Causal Evaluation of Public Debt Sustainability and Intergenerational Equity in West Africa

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Abstract
This study investigated the existence of causal relationship between public debt sustainability variables and intergenerational equity West African from 1990 to 2020. The study employed ex-post facto research design using secondary annual panel data obtained from various publications of International Monetary Fund (IMF) and the World Development Indicators (WDI) for the periods 1990-2020. The data were analyzed using Panel Granger Causality techniques. Results from the study revealed a unidirectional causal relationship running from total reserves to tax revenue as well as trade openness to total reserves, no causal relationship between public external debt, exchange rate, tax revenue and foreign reserve and a bidirectional causality between trade openness and public external debt which implies a two-way relation between trade openness and public external debt. Hence fiscal policy authorities in West Africa, particularly the debt management offices (DMOs), should prioritize prudent debt management and adequate reserve accumulation to promote tax smoothing., sufficient reserve accumulation, and careful balance between borrowing and reserve preservation. Striking the right balance would contribute to debt sustainability, currency stability, investor confidence, and long-term economic resilience.

Keywords: Public Debt Sustainability, Intergenerational Equity, Foreign Reserve, Panel Granger Causality, West Africa

JEL Classifications: H62, H63, H63

Introduction

Behind the glitter of economic prospects, West Africa is enveloped by a crisis that has the potential to destroy not only the prosperity of its present citizens but even the future of generations to come. Public debt, once a tool that fostered development and spurred growth in itself, has grown to become a double-edged sword, which has cast a long shadow over the hopes of intergenerational equity. As successive governments yield to immediate demands from their constituents, the burning question haunts how a region can balance its economic aspirations

today against the moral imperative to secure the well-being of future generations, when the sustainability of this fiscal maneuvering is in serious question. This inquiry delves deep into the causal evaluation of public debt sustainability and intergenerational equity in West Africa, revealing significant gaps in both theoretical understanding and empirical evidence, and offering a nuanced perspective on a challenge that is as urgent as it is complex.

Equity across generations refers to sustainable development balancing the use of resources to allow the fulfillment of the essential needs of the present generation and future generations. (Agius 2006). The implication of this principle revolves around how immediate consumption of resources needs to be managed in a way that productive capacity to be passed onto future generation is disrupted thereby creating economic difficulties and failure to achieve macroeconomic goals. Intergenerational equity incorporates the maximization of the well-being of both the current and future populations without affecting the growth of the present one, prudent and optimal utilization of state resources to attain comprehensive welfare coverage by all generations (Oskarson, 2009).

Naturally, the need for borrowing is a result of an inherent mismatch between the needs of individuals, corporate entities, or governments and the available resources to meet these needs. This eventually creates a situation where deficits must be financed to meet needs. According to Tella (2018), when government expenditure exceeds its revenue, the ensuing deficit can be financed using alternative avenues of borrowing. The role of public debt depends on its use. On the other hand, public debt accrued for purposes such as welfare expenditure on the current generation, war financing, or arising out of corrupt and ineffective practices in the public sector is injurious and burdensome to the future generations. (Donohoe, 2003). In other words, if public debt is channeled for investment in productive socioeconomic infrastructure, it can be turned into an advantage for the next generation by perhaps raising the economy's productive capacity, supporting future growth, creating jobs, and developing society. (Dritsaki, 2013).

The high level of borrowing by successive governments in West Africa, aimed at raising aggregate demand and consequently bringing about desirable growth and development for the current generation, has not resulted in any reasonable benefits to this generation but rather an accumulation of debt burden and, therefore, the beginning of concern over the long-run implications of such deficit financing on debt sustainability and intergenerational equity.

The increasing cost of borrowing and ineffective utilization of the borrowed money have created significant problems, which have raised critical reconsideration of the short-term and long-term structural impacts that government borrowing has on both current and future generations (Heise2019). Theoretically, the lacuna in the literature on the causal evaluation of the sustainability of public debt and intergenerational equity in West Africa lies in the insufficiently explored nuances that characterize the influence of public borrowing on different generations. While these general principles guiding debt sustainability and intergenerational equity have been variously documented, there is still a need for more comprehensive theoretical frameworks that specifically address the unique economic, social, and political contexts of West African countries. This is often a theoretical discourse that fails to examine in detail how public debt influences various macroeconomic variables such as growth, employment, and social development in the region. Thirdly, interlinkages between debt accumulation, resource allocation, and long-term economic stability have not been properly reviewed, which left many lacunae in comprehending the broader set of implications for intergenerational equity.

Empirically, public debt sustainability and intergenerational equity in West Africa remain limited due to a general lack of high-quality data supported by comprehensive empirical analyses. Indeed, most of the studies on the subject are focused on short-term fiscal indicators that do not consider the long-term consequence of public borrowing on succeeding generations. This calls for an empirical investigation that adopts evidence-based policy making in order to analyze the dynamic relationship existing between public debt and economic growth, with its spillover into social welfare in West Africa. In sum, the heterogeneity of the West African economies is taken into account, considering various aspects of economic developments, quality of institutions, and governance structures. This also tends to identify the channels through which public debt affects intergenerational equity, like in education, health, and infrastructure, and how changes in these areas have affected or will affect the overall welfare of the future generation.

General literature on the causal assessment of the sustainability of public debt and intergenerational equity, in most cases, falls short of incorporating critical economic realities inherent in the West African context. In this regard, these critical realities involve high levels of political instability, corruption, and generally weak institutional frameworks, which undermine effective management

of public debt. More precisely, the literature often neglects the view of external factors that usually are connected with global economic fluctuations, volatility of commodity prices, and international financial conditions-those which seriously impact debt dynamics and economic stability in the region. This calls for research that will integrate these economic realities into the analysis of sustainability of public debt and intergenerational equity in a bid to appreciate the challenges and opportunities facing the region more holistically. This is a very special feature of the research that analyzes the interconnection between public debt sustainability and intergenerational equity within the specific context of West Africa. Indeed, through the interdependence of public borrowing practices, it concerns the welfare of the current generation and future generations, bringing in the crucial relevance of prudent debt management and efficient resource allocation. It focuses on policies that must be such as to serve both immediate fiscal imperatives and long-term prospects of economic growth and social development. This is all the more so, given the complexity of the inter-relationships between debt accumulation, economic growth, and social welfare in the West African sub-region.

This study contributes to the existing body of literature by providing empirical evidence of the long-run effects that public debt has on intergenerational equity in West Africa. Such analysis has been performed by applying state-of-the-art econometric methods that describe how public debt, economic growth, and social welfare are dynamically related with the aim of throwing light on specific channels through which public borrowing impacts future generations. This empirical focus enhances the understanding of how different types of public debt-for example, external versus domestic debt-and the different uses of borrowed funds-for instance, investing in infrastructure versus current expenditure-affect intergenerational equity and provide valuable policy implications for West African governments.

Another critical contribution of this research is the integration of unique economic, social, and political contexts in West African countries into the analysis of public debt sustainability and intergenerational equity. While consideration is given to various factors, including political instability, corruption, institutional quality, and conditions that are part of the external economic environment, this piece of research stands to present the challenges and opportunities inherent in public debt management in the region in a far holistic and nuanced manner. Such an analysis is critical to devising debt management strategies that could contribute toward sustainable development and intergenerational equity in West Africa.

Other sections of the paper are structured as follows with the introduction of the study: Section 2.0 discusses a review of relevant literature and theory; Section 3.0, data presentation; and Section 4.0, analysis and interpretation of data.

Literature Review

The following section gives a detailed analysis of sustainability and intergenerational equity in West Africa's emerging crisis of public debt. While governments balance their immediate economic needs against long-term fiscal health, the understanding of current borrowing practices and their impact on both the present generation and those yet to come becomes cardinal. This review thus synthesizes the extant research on the causal evaluation of public debt sustainability and intergenerational equity in West Africa by identifying the key themes and central arguments that point to gaps and areas for further investigation. Recent empirical studies underscore the precarious state of external debt sustainability in West African countries.

In his study, Omotor finds that most of the countries in the ECOWAS region are increasingly adopting unsustainable debt trajectories and hence present a challenge in future debt obligations. The disturbing trend demands further informed knowledge of the connection that public debt may have with economic growth, especially when intergenerational equity is an issue.

The literature identifies a clear functional relationship between public debt and economic growth. The study by Bamiatzi, Efthyvoulou, and Jabbour (2017) suggests that foreign acquisitions may severely reduce corporate debt ratios, which points toward the positive contribution of foreign investment in debt easing. The role of external debt on growth has been considered by Schclarek (2004) for a number of economies. According to him, lower levels of total external debt result in higher growth rates. But this negative relationship is mostly driven by public rather than private external debt. For instance, Abbas and Christensen (2010) talk about how low to moderate levels of domestic debt positively influence the growth of low-income countries, including those from Sub-Saharan Africa.

The studies focused on the question of the sustainability of debt go further to include country-specific analyses. Such studies, through econometric modeling of the fiscal situation in Japan for example, have unequivocally declared it

unsustainable in spite of its advanced economy status. Examples include Yilanci and Özcan 2007, and Doi, Hoshi, and Okimoto 2011.
In Nigeria, Egbetunde (2012) uses a VAR analysis and was able to uncover a co-integrated relationship that existed between the level of public debt and economic growth, showing causality in both directions. This postulates that in the long term, public debt and economic growth cause each other. In Chad, Kouladoum (2018) finds that debt service payments influence the real exchange rate nonlinearly significantly, underlining the complexity of the relationship between debt servicing and macroeconomic stability.

Another highly important and interlinked theme is that of exogenous factors/conditions of the world economy. Research by Schoder et al., 2013, and Osigwe et al., 2015, on the euro area reveals that the introduction of the euro shifted external debt accumulation from sustainability to unsustainability, which also again shows how global economic policies might impact debt sustainability. In Nigeria, Draz and Ahmad (2015) find that foreign debt significantly impacts foreign exchange reserves and inflation, illustrating the broader economic implications of external borrowing.

Another important strand of the existing literature tries to see the relationship between public debt and investment and growth. Using Bangladesh, Saifuddin (2016) showed that public debt indirectly contributes to growth through its positive impact on investment. Empirical evidence of the sustainability of the external debt for European countries is provided by Cuestas et al. (2015) and Sánchez-Juárez and García-Almada (2016), showing the positive influence of public debt on economic growth due to public investment. On the other hand, Onakoya and Ogunade (2017) hold that external debt impinges negatively on long-run economic growth. Owusu-Nantwi and Erickson (2016), on the contrary, present evidence of a co-integrating long-run relationship between public debt and economic growth through a bidirectional Granger causality in the short run.

The causal link between public debt and economic growth strongly varies across different contexts. Indeed, such a variety shows that the nexus between debt and growth is rather complex and stresses the importance of context-specific studies. Elom-Obed et al. (2017) conduct an in-depth analysis of 72 countries, citing unidirectional causality running from public debt to economic growth in most cases, while only nine show bidirectional causality, and in twenty-seven economies, no causality was proven.

Significantly, within the context of West Africa, huge economic and political transitions have over-relied on accumulation of public debt. Characterized by debt crises, this period called for various initiatives like the Heavily Indebted Poor Countries Initiative and the Multilateral Debt Relief Initiative aimed at providing debt relief. The aforementioned historical dynamics make it extremely important to question critically the causality that is found between the public debt accumulation and some macroeconomic variables, in particular, how it is related to foreign reserves.

From a theoretical perspective, the literature level indicates some consideration for differentiated effects of public borrowing on various generations in West Africa. While general principles of intergenerational equity and debt sustainability have been well explored, more comprehensive theoretical frameworks are still needed that would take into account specific economic, social, and political contexts of the West African countries. Most current theoretical discourses fail to provide more detailed discussions of how accumulated public debt affects the macroeconomic variables of growth, employment, and social development in the region. The linkages among debt accumulation, resource allocation, and long-term economic stability remain unexplored; thus, significant gaps are left unexplained to show the full implications for intergenerational equity.

Empirical studies on public debt sustainability and intergenerational equity studies in West Africa are few because of a lack of reliable data and complete analyses. Current studies mostly focus on short-term fiscal indicators that do not deal with the long-run impact of public borrowing on the future generation. It is also expected that empirical investigations into the necessity of some of the channels through which public debt impacts intergenerational equity-for instance, investments in education, healthcare, and infrastructure-how these would in turn affect the wellbeing of future generations. Further, the general literature often omits key economic realities relevant to the West African context, such as political instability, corruption, and general weak institutional frameworks, which undermine effective public debt management. External factors, like fluctuations in the world's economy, volatility in commodity prices, and conditions of international finance, although remaining in the background, strongly impress on debt dynamics and economic stability in West African countries. This calls for the reinsertion of such realities into economic analysis, which therefore gives a balanced understanding of challenges and opportunities facing the region on public debt sustainability and intergenerational equity.

This can be estimated as one of the peculiarities of the current research, since it is focused on the interrelatedness of the public debt.

Several key economic theories have supported the theoretical basis of public debt sustainability and intergenerational equity. Each of these has unique insights about the implications of debt accumulation, which are important to understand for the analysis of specific challenges faced by West Africa so as to identify the gaps in the existing literature. Public debt sustainability and intergenerational equity are sustained by a number of key economic theories, each with its set of unique insights into the implications of debt accumulation. These theories come in handy in conceptualizing certain issues that face the countries of West Africa, as well as revealing the gaps in the current literature.

In what was termed the Capital Stock Transfer Theory by Ricardo, 1817, but was later developed into a complete theory by Pigou, 1920, borrowed capital from the present period to finance a public investment project could be transferred to the future generations either through tax revenue or the inherited real capital. The smaller or larger the inherited real capital, the lighter or heavier would be the burden on future generations. The main thrust of the argument in this theory is that future generations depend upon the sacrifice the present generation makes concerning current consumption to relinquish resources and build a big production base. This is an inevitable sacrifice for creating a pool of capital to finance public investment projects. In such projects, if financed by borrowed money through floating public debt, bondholders will reduce investment rather than consumption. This theory points out the critical trade-off between present and future welfare, which underlines the fact that efficient allocation of borrowed funds towards productive investment benefits future generations. Yet, the theory establishes that there is great risk in case the reduction of present consumption is not performed with the necessary degree, so as not to transfer an unsustainable debt burden on future generations.

The functional finance theory, presented by Lerner (1943), tries to break the traditional explanation of public debt. According to this theory, the absolute size of the national debt does not matter, and a large size of interest payments is not necessary to create any burden upon the society. Instead, this theory prescribes that the economic effect of a public debt should be judged by the nature of an expenditure financed by debt and the income-generating potentiality thereof. From that perspective, the size of the debt becomes less important, and

effectiveness in expenditures toward the stimulation of economic growth and the generation of future income becomes more important. Applying this to West Africa, the theory postulates that borrowing for growth-enhancing projects can easily neutralize the negative impact of accumulated debt, assuming effective use is made of such funds for the desired long-term economic development.

The theory presented by Buchanan in the Welfare Attitude provides a critical view on public debt as well as intergenerational perspective. Buchanan, 1950, a debater in the loan financing of public investment, shifts the burden into the future generation. He felt that though government securities are purchased on a voluntary basis by the present generation, the future generations who were compelled to pay interest and redeem the bonds may experience sacrifice through compulsory tax payments. The theory underlines the ethical aspects of public borrowing, making it intergenerationally fair and running the risk of moral hazard by passing burdens of debt to future taxpayers without consent.

Bowen-Davis-Kopf Thesis provides another angle to the conventional debt stance. Bowen (1994), Davis (2001) and Kopf (2006) suggest that current saving isn't necessarily curtailed when a generation borrows to fund public investment. The former generation, as per them saves to buy bonds in the beginning period and then sells these to the next generation, in turn, to finance their consumption during the retirement period. From this perspective, the dynamics of the intergenerational debt are more subtle and determined by savings and investment behaviour of the initial generation. This determines the debt burden that will impact future generations.

Two-Period OLG Theory is the basic framework from which intergenerational dynamics and their implications for economic policy can be analyzed. The theory divides the population into two groups: the young and the old, where each goes through both stages in a lifetime. The critical sense of this OLG theory is that the core intergenerational transmission of resources and policy decisions have impacts on different age cohorts. It captures the complexity of intergenerational economic relationships through a prism and thus makes choices on public debt that the current generation is undertaking the very reason for opportunities and constraints future generations will face. More relevance is given to the theory on the long-term implication of public debt in West Africa, since demographic changes add to the important impact of economic policy on intergenerational equity.

The OLG model allows a more robust analytical framework for growth and policy decisions in that it embeds intergenerational considerations explicitly. In filling the gap in the literature that was mostly focused on economic growth effects of public debt accumulation, it puts emphasis on issues of fairness, dynamic analysis, life cycle effects, and long-term implications. The model is important in understanding how public borrowing practices in West Africa would impact the welfare of the current and future generations and, in that vein, require policies which balance immediate fiscal needs with long-term sustainability.

Despite these enlightening theories, the literature still has some reasonably wide gaps regarding the specific economic, social, and political contexts of West African countries. Most of these approaches do not go deeply into how public debt influences the levels of growth, employment, and social development in the region. These interlinkages of debt build-up, resources allocation, and long-run economic stability are not well explored; hence, gaps in understanding remain with respect to the full implications for intergenerational equity. In empirical studies, sustainability and intergenerational equity in West African economies remain severely impeded due to the serious lack of trustworthy data and comprehensive analyses of cases. Most studies limit themselves to short-run fiscal indicators and do not deal with any discussions related to the long-term impact of public borrowing on future generations.

General literature also tends to omit some fundamental economic facts that are pertinent in a West African context, including political instability, corruption, and weak institutional frameworks that usually undermine proper public debt management. It is also often silent about other exogenous factors, such as shifted fortunes of the global economy, commodity price volatility, and changed conditions of international finance, which equally have very deep implications for West Africa's dynamics of debt and economic stability. The need to address these gaps calls for integration of such economic realities within the analyses of public debt sustainability and intergenerational equity toward holistic understanding of the region's challenges and opportunities.

Research Methodology

This study augments the two-period overlapping generational model to explain the infinite horizon intergenerational model in accounting for the causal relationship between public debt sustainability and intergenerational equity in the West Africa. The two-period overlapping generational model considers an economy where time is discrete. Individuals who are identical within and across generations are

indexed by their date of birth, *t*. An individual's life cycle consists of two periods, which we refer to as youth and old age. The number of individuals born in period *t* is $N_t = (1 + n)N_t - 1$, where n > −1 is the exogenous population growth rate. The study leans empirical credence to the public debt sustainability-intergenerational equity relationship, we introduced public debt sustainability indices as a predictor of the weighted infinite sum of lifecycle utilities of current and future generations (intergenerational equity) in order to attain the debt-induced intertemporal equilibrium across generations.

$$V_t = \sum_{j=t}^{+\infty} \gamma^{j-t} U_j PUBLIC_{DEBT_{SUS_{it}}} \quad (1)$$

$$FORESRV_{it} = \sum_{i-1}^{m} \alpha_i FORESRV_{it-1} + \sum_{j-1}^{n} \delta_j DEBT_{sust_{t-j}} + \varepsilon_{1t} \quad (2)$$

$$DEBT_{sust_t} = \sum_{i-1}^{m} \gamma_i FORESRV_{it-1} + \sum_{j-1}^{n} \varphi_j DEBT_{sust_{t-j}} + \varepsilon_{2t} \quad (3)$$

Where: $FORESRV$ is foreign reserve and $DEBT_{sust}$ is public debt sustainability variables (external debt to GDP, debt service to GDP and tax to GDP ratio); ε_{1t} and ε_{2t} are the disturbances which are assumed to be uncorrelated. In this framework, there are four possible hypotheses.

Case 1: Unidirectional causality from $FORESRV$ to $DEBT_{sust}$. Thisis indicated if $\sum \alpha_i \neq 0$ and $\sum \delta_j = 0$

Case 2: Unidirectional causality from $FORESRV$ to $DEBT_{sust}$. Thisis indicated if $\sum \gamma_i = 0$ and $\sum \psi_j \neq 0$.

Case 3: Bilateral causality. Thisis indicated if $\sum \alpha_i \neq 0$ and $\sum \delta_j \neq 0$.

Case 4: No causality. Thisis indicated if $\sum \alpha_i = 0$ and $\sum \delta_j = 0$.

The data used in the study are secondary data spanning from 1990 to 2020, which were derived from the World Development Index.

Table 1: Description and Measurements of Variables

Signs	Description	Source
$FORERSV_{it}$	Total external reserve of country *i* through Period *t*	World Development Indicators (2020)
$\frac{EXDEBT}{GDP}_{it}$	Total external debt to GDP ratio of country *i* through Period *t*	World Development Indicators (2020)
$\frac{DSEDEBT}{GDP}_{it}$	Total debt servicing cost of external debt to GDP country *i* through Period *t*	World Development Indicators (2020)
$\frac{TAX}{GDP_{it}}$	Total tax to GDP ratio of country *i* through Period *t*	World Development Indicators (2020)
$\frac{TRADE}{GDP}_{it}$	Trade openness indicating the total trade to GDP of country *i* through Period *t*	World Development Indicators (2020)
EXR_{it}	Domestic currency to a unit of international (US Dollar) of country *i* through Period *t*	World Development Indicators (2020)

Source: Author's compilation (2024)

Presentation and Analysis of Results

Furthermore, the partial correlation coefficients of the series are presented in Table 2. The correlation coefficients of debt indices (external debt stock and external debt service) and total reserves (excluding and minus gold) are negative. This implies that the depletion of foreign reserve come along with high external debt of countries in the region. This signals potential economic vulnerabilities and challenges of the region. It therefore suggests a higher risk of financial vulnerability for the country. In times of economic distress or market instability, countries with limited reserves are likely to struggle to meet its debt obligations, potentially leading to default or a crisis. Also, the negative association denotes limited fiscal flexibility, which implies that decreasing reserves limit a country's ability to respond to economic shocks effectively.

Table 2: Correlation Matrix Results

	Trigdp	Trmgdp	tdsexgdp	tedbtgdp	Txgdp	Exr	trdgdp
Trigdp	1	0.998	-0.144	-0.283	0.092	-0.077	0.184
Trmgdp		1	-0.151	-0.281	0.089	-0.075	0.182
Tdsexgdp			1	0.236	0.015	-0.081	0.313
Tedbtgdp				1	-0.036	-0.107	0.221
Txgdp					1	0.002	0.338
Exr						1	0.051
Trdgdp							1

Note: trigdp - Total reserves includes gold (% of GDP); trmgdp - Total reserves minus gold (% of GDP); tdsexgdp - Total debt service on external debt (% of GDP); tedbtgdp - Total external debt stocks (% of GDP); txgdp - Tax revenue (% of GDP); exr - Official exchange rate (LCU per US$, period average); and trdgdp - Trade (% of GDP).
Source: Author's computation (2024)

The values of our coefficients revealed the absence of multicollinearity problem. It is imperative to note that the following economic indices, total reserve (including gold) and total reserve (minus gold) with correlation coefficient of 0.998 were not considered in the same empirical model for our estimation. Thus, the problem of multicollinearity is avoided in the empirical analysis. The panel unit root and cointegration tests were reported shows the unit root test results using Levin, Lin and Chin (2002) and Breitung (2001) statistics approaches.

Table 3: Panel Unit Root Test Results

Variables	**Variable Description**	**Levels**		**1st Difference**		**Decision**
		LLC	**Breit**	**LLC**	**Breit**	
Trigdp	Total reserves includes gold (% of GDP)	-1.3388	-1.0056	-13.679***	-10.512***	I(1)
Trmgdp	Total reserves minus gold (% of GDP)	-1.6071*	-0.9666	-14.596***	-19.432***	I(1)
Tdsexgdp	Total debt service on external debt (% of GDP)	-6.0675***	-3.4127***	-	-	I(0)
Tedbtgdp	Total external debt stocks (% of GDP)	-0.8094	-2.6152***	-12.665***	-	I(1)
Txgdp	Tax revenue (% of GDP)	-0.9844	1.8623	-14.958***	-3.7821***	I(1)
Exr	Official exchange rate (LCU per US$, average)	2.1517	3.6131	-10.328***	-2.0572***	I(1)
Trdgdp	Trade (% of GDP)	-3.2359***	0.9924	-	-11.131***	I(1)

*Note: LL denotes Levin, Lin & Chin (2002); Brrit represents Breitung (2001); ***, ** & * denote 1%, 5% & 10% significance levels respectively.*
Source: Author's computation (2024)

As reported in table 3, both methods confirmed that total debt service on external debt (tdsexgdp) is stationary at the level of I (0). Also, the two estimators showed that total reserves includes gold (trigdp), total reserves minus gold (trmgdp), tax revenue (txgdp) and official exchange rate (exr) are is integrated at the first difference I(1). As regards total external debt stocks (tedbtgdp) and trade openness (trdgdp), the unit root test results are mixed using the two estimators. The results of Breitung (2001) unit root test showed that total external debt stocks (tedbtgdp) are stationary at levels but the Levin, Lin and Chin (2002) unit root test found that they are stationary at first differences. Meanwhile, the unit root test of trade openness is stationary at levels but the unit root test of Breitung (2001) is stationary at first difference. The study concluded that total external debt stocks (tedbtgdp) and trade openness (trdgdp) are stationary at first difference.

We apply Granger causality methodology to analyze the relationships helps to identify causal relationships, understand temporal dynamics, inform policy decisions, and provide insights into the complex interactions among variables while the variables serve as proxies for different dimensions of public debt sustainability: external debt to GDP ratio for assessing external debt vulnerability, tax revenue to GDP ratio for fiscal capacity, trade openness to GDP ratio for economic resilience through international trade, and exchange rate for managing currency risks associated with external debt. Together, they provide a comprehensive framework for evaluating a country's ability to manage and sustain its public debt over the long term.

The F-statistics of panel causality results of indicators of public debt and intergenerational equity is reported in Table 4. The causality test results reported in the table showed that the null hypothesis of the causal relationship between total reserves includes gold and total reserves minus gold measuring intergenerational equity were not statistically significant at the conventional level. This means that there is no causal relationship between total reserves including gold and total reserves minus gold in West Africa within the periods understudied. It suggests that the presence or absence of gold in the total reserves of countries in the region does not have a significant impact on the overall level of reserves.

Table 4: Panel Causal Tests of Public Debt and Intergenerational Equity

Dependent	**Independent Variables**						
Variables	Trigdp	trmgdp	tdsexgdp	tedbtgdp	txgdp	exr	Trdgdp
Trigdp		0.972	4.603**	4.041**	0.612	0.033	8.158***
Trmgdp	0.596		4.648**	4.154**	0.634	0.042	8.160***
Tdsexgdp	5.067***	5.465**		11.77***	0.324	1.015	21.65***
Tedbtgdp	5.732***	5.513***	9.346***		0.299	1.386	10.31***
Txgdp	2.852*	2.883*	0.054	0.835		0.123	0.031
Exr	1.064	1.065	0.164	1.402	0.447		1.052
Trdgdp	0.285	0.309	33.58***	37.24***	2.999*	0.343	

*Note: ***, ** & * denote 1%, 5% & 10% significance levels; trigdp - Total reserves includes gold (% of GDP); trmgdp - Total reserves minus gold (% of GDP); tdsexgdp - Total debt service on external debt (% of GDP); tedbtgdp - Total external debt stocks (% of GDP); txgdp - Tax revenue (% of GDP); exr - Official exchange rate (LCU per US$, period average); and trdgdp - Trade (% of GDP).*
Source: Author's computation (2024)

The null hypotheses of tax revenue Granger causing intergenerational equity variables were not rejected at 5% significance levels. However, the null hypotheses feedback of intergenerational equity variables Granger causing tax revenue were not accepted at 10% level of significance. It means that there is a one-way causal relationship running from intergenerational equity variables to tax revenue. However, the study found no causal relationship between public debt and tax revenue within the periods understudied. Likewise, the causal test results showed that exchange rate have no causal relationship with public debt and intergenerational equity indicators. Regarding trade openness, the result found a unidirectional causal link running from trade openness to intergenerational equity. Meanwhile, the result showed a two-way causal nexus between trade openness and public debt variables. As well, there is a unidirectional causality from tax revenue to trade openness while exchange rate and tax revenue have no causal relations

The empirical outcome of the study causal analysis reveals a unidirectional causal relationship running from total reserves to tax revenue as well as trade openness to total reserves, An indication that one the study only causes another without reciprocatively reacted, Revelation of no causal relationship between public external debt, exchange rate, tax revenue and foreign reserve indicates that nonexistence causal nexus between/among between public external debt, exchange rate, tax revenue and foreign reserves within the periods understudied. The study however reported bi directional causality between trade openness and

public external debt which implies a two-way relation between trade openness and public external debt.

The report of a one-way causal relationship running from intergenerational equity variables to tax revenue as well as trade openness to intergenerational equity concur with the studies of Hilton (2021) study in Ghana, Kablamaci (2018) and Shariful et al., (2018) which but not in line with Egbetunde (2012) and Owusu-Nantwi and Erickson (2016). Outcome of no causal relationship between public debt and tax revenue as well as exchange rate and intergenerational equity indicators within the periods understudied is in line with Ogunmuyiwa (2011), Onakoya and Ogunade (2017).

Conclusion and Policy Recommendations

The bi-causal relationship between external debt and total reserves emphasizes the need for prudent debt management, sufficient reserve accumulation, and careful balance between borrowing and reserve preservation. Striking the right balance contributes to debt sustainability, currency stability, investor confidence, and long-term economic resilience while the absence of a causal relationship between total reserves including gold and total reserves without gold indicates that countries in West Africa have the flexibility to hold reserves in various forms without affecting the overall reserve level. This allows for diversification of reserve holdings, which can help mitigate risks and provide stability in the face of changing macroeconomic variables.

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