability. Longevity in West African countries is one of the lowest globally despite many years of external borrowing to fund infrastructural development by governments in the region (WPR, 2022). Poor access to quality healthcare and inadequate social and economic amenities continue to be the bane of longevity, suggesting less impact of governments' borrowed funds.

Longevity, the response variable is measured by life expectancy at birth. It represents the number of years an individual is expected to live, given that the prevailing conditions of mortality during birth are held constant throughout the individual's lifetime (WDI, 2022). Adoption of life expectancy to proxy longevity was anchored on the intuition that it is a function of an individual's lifestyle choices or habits. These choices or habits are substantially determined by response to incentives from factors such as quality education, wealth creation, enhanced physical and mental health condition, employment opportunities, security and freedom, quality recreation and leisure time, environmental protection, etc. External debt deployment for these factors can enhance the quality of life, mirrored through higher longevity

in a country. Furthermore, a country's life expectancy reflects the quality of its available human resources needed for economic enhancement.

External debt has three components: public and publicly guaranteed debt, private non-guaranteed debt, and IMF credit (WDI, 2022). Assessing these components individually for West African countries is challenging due to data unavailability, hence, the constrain of this study. Nevertheless, this study tried circumventing this limitation by assessing external debt from three essential debt perspectives: sustainability, liquidity, and solvency. External debt sustainability is captured using the external debt-to-GDP ratio, which compares the debt burden of a country to its resource base. In essence, it shows the ability of the country to pay back its debts using its productive output. The external debt servicing to GDP ratio was used to proxy external debt liquidity. It expresses the quanity of a country's output traded for debt servicing. It also indicates a country's vulnerability in servicing its debt in the course of depleting productive outputs. External debt-to-exports is used to indicate debt solvency, that is, the ability of a government to fulfil its debt obligation through its export proceeds. As these ratios grow higher, the more unsustainable, illiquid, and insolvent a country's debts. Also, the risk of a repayment default is more elevated, triggering a financial panic both in the domestic and international markets. Consequently, the chances of achieving higher longevity through debt sponsored developmental projects in a country diminishes.

Another data limitation of this study relates to the long-term role of governance in the external debt-longevity nexus in West African countries. Considering this study's time frame (1981-2020), having quantifiable governance indicators for all countries considered is currently realistically inconceivable. However, macroeconomic volatility, a product of economic governance, is a control variable. Macroeconomic volatility plays a significant interactive role in a nation's use of external debt to provide infrastructural development necessary for enhancing longevity. Two core indicators of macroeconomic volatility used in this study are inflation and the exchange rate. Producers and consumers often consider both variables as crucial indicators when assessing the health of an economy (Aladejare, 2021). A comprehensive inflation measure known as the GDP implicit deflator is applied. It gives a broader picture of price changes on all goods and services produced in an economy over time against the consumer price index measure which is based on limited consumer goods baskets. Furthermore, this study adopted the exchange rate growth indicator to capture the macroeconomic impact of exchange rate variability on the subject matter. Frequent changes in the exchange rate can make debt management cumbersome and undermine the usefulness of borrowed funds for development goals. Such variations in the value of a country's exchange rate can substantially impact the value of its foreign-denominated debts affecting the quality of life either positively or adversely. Table 1 contains the sources of the study data and their measurement.

Table 1: Variable description

Variable	**Measurement**	**Sources**	**Symbol**
Longevity	Life expectancy at birth	WDI (2022)	le
External debt sustainability	Total external debt % of GDP	WDI (2022)	$txgdp$
External debt liquidity	Total external debt servicing % of GDP	WDI (2022)	$xsgdp$
External debt solvency	Total external debt % of exports	WDI (2022)	edx

Inflation rate	$\frac{Nominal\ GDP}{Real\ GDP} * 100$	WDI (2022)	inf
Exchange rate variability	% change in (national currency/US dollar)	Penn World Table (2021)	exr

Source: Author's computation.

3.2 Methodology

3.2.1 Cross-sectional dependency test

The negative effect of data cross-sectional dependence (CSD) on panel analyses have received the deserved acknowledgement of late. Poor model selection and estimated coefficients constitute some considerable challenges (Shen et al., 2021; Aladejare, 2022). Therefore, when the problem of CSD in a panel data analysis is ignored, the chances of having inconsistent and inefficient estimates arise. The core factors that account for CSD in panel data analysis include unobserved components, common shocks, and the possibility of residual interdependency (Su et al., 2020; Aladejare, 2022). Consequently, when treating panel data analysis associated with issues such as economic or financial integration and shared economic policies, the probability of having problems of CSD will be very high; hence, it should be treated. This study conducted four CSD tests which are Breusch and Pagan's (1980) Lagrange multiplier (LM) test, Pesaran's (2004) scaled LM test, Pesaran's (2004) CSD test and the Baltagi et al. (2012) bias-corrected scaled LM test.

The Breusch-Pagan CSD test equation is expressed as follows:

$$CSD_{BP} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\gamma}_{ij}^2 \qquad Equ.1$$

where T denotes time unit/sample periods, N represents panel cross-sectional size and $\hat{\gamma}_{ij}^2$ denote the pair-wise cross-sectional correlation parameters. The Breusch-Pagan LM test is valid given the null hypothesis of no CSD for panels with $T \rightarrow$ infinity and N is fixed is accepted. Nevertheless, the Pesaran (2004) scaled LM CSD test was developed to handle large panels where T and N tend towards infinity. Pesaran's scaled LM CSD test equation is expressed as:

$$CSD_{Plm} = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\gamma}_{ij}^2 - 1)\tilde{}N(0,1) \qquad Equ.2$$

A crucial challenge with the Pesaran (2004) scaled LM CSD test is its potential bias in revealing substantial size distortions when N is large, and T is small. Consequently, a more adjustable CSD test for when both T and N move toward infinity was developed by Pesaran (2004) and represented as:

$$CSD_P = \sqrt{\left(\frac{2T}{N(N-1)}\right)} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N-1} \gamma_{ij}\right) \qquad Equ.3$$

Baltagi et al. (2012) later developed a biased-scaled LM CSD test on the premise of N and T also tending to infinity. The test is derived in the context of a fixed effect homogenous panel data model, and its equation is revealed as follows:

$$CSD_B = CSD_{Plm} - \frac{2N}{2(T-1)} = \sqrt{\left(\frac{2T}{N(N-1)}\right)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\gamma}_{ij}^2 - 1) - \left(\frac{N}{2(T-1)}\right) \qquad Equ.4$$

Once CSD is confirmed in the dataset, the applicable econometric approaches that treat CSD issues are deployed.

3.2.2 Slope heterogeneity test

Another challenge with panel data analysis is the assumption of slope homogeneity, which can distort regression outputs due to demographic and economic variations in the cross-sections under consideration. Thus, conducting a slope heterogeneity test is crucial when handling panel datasets. Its place is to ascertain whether the coefficients of interest are truly homogenous or vary with cross-sections. For the purpose of validating the existence or absence of heterogeneous slope parameters, the Swamy (1970) test and the Pesaran and Yamagata (2008) adjusted or standardised version were adopted.

The test statistics for both Swamy (1970) and Pesaran and Yamagata (2008) are expressed as follows:

$$E = \sum_{i=1}^{N} (\varphi_i - \varphi_{FEW})' \frac{W_i' H_t W_i}{\sigma_i^2} (\varphi_i - \varphi_{FEW}) \qquad Equ.5$$

$$\tilde{\Delta} = \sqrt{N} \left(\frac{\frac{1}{N} E - R}{\sqrt{2N}} \right) \qquad Equ.6$$

$$\tilde{\Delta}_{Adjusted\ version} = \sqrt{N} \left(\frac{\frac{1}{N} E - R}{\sqrt{\frac{2R(T-R-1}{T+1}}} \right) \qquad Equ.7$$

where E and Δ are test statistics, the Swamy (1970) test is given in Equation 6, and the Pesaran and Yamagata (2008) adjusted version is shown in Equation 7. Pooled OLS and FE weighted pooled estimates are denoted by φ_i and φ_{FEW} respectively. Furthermore, H_t and W_i denotes identity matrix and matrix covariates, respectively, deviating from the mean. R denotes the number of exogenous or covariates, while σ_i represents the estimator for σ_i^2.

3.2.3 Panel unit root test

By validating the existence of CSD and heterogeneity in the panel dataset, mainstream first-generation unit root techniques such as Levin-Lin and Chu (LLC) and I'm, Pesaran, and Shin (IPS), obviously cannot be relied on to control for CSD effects in the series. Hence, there is a need to apply robust panel unit root approaches that can control CSD and heterogeneity in a series. For this purpose, the Madalla and Wu (1999) first-generation panel unit root test that corrects for CSD and allows for heterogeneity is employed. In addition, the Pesaran (2003) cross-sectional augmented Dickey-Fuller (CADF) and Pesaran (2007) cross-sectional Im Pesaran and Shin (CIPS) second-generation unit root test was also applied. The CADF test statistic equation is expressed as:

$$\Delta G_{it} = \infty_{it} + \tau_i G_{i,t-1} + \delta_i \bar{G}_{t-1} + \varphi_i \Delta \bar{G}_t + \mu_{it} \qquad Equ.8$$

where ∞_{it}, G_{it} and μ_{it} represents the intercept, study variables and error term, respectively; inserting the first lag expression yields the following equation:

$$\Delta G_{it} = \infty_{it} + \tau_i G_{i,t-1} + \delta_i \bar{G}_{t-1} + \sum_{j=0}^{p} \varphi_{ij} \Delta \bar{G}_{t-j} + \sum_{j=1}^{p} \tau_{ij} \Delta G_{i,t-j} + \mu_{it} \qquad Equ.9$$

where $\bar{G}_{t-j}$ and $\Delta G_{i,t-j}$ denote the intercept, mean of lagged and first difference operator, respectively, across the specific cross-sections. The following function is for the CIPS test statistic:

$$CIPS = \frac{1}{N} \sum_{i=1}^{n} \tau_i \, (N, T) \qquad Equ.10$$

where the coefficient $\tau_i(N, T)$ express CADF test statistics further shown as follows:

$$CIPS = \frac{1}{N} \sum_{i=1}^{n} CADF_i \qquad Equ.11$$

3.2.4 Panel cointegration test

The Westerlund (2007) error correction model (ECM)-based cointegration approach is applied to validate the long-term association between the study variables. This test improves on conventional panel cointegration techniques such as the Pedroni and Kao test by yielding reliable outputs in the presence of CSD and heterogeneity (Aladejare, 2022). Four test statistics are often presented, comprising two group tests (G_t and G_a) and two panel statistics (P_t and P_a). The Westerlund (2007) equation is represented as:

$$\Delta y_{it} = \Gamma_i' m_t + \zeta_i y_{it-1} + \beta_i' X_{it-1} + \sum_{j=1}^{Pi} \varrho_{ij} \Delta y_{it-j} + \sum_{j=0}^{Pi} \emptyset_{ij} \Delta X_{it-j} + \epsilon_{it} \qquad Equ.12$$

where $\emptyset$, $\Gamma_t = (\Gamma_{1i}, \Gamma_{2i})'$ and $m_t = (1, t)'$ denotes the error correction coefficient, vector of the cointegration nexus between X (regressor) and y (regressand), and the deterministic components. The equation for the four Westerlund test statistics are:

$$G_t = \frac{1}{N} \sum_{i=1}^{n} \frac{\hat{\forall}_\iota}{SE(\hat{\forall}_\iota)} \qquad Equ.13$$

$$G_a = \frac{1}{N} \sum_{i=1}^{n} \frac{t\hat{\forall}_\iota}{\hat{\forall}_\iota(1)} \qquad Equ.14$$

$$P_t = \frac{\hat{\forall}_\iota}{SE(\hat{\forall}_\iota)} \qquad Equ.15$$

$$P_a = (\widehat{\forall_\iota})T \qquad Equ.16$$

where $\widehat{\forall_\iota}$ is the OLS estimator, $SE(\widehat{\forall_\iota})$ and $\widehat{\forall_\iota}(1)$ indicates the standard error and semi-parametric kernel estimator of $\widehat{\forall_\iota}$ respectively.

3.2.5 Panel estimation procedure

When handling analysis involving panel datasets with large N and T, the existence of cross-sectional heterogeneity cannot be ignored (Shen et al., 2020). Therefore, if the existence of CSD and heterogeneity are validated, the use of traditional panel methodologies such as FE, random effect (RE), dynamic OLS (DOLS), fully modified OLS (FMOLS), pooled mean group (PMG), difference GMM, etc., are likely to produce bias estimates (Chudik et al., 2017; Chen, 2018; Xue et al., 2021). These techniques are built on the assumption of homogeneity in the dataset and ignore issues of, or both, CSD and heterogeneity. This study ensured robustness in the estimated parameters of the variables by applying three novel econometric estimation techniques that correct for the highlighted deficiencies in traditional methodologies. The adopted techniques are the CS-ARDL, DCCE, and D-K.

3.2.5.1 The cross-sectional augmented ARDL (CS-ARDL)

The more recent estimation technique called the CS-ARDL, developed by Chudik et al. (2013), has its methodological framework expressed as follows:

$$y_{it} = \propto_i + \sum_{i=1}^{p} \vartheta_{i1}\, y_{i,t-1} + \sum_{1=0}^{q} \omega'_{i1}\, X_{i,t-1} + \varepsilon_{it} \qquad Equ.17$$

The CS-ARDL procedure is well adapted to the issue of CSD, heterogeneity, endogeneity, non-stationarity, and omitted variables in panel data analysis (Chudik et al., 2017; Bindi, 2018). Its framework is designed to augment the traditional ARDL methodology by incorporating cross-section means of covariates, their lags and the response variable. By transforming Equation 17, the basic CS-ARDL model is expressed as:

$$y_{it} = \propto_i + \sum_{i=1}^{p} \vartheta_{i1}\, y_{i,t-1} + \sum_{1=0}^{q} \omega'_{i1}\, X_{i,t-1} + \sum_{1=0}^{q} \omega'_{i,1}\, \overline{Z_{t-1}} + \varepsilon_{it} \qquad Equ.18$$

$$\overline{Z_t} = \left(\overline{y_t}, \overline{X'_t}\right) \qquad Equ.19$$

$$\varepsilon_{it} = \Pi'_i f_t + \mu_{it} \qquad Equ.20$$

where Equation 19 indicated by $\overline{Z_t}$ gives the cross-sectional means for the covariates of the response variable ($\overline{y_t}$) and the regressor ($\overline{X'_t}$). f_t denotes the unobserved common factor that creates dependency among cross-sectional units. The common factors are expressed through a detrending process of the cross-sectional means and lagged through Equation 19. Equation 18 is estimated by a pooled mean group (PMG) approach, and Equation 21 is applied to derive the long-term parameters.

$$\widehat{\eta_\iota} = \frac{\sum_{i=0}^{q} \widehat{\omega'_{1\iota}}}{1 - \sum_{i=0}^{q} \widehat{\vartheta_{1\iota}}} \qquad Equ.21$$

Likewise, transforming Equation 17, as revealed in Equation 22, yields the ECM form of the model (Ditzen, 2019).

$$\Delta y_{it} = \propto_i \left[y_{i,t-1} - \emptyset_i X_{it}\right] - \sum_{i=1}^{p} \vartheta_{i1}\, y_{i,t-1} + \sum_{1=0}^{q} \omega'_{i1}\, X_{i,t-1} + \sum_{1=0}^{q} \omega'_{i,1}\, \overline{Z_{t-1}} + \varepsilon_{it} \qquad Equ.22$$

where:

$$\widehat{\emptyset_\iota} = \frac{\sum_{i=0}^{q} \widehat{\omega'_{1\iota}}}{\widehat{\propto}_i} \qquad Equ.23$$

3.2.5.2 The dynamic common correlated effects (DCCE)

The DCCE methodology was later developed by Chudik and Pesaran (2015) on the rationale of the mean group (MG) estimation earlier developed by Pesaran and Smith (1995), the PMG technique formulated by Pesaran et al. (1996), and the common correlated effects (CCE) approach developed by Pesaran (2006). Although the PMG technique is known for averaging and pooling panel data and permitting the intercepts, slope coefficients, and error variances to vary across cross-sections (Aladejare, 2018), it is limited by ignoring CSD between the cross-sectional units (Xue et al. 2021).

In contrast, since the DCCE technique accounts for CSD, its estimator is more reliable. Furthermore, the DCCE methodology uses the means and logs of cross-sectional units to address the challenge of CSD. It also corrects heterogeneity by applying the mean group (MG) estimation properties. It evaluates the DCCE using heterogeneous slopes to presume that a common factor can proxy the variables. Another advantage of the DCCE approach is its suitability for a large panel dataset and a small or unbalanced panel dataset (Ditzen, 2019).

The general DCCE Equation specification is written as:

$$y_{i,t} = \propto_i y_{i,t-1} + \beta_i X_{i,t} + \sum_{\mathrm{P}=0}^{\mathrm{P}_T} \Upsilon_{xip}\, \bar{X}_{t-\mathrm{P}} + \sum_{\mathrm{P}=0}^{\mathrm{P}_T} \Upsilon_{yip}\, \bar{X}_{t-\mathrm{P}} + \varepsilon_{it} \qquad Equ.24$$

where P_T is the lag of cross-sectional means, and Υ_{xip} and Υ_{yip} represents the unobserved common factors.

3.2.5.2 The Driscoll and Kraay (D-K) estimation procedure

The D-K approach introduced by Driscoll and Kraay (1998) produces robust estimates in the presence of serial and spatial dependence, heteroscedasticity, and CSD in the panel datasets. Like the DCCE technique, it is also adaptable to small and large panels and balanced and unbalanced panels (Nathaniel, 2021).

Aside from being a non-parametric technique, it entails collecting the products' mean between the regressors and the residuals. Both are then used in a weighted heteroscedasticity-and-autocorrelation-consistent (HAC) estimator to derive standard errors which are significant in

the presence of CSD (Jalil, 2014). The D-K procedure requires the estimation of Equation 25 specified as:

$$y_{i,t} = X'_{i,t}\beta + \varepsilon_{i,t}, \qquad i = 1, \dots, N, t = 1, \dots, T \qquad Equ. 25$$

4. Empirical Findings

3.1.1 Descriptive statistic

Average life expectancy in West Africa has been poor compared to what obtains in other parts of Africa and the world. From Table 2, the average life expectancy in West Africa is approximately 54.5 years. This value falls short of the global average of 73 years, African average of 64.5 years, Latin America's average of 76 years, and Asia's average of 74 years (WPR, 2022). This suggests that the effects of the enormous external borrowings by West African governments are yet to translate to better longevity for their citizens. Further revelation, Table 3 shows that Sierra Leone has the lowest mean life expectancy of 49 years, while Cape Verde, with a mean value of 68.7 years, is the highest in West Africa. Although a debt-to-GDP ratio of 40% for developing and emerging countries have often been noted as a prudential baseline to guarantee fiscal sustainability (Choudhury and Islam, 2016), evidence in Table 2 shows that aggregate external debt for West Africa is unsustainable since $txgdp$ mean is 69%. Mali's $txgdp$ of 196.4% and Burkina Faso's 31.2% are the highest and lowest in West Africa, respectively (Table 3). However, the aggregate debt liquidity for the region, as revealed in Table 2, is 3.4%. Further evidence in Table 3 indicates Burkina Faso and Cote d'Ivoire with 7.5% and 1.2% to be the highest and lowest, respectively.

Table 2: Aggregate descriptive statistic

Variable		Mean	Std. Dev.	Min	Max	Observations
le	Overall	54.515	7.443	35.705	73.004	N = 560
	Between		6.205	43.047	68.669	n = 14
	Within		4.425	43.455	66.425	T = 40
$txgdp$	Overall	69.000	61.279	4.713	471.477	N = 560
	Between		41.251	31.158	196.391	n = 14
	Within		46.607	-101.955	344.086	T = 40
$xsgdp$	Overall	3.434	3.203	0.097	20.349	N = 560
	Between		1.669	1.198-	7.463	n = 14
	Within		2.769	2.960	17.564	T = 40
edx	Overall	312.632	520.172	3.420	6241.904	N = 560
	Between		350.217	29.367	1480.024	n = 14
	Within		395.581	-1102.43	5074.511	T = 40
inf	Overall	11.360	22.195	-29.172	219.003	N = 560
	Between		10.600	3.310	31.004	n = 14
	Within		19.701	-23.561	208.689	T = 40
exr	Overall	10.167	24.700	-22.917	215.894	N = 560
	Between		10.061	2.693	31.510	n = 14
	Within		22.714	-29.352	194.551	T = 40

Source: Author's Estimated Output.

Debt solvency (edx) level in West Africa is poor; this is because the region's mean value of 312.6% (Table 2) exceeds the World Bank's 140% benchmark for developing countries. Specifically, Guinea-Bissau has the worst debt solvency average of 1480%, while Mauritania enjoys the best mean of 29.4% in the region (Table 3). Within the study period, the mean inflation rate for the region was 11.4%, and exchange rate variability was 10.2% (Table 2).

Thus, indicating that macroeconomic volatility is high in the region. Table 3 demonstrates that Cape Verde has the region's lowest inflation (3.3%) and exchange rate (2.7%) variability. However, Sierra Leone holds the record for the worst inflation (35%) and exchange rate variation (35.5%) in the region within the study time frame (Table 3).

Table 3: Summary statistics of cross-sections

		le	$txgdp$	$xsgdp$	edx	inf	exr
Benin	Mean	55.962	42.844	1.684	202.960	4.908	3.768
	Std. Dev.	3.954	24.582	1.155	123.765	9.519	18.353
Burkina Faso	Mean	53.086	31.158	1.198	261.818	3.338	3.768
	Std. Dev.	4.610	12.194	0.507	146.890	4.856	18.353
Cape Verde	Mean	68.669	58.110	2.548	206.538	3.310	2.693
	Std. Dev.	3.775	21.423	0.800	70.132	10.432	10.028
Cote d'Ivoire	Mean	50.907	85.482	7.463	175.142	5.239	3.768
	Std. Dev.	2.912	54.054	5.658	88.274	14.077	18.353
Gambia	Mean	56.126	52.876	5.834	216.798	4.536	7.544
	Std. Dev.	4.957	25.044	3.098	74.854	12.889	10.946
Ghana	Mean	58.205	69.590	4.306	216.094	13.007	25.189
	Std. Dev.	2.952	34.471	3.251	162.758	25.475	24.646
Guinea-Bissau	Mean	52.747	59.811	4.316	1480.02	28.740	22.907
	Std. Dev.	4.578	32.631	2.641	1390.85	22.285	32.545
Mali	Mean	49.935	196.391	2.755	323.524	25.885	3.768
	Std. Dev.	5.608	127.825	2.128	207.677	32.552	18.353
Mauritania	Mean	59.753	66.388	1.981	29.367	4.653	5.674
	Std. Dev.	2.177	35.903	1.133	46.404	7.814	8.445
Niger	Mean	50.511	47.542	2.878	274.653	4.138	3.768
	Std. Dev.	7.267	22.481	2.876	131.974	7.899	18.353
Nigeria	Mean	48.398	33.509	2.545	166.585	21.674	20.366
	Std. Dev.	3.094	28.427	2.001	165.763	35.112	29.473
Senegal	Mean	59.796	48.959	3.444	162.573	3.587	3.768
	Std. Dev.	5.002	14.471	1.436	58.940	6.098	18.353
Sierra-Leone	Mean	43.047	98.676	3.301	475.502	31.004	31.510
	Std. Dev.	6.088	60.789	3.642	352.588	36.118	47.023
Togo	Mean	56.071	74.667	3.830	185.273	5.017	3.854
	Std. Dev.	2.482	35.696	3.878	93.904	8.513	18.334

Source: Author's Estimated Output

4.1 Correlation matrix and cross-sectional dependency test

Table 4 shows the correlation test with evidence of less multi-collinearity between the study variables. Further probe for multi-collinearity using the variance inflation factor (VIF) indicate less collinearity between the regressors. Another obvious fact is the adverse correlation between life expectancy and the three external debt indicators and the interaction variables.

Table 4: Correlation matrix

	le	$txgdp$	$xsgdp$	edx	inf	exr
le	1					
$txgdp$	-0.349	1				
$xsgdp$	-0.232	0.370	1			
edx	-0.276	0.183	0.202	1		
inf	-0.384	0.334	0.120	0.256	1	
exr	-0.285	0.144	0.181	0.355	0.361	1
	VIF	1/VIF				

$txgdp$	1.29	0.774
$xsgdp$	1.29	0.776
inf	1.27	0.786
edx	1.20	0.833
exr	1.20	0.835
Mean VIF	1.25	

Source: Author's computation.

Presented in Table 5 are the four CSD tests conducted, showing the rejection of the null hypothesis of cross-sectional independence. Thus, there is a significant level of cross-sectional dependence between West African countries.

Table 5: Cross-sectional dependence test

Variable	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
le	2517.432***	179.859***	179.680***	48.098***
$txgdp$	1581.784***	110.504***	110.325***	31.488***
$xsgdp$	918.420***	61.332***	61.153***	26.277***
edx	882.090***	58.640***	58.460***	23.771***
inf	395.906***	22.601***	22.422***	7.938***
exr	1169.245***	79.925***	79.745***	23.737***

Note: *** indicates statistical significance at 1%. H_o: No cross-section dependence
Source: Author's Estimated Output

4.2 Slope heterogeneity and unit root tests

Table 6 contains the estimated output for slope heterogeneity in the coefficients. The null hypothesis of homogenous slope parameters was invalidated, while the alternative was upheld based on the output. By validating the existence of slope heterogeneity in the parameters, debt sustainability, liquidity, solvency, and macroeconomic volatility differ across West African countries.

Table 6: Slope heterogeneity Test

Test-Statistics	Value	P-value
$\bar{\Delta}$	16.928	0.000***
$\bar{\Delta}_{adjusted}$	18.590	0.000***
H_0	Slope coefficients are homogenous	

Note: *** indicates statistical significance at 1%, and H_o: Homogenous slope parameters.
Source: Author's Estimated Output

Table 7 contains the outcome for the panel unit root tests with CSD and heterogeneity incorporation. By validating the existence of CSD and slope heterogeneity in the study variables, their incorporation into the unit root process becomes imperative. Table 7 indicates that life expectancy, external debt-to-GDP, and external debt-to-export are I(1) series. In contrast, external debt servicing-to-GDP, inflation, and exchange rate variability are level stationary variables.

Table 7: Unit root test

	First generation unit root		Second generation unit root				
Variable	Maddala and Wu (1999)		Pesaran's CADF (2003)		Pesaran's CIPS (2007)		
	Without trend	With trend	Without trend	With trend	Without trend	With trend	Decision

le	33.209	7.472	-2.819***[b]	-3.780***[b]	3.554	5.046	I(1)
$txgdp$	13.773	23.713	-2.122*[a]	-4.746***[b]	-1.400*	-1.021	I(1)
$xsgdp$	67.830***	67.729***	-3.135***[a]	-3.315***[a]	-5.433***	-4.145***	I(0)
edx	63.734***	37.332	-4.474***[b]	-4.533***[b]	-1.192	0.578	I(1)
inf	191.964***	170.573	-3.984***[a]	-4.030***[a]	-8.811***	-7.184***	I(0)
exr	178.176***	146.067***	-3.043***[a]	-3.953***[a]	-5.066***	-9.122***	I(0)
H_0	Series is I(1)		Series is nonstationary		Series is I(1)		

Note: a and b represents stationarity at the level and first difference, respectively, while *, **, and *** indicate statistical significance at 10%, 5% and 1%, respectively.
Source: Author's Computation.

4.3 Panel cointegration test

After determining the series' stationarity, the following approach ascertains the long-term association between the variables. Captured in Table 8 is the outcome of the Westerlund CSD cointegration test. The null hypothesis of no cointegration was rejected from the four test statistics. Hence, this indicates that long-run nexus exists between variables in the model.

Table 8: Westerlund panel CSD cointegration Test

Statistic	Value	Z-value	Robust P-value
G_t	-0.753	7.434	0.867
G_a	-0.443	6.596	0.000***
P_t	-0.985	7.303	0.000***
P_a	-0.258	4.965	0.000***
H_0	No cointegration		

Note: *** indicates statistical significance at 1%, respectively.
Source: Author's computation.

4.4 Discussion of panel estimated outcomes

Contained in Table 9 are the CS-ARDL, DCCE, and the D-K result. Both the CS-ARDL and DCCE had short and long term outcomes. However, the three outputs expressed the overwhelming robust long-term impact of the debt indicators on longevity. This indicates that external debt's effect on longevity is more of a long-term than a short-term phenomenon.

Inferences from Table 9 show that the external debt sustainability indicator positively affects longevity in both the short and long term in the CS-ARDL output. However, the long-term impact in the DCCE and the D-K result was adverse. Hence, the lower the external debt-to-GDP ratio rises (debt unsustainability) in West Africa, the lower the longevity. Effects from lack of continuity of government projects and misappropriation of borrowed funds on ventures that have no direct impact on welfare could be responsible. External borrowings are meant to be used for road construction, building and equipping schools and hospitals, housing projects, boosting electricity and agricultural sectors, providing potable water and sanitation facilities, etc. However, changes in government, either through democratic means or coup d'etat, as the case may be, have led to growth in several abandoned projects. The reason is that African leaders have continued to fail to recognise the continuum in the governance process, regardless of their political party or ideological affiliations. Consequently, there are numerous cases in which borrowed funds expended on capital projects by previous administrations are abandoned by their successors. Hence, denying the people the benefits derivable from such projects had they been completed. There are also instances where capital projects are not evenly spread or are instituted in communities without prior consultations to ascertain if such project fulfils their immediate or basic need. In such cases, external debt will also inversely impact longevity.

External debt illiquidity was found to negatively impact longevity in the long-term in the CS-ARDL and D-K results. As external debt servicing-to-GDP continues to rise, longevity will be adversely affected in the region. The rising cost of external debt servicing in West African countries erodes governments' development spending, which is being crowded out in the budget. In order words, higher debt servicing makes it increasingly difficult for citizens to have better welfare due to its crowing-out effect. Like other developing countries, the West African governments have continued to demand external debt to finance sustainable long-term development in their countries. However, with the rising debt comes the growing cost of servicing and its eventual negative effect on longevity. When debt servicing cost rises, more resources are committed to interest payment which crowd-away scarce funds needed to provide health care facilities, schools, security and potable water, infrastructure in the real sector, etc. Poor management of the debt servicing situation can result in debt illiquidity. In a dire situation, debt illiquidity can promote government debt roll-over strategy (Ponzi debt games) by funding debt servicing through issuing fresh borrowing despite the uncertainty of future funds. The quality of life will deteriorate in the long run, reflecting declining longevity.

External debt insolvency is revealed to have an overwhelming adverse impact on longevity in the CS-ARDL outcome from the short-term into the long-term. The DCCE and D-K results further supports the long-term negative effect of external debt insolvency on longevity. This, suggests that the higher the external debt-to-export ratio, the lower longevity becomes. It is known that primary products constitute the bulk of West African exports. For instance, Nigeria has 96% export in crude oil, Cape Verde's export is 75% of fish, Guinea has 76% export in bauxite, Niger has 83% export in uranium, etc., (Aladejare, 2019). Hence, West African countries depend on imports for finished and sophisticated goods for which productive capacity is inadequate. Such significant reliance on imports reduces fiscal liquidity in these countries, and in turn, debt management issues such as debt servicing vulnerability and insolvency are aggravated.

Furthermore, rather than deploy external borrowings to ventures that can guarantee future debt repayments in principal and interest, recurrent expenditure often takes a large share of the external borrowing. This phenomenon has resulted in the over-stretching of existing developmental infrastructure by the ever-growing population. Hence, the creation of an enormous infrastructure deficit in the region. To exacerbate further, weak fiscal management in most West African countries contributes to poor external debt management. For instance, Nigeria possesses 75% of West Africa's GDP and half the region's population (AfDB, 2018). To date, the country borrows to fund its subsidy policy on refined petroleum products, fertiliser, and electricity. Nevertheless, weak monitoring institutions have also made this welfare policy ineffective. Product hoarding (especially in fertiliser and refined petroleum) and illegal resale to merchants for undue profits are often reported, worsening longevity through poor quality of life.

Financial markets in West African countries also contribute to the adverse effect of external debt insolvency on longevity. Like other developing countries, financial markets in West Africa possess weak credit instruments and inadequate savings (Aladejare, 2021). Thereby constraining the level of international trade agreements and investments the financial institutions can finance. Hence, most countries in West Africa are prone to unfavourable terms of international trade so long as external debt facilities are used to augment import finance. Such an approach will crowd away scarce funds that could provide basic amenities needed to promote longevity since they have to be repaid sometimes within a short period.

Evidence from the macroeconomic volatility indictors confirms that inflation adversely impacts longevity only in the D-K outcome. Inflation diminishes the purchasing power of individuals in an economy. Thus, limiting their access to quality goods and services which is needed to boost their quality of life and ultimately longevity. On the other hand, exchange rate variability negatively affects longevity in both the DCCE and D-K results. Poor exchange rate management in terms of limited exports can aggravate long-term external indebtedness, which deteriorates longevity in the region. Exchange rate variability impacts external debt repayment, primarily denominated in foreign currency. Hence, higher currency variability increases both principal and interest repayment on foreign-denominated debts; since domestic currency will be traded for the repayment of the foreign-denominated debt. Also, depreciation of the domestic currencies is supposed to make exports cheaper. However, the constrain posed by limited exportable goods (mainly primary products) in West African countries will further exacerbate the external debt burden and servicing cost. The implication of these effects is shrinkage in available funds for development purposes to promote longevity.

The short-term speed of adjustment coefficients for the CS-ARDL and DCCE outcomes are rightly signed and significant. Furthermore, the estimated coefficients are very similar in value in both results; indicating that about 18 months may be required for short-term disequilibrium to correct to the long-term equilibrium path.

Table 9: Panel estimated outputs

Dependent variable: le				
Regressor	**CS-ARDL**	**DCCE**	**D-K**	**Decision**
Long-run estimates				
$txgdp$	0.014**	-0.003**	-0.024***	Negative
$xsgdp$	-0.101*	0.033	-0.196**	Negative
edx	-0.003**	-0.002**	-0.002***	Negative
exr	-0.007	-0.002*	-0.034***	Negative
inf	0.005	-0.001	-0.079***	
$cons$	0.619***	4.422**	58.659***	
Short-run estimates				
ecm	-0.614***	-0.641**	-	
$txgdp$	0.005*	-0.0004	-	
$xsgdp$	-0.007	0.012	-	
edx	-0.003*	-0.002	-	
exr	0.001	-0.001	-	
inf	-0.001	-0.001	-	
$cons$	0.352**	2.730***	-	
No. of obs.	532	546	560	
Obs. per group	38	39	40	
No. of groups	14	14	14	

Where *, ** and *** indicates significance at 10%, 5%, and 1% respectively.
Source: Author's computation.

5. Concluding Remarks

This study assessed the impact of external debt on longevity in developing countries, with particular reference to West Africa from 1981 to 2020. In this study, longevity was proxied by life expectancy at birth, while the external debt effect was evaluated from the perspective of sustainability, liquidity, and solvency. Furthermore, effects from macroeconomic volatility were controlled for through inflation and exchange rate variability. Methodological robustness was ensured by adopting panel unit root, cointegration, and estimation procedures that

incorporate panel dataset CSD and heterogeneity in their estimation process. Robust inferences for the study was derived by comparing estimated outcomes from the CS-ARDL, DCCE and D-K method. Empirically, the study showed that unsustainable, illiquid, and insolvent external debt and macroeconomic volatility shorten longevity in West African countries. Hence, longevity will decline when weak external debt management promotes poverty not just in West Africa but also in other developing countries, as reported in empirical studies (such as Loko et al., 2003); Saungweme and Mufandaedga, 2013; Zaghdoudi and Hakim, 2017; and Ma et al., 2022).

Nevertheless, external debt will improve the longevity in West Africa when governments recognise that the continuation and completion of successive governments' developmental projects are crucial. Issues of difference in political affiliation or ideology should be relegated to the goal of improving the quality of life, which promotes longevity. In addition, developmental projects in communities should always reflect their immediate need to reap maximum positive impact on quality of life. Emphasis should also be on strengthening institutions in individual countries through collaborative punitive measures by international bodies such as the World Bank, IMF, African Development Bank, etc., against countries who invest borrowed funds in unproductive ventures. If adopted, fiscal reform is most likely to trend in most West African countries. Investments in highly skilled human resources should be scaled-up to encourage domestic investment in the production of sophisticated goods.

External debt can further promote longevity through export diversification policy when adequately channelled towards improving the value chain of primary products and then the supply chain channels domestically and internationally. It is anticipated that such a measure will increase aggregate output, improve purchasing power, and raise GDP per capita. It will also widen the revenue base for governments and the opportunity to expend more on developmental projects. Also, guaranteeing effective regional monetary policy management is vital for lowering the external debt burden. Consequently, the establishment of a regional Central Bank is proposed. Such establishment, when operational, should be saddled with the effective implementation of regional monetary policies and complement the efforts of domestic Central Banks in advancing a robust and reliable financial sector. It is further opined that the bank will help curtail the rising cost of external debt through guidance on debt and exchange rate management.

Compliance with Ethical Standards

Authors' contributions

The corresponding author conceived the idea, wrote the introduction, collected and analysed the data, interpreted the results, reviewed the required literature, edited the manuscript, wrote the methodology section, provided the relevant policy directions, read and approved the final manuscript.

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Research involving human participants and or animals

This study article does not contain any study with human participants or animals performed by the author.

Data Availability Statement
The data that support the study's findings are available from the corresponding author upon reasonable request.

Consent to participate
Not applicable.

Consent to publish
Not applicable.

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