

Olowofeso, Olorunsola E. et al.

Research Report

Public debt - Economic growth nexus in the WAMZ: Are there different components threshold effects?

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Public Debt - Economic Growth Nexus in the WAMZ: Are There Different Components Threshold Effects?¹

WAMI OCCASSIONAL PAPER SERIES 32

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Abstract

This study presents novel empirical evidence on the optimal disaggregated public debt-growth threshold in the WAMZ over the period 1996-2022. Determining the public debt-growth threshold in a disaggregated form is crucial for macroeconomic policy measures in the region to curb high public debt levels that can diminish the ability of governments to cushion adverse shocks. Although there is considerable empirical literature on this subject, previous studies generally focused only on total public debt or external debt components, while ignoring the impacts of domestic debt and debt service on the economies of the region. The estimated results clearly indicate that most components of public debt have inherent negative effects on per capita income. Furthermore, they show that domestic debt appears to have less negative dampening effects on economic growth than external debt. This outcome supports the recent shift by WAMZ countries from foreign debt to more domestic debt due to the relative ease of debt mobilization. Similarly, the results from panel threshold models indicate a threshold value of 87.45 percent of GDP for total public debt, 12.71 percent for external public debt, 46.94 percent for domestic public debt, and 17.80 percent for total debt service, all of which are statistically significant at different levels. These findings suggest that implementing a mix of fiscal and monetary policy measures to ensure that all components of the public debt-to-GDP ratio remain below their threshold levels would support economic growth. Above these thresholds, all components of the public debt-to-GDP ratio would be harmful to growth. The findings provide strong empirical support for the policy stance of the WAMZ convergence criterion to contain public debt at less than or equal to 70 percent, which is also reflected in the debt-growth nonlinear relationship.

Key Words: Public Debt; Growth; Panel Data Models; Threshold Effects; West Africa
JEL Classification : E62, O47, C23.

1.0 Introduction

The problem of rising public debt has been a concern for policy makers since the global financial crisis of the 2000s. This issue became more prominent after the emergence of the COVID-19 pandemic at the end of 2019. The need to provide necessary social and health services led to increased government spending at a time when unemployment was widespread and tax revenue was decreasing. Also, to avoid total collapse in economic activities, the governments of most countries also provided stimulus packages for their economies, putting further pressure on the fiscal space. This unanticipated government expenditure to tackle the pandemic puts significant pressure on national budgets leading governments to resort to debt financing of the deficits. With global debt levels already on the increase before the COVID-19 pandemic, the result was high levels of public debt that has raised concern on the sustainability of such high levels of debt if the trend continues.

In the WAMZ, the story was not different as public debt to GDP in the region during the pandemic increased by an average of 7.19² percentage points. As at end 2021, average public debt to GDP in the WAMZ region was 62.92 percent. Though this average was below the secondary convergence criteria of 70 percent debt to GDP, in 2020 and 2021, only three out of six countries in the WAMZ were able to pass the secondary convergence criteria on debt to GDP. The debt situation further deteriorated for two of the WAMZ member countries due to the energy and commodity price shock brought about by the Russia invasion of Ukraine in early 2022.

The implication of high public debt on the macroeconomy are numerous. High public debt levels can lead to vulnerabilities in the macroeconomy, amplify macroeconomic and asset price shocks and diminish the ability of governments to cushion adverse shocks (OECD, 2012).³ High public debt can also be inflationary in nature and can pose a challenge to central banks struggling to curb inflation. High public debt levels imply high debt servicing which reduces the fiscal space for public investment in infrastructure and other growth stimulating sectors. In addition, debt can be unsustainable when they become excessively high and can consequently lead to debt distress or a default. The consequences of a default can be devastating for an economy leading to loss of market access, high borrowing cost, low investment, and growth. Thus, it is prudent for countries to keep public debt at a sustainable level in order not to harm economic growth and stability.

Previous studies on this issue in the WAMZ have considered the holistic effect of public debt on economic growth using panel data analysis whilst other studies have only considered the effect on only one of the components of public debt on economic growth. For example, Jarju et. al. (2016) examined external debt- economic growth relationship in the WAMZ using trend analysis and panel data analysis. The aim of the paper was to analyse external debt and economic growth trends in the WAMZ for the period 1980s to 2014 and to examine the external debt economic growth relationship for the period 2000 to 2014. The fixed effect model and a

² This is for the period end 2019 to end 2021 and captures the period when the pandemic was active in in most countries in the zone.

³ OECD (2012), "Debt and Macroeconomic Stability", OECD Economics Department Policy Notes, No. 16.

random effect model was used to estimate the non-linear relationship between external debt and economic growth. The main findings shows that there is a non-linear relationship between external debt and economic growth and follows a “Laffer curve” shape. This finding supported the debt overhang theory that insinuate that debt accumulation above certain threshold is detrimental to growth. The paper also confirms the presence of crowding-out effect of external debt on investment due to high debt service resulting from high stock of external debt.

Also, in WAMI OPS 17, Egbuna et al (2019) examined the sustainability of public debt levels in the WAMZ using panel data from 2000 to 2018. Specifically, the paper examined the existence of non-linearities in the relationship between primary balance and public debt, i.e., the existence of threshold effect. In addition, the paper examines the heterogeneous composition of debt across WAMZ member countries. The paper employed the Panel smooth transition technique, pooled OLS technique and panel fixed effect model to analyse the above relationship. The findings indicate that public debt was sustainable during the period as it finds positive response of primary balance to changes in public debt. Also, non-linearities was observed in the response of primary fiscal balance to rising public debt, implying that the response varies at different debt levels. A threshold level of public debt to GDP of 90 percent was established beyond which countries are at risk of sovereign debt default.

Finally, in WAMI paper OPS 22, Olowofeso et al (2021) investigated the degree of fiscal convergence among the WAMZ countries and how it is affected by the divergence of public debt, inflation, and current account balances. Fiscal convergence is important for a monetary union as it helps to maintain macroeconomic stability and sustainability. The paper uses the log t convergence test and the dynamic panel threshold model to analyse the data from 2001 to 2019. The results show that there is strong evidence of fiscal divergence among the WAMZ countries and that reducing the divergence of public debt, inflation and current account balances would foster fiscal convergence. The paper recommends fiscal consolidation, external sector diversification and fiscal reforms to enhance policy synchronization and convergence in the WAMZ.

Nonetheless, public debt is comprised of both domestic and external debt and the channels by which they affect growth are different. For example, via the crowding out effect, domestic debt can reduce the availability of funds for private investment and consumption, which can lower economic growth. Whilst external debt can reduce the availability of foreign exchange for imports and investment, which can lower economic growth. Also, the impact on growth of each type of debt and at different threshold level varies. Thus, it is no secret that the high level of the components of public debt in some of the WAMZ countries is a major cause for concern. Policy makers will be interested to know at what point is different components of public debt (total, external, domestic and debt service) detrimental to economic growth in the WAMZ member countries? What are the inflexion points for different components of public debt (total, external, domestic and debt service) in the WAMZ member countries? And what are the significant effects of these different components of public debt on economic growth at the different threshold points if any?

In view of the above, this paper seeks to examine the compositional threshold effects (total, domestic, external and debt service) of debt on growth in the WAMZ, with the view to

providing empirical evidence on the optimal (threshold) total, domestic, external and debt service on growth in the WAMZ. The objectives of the paper are threefold: (i) it examines the threshold effect of total debt, domestic, external and debt service on economic growth of WAMZ member countries, (ii) estimate the threshold value at which total, domestic, external and debt service are detrimental to growth in the WAMZ. The study will aid macroeconomic policy design and implementation in the WAMZ region and will give WAMZ policy makers good insight of debt dynamics in the entire WAMZ region.

The study adopts several model estimation techniques to achieve these objectives. It, however, pins down to dynamic panel threshold regression analysis estimation technique proposed by Seo and Shin (2016) and applied by Seo et. al. (2019) and Assoum and Alinsato, (2023), that can allow us to test for the presence of threshold effect in the components of public debt (total, external and domestic) as well as debt service relationship to economic growth and in a nonlinear form. The model assumes that there are two regimes, one with low debt and high growth, and another with high debt and low growth spanning the period 1990 to 2022. The model estimates the threshold level of debt that separates the two regimes, as well as the slope coefficients for each regime. The dynamic panel threshold regression model is suitable for a study of debt and growth nexus because it can capture the possibility of debt overhang effects and non-linearities in the public debt-growth relationship.

The paper will make the following contribution to the debt growth literature. First, the paper, applied the Dynamic threshold regression technique to different components of debt in WAMZ member countries. The threshold regression allows us to model heterogeneity of the slope parameters. Second, this is the first time the different components of public debt - growth nexus is empirically examined for the entire WAMZ region in a single study. Previous studies have focussed on external debt growth nexus as in Jarju et. al. (2016) and on Debt Sustainability as in Egbuna et. al.(2019). This study examined the holistic effect of public debt on the growth of countries in the WAMZ as well as disaggregated components of public debt and its servicing on economic growth in the WAMZ, using different estimation techniques. The comprehensive nature of the study will give WAMZ policy makers a clear perspective for policy formulation in the WAMZ.

Following this introduction, the rest of the paper is organized as follows. The next section presents stylized facts on public debt and growth in the WAMZ, whilst section three discusses the theoretical and empirical literature. Section four examined the methodology and the estimation technique which is followed by presentations and discussion of the estimation results in section five. Finally, section six provides the conclusion and policy recommendations of the study.

2.0 Stylized Facts on Public Debt and Economic Growth in the WAMZ

2.1 Trend in Public Debt in the WAMZ 2010 to 2022

Global public debt which comprises of general government domestic and external debt reached a record \$92 trillion in 2022, of which developing countries owe almost 30% of the total and about 70% is attributable to China, India, and Brazil. In addition, developing countries' total public debt to GDP ratio increased from 35% in 2010 to 60% in 2021⁴. Similarly, WAMZ countries have accumulated high levels of public debt less than two decades after the debt relief under the Highly Indebted Poor Countries (HIPC) initiative and the Multilateral Debt Relief Initiative (MDRI) programmes. According to data from the IMF World Economic Outlook database, the average public debt-to-GDP ratio in the WAMZ increased from 38.0 percent in 2010 to 63.7 percent in 2020 and increased to 64.1 percent in 2022 as estimated by the World Bank. Compared to other sub-Saharan African countries, the WAMZ countries have a higher average public debt-to-GDP ratio of 64.1 percent in 2022, compared to 55.5 percent for the rest of sub-Saharan Africa. Figure 2.1 shows the trend of debt to GDP for WAMZ member countries, the average for sub-Saharan Africa and the average for WAMZ.

The Gambia's debt to GDP ratio has increased significantly from 42.9 percent in 2010 to a peak of 87.0 percent in 2017, before declining slightly to 80.6 percent in 2022, implying that the Gambia's public debt has grown faster than its economic output over the past decade. The Gambia's rising debt accumulation may be attributed to the political instability that followed the disputed presidential election in December 2016, which led to a sharp decline in tourism revenues and donor support; the weak fiscal management that resulted in large budget deficits and arrears; and the high interest rates on domestic and external borrowing that increased the debt servicing costs.

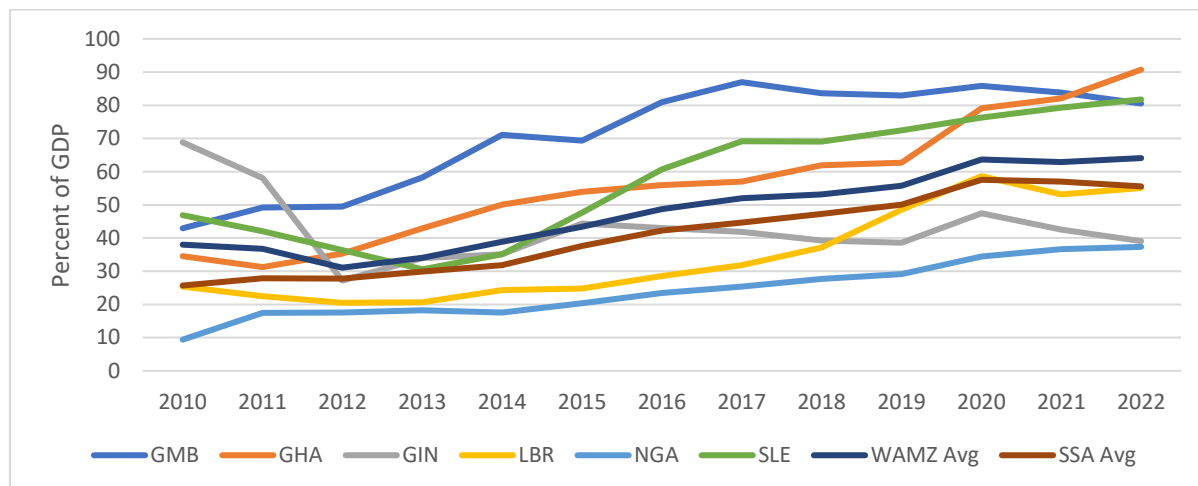
Similarly, Ghana's debt to GDP ratio has increased significantly from 34.5 percent in 2010 to 90.7 percent in 2022. Some of the possible factors that contributed to this trend are the impact of the COVID-19 pandemic, the depreciation of the local currency, the high interest payments on external and domestic debt, and the low revenue mobilization. Some of the possible factors that contributed to this trend are the impact of the COVID-19 pandemic, the depreciation of the local currency, the high interest payments on external and domestic debt, and the low revenue mobilization.

Guinea's debt to GDP ratio has fluctuated significantly over the past 12 years, reaching a peak of 68.9 percent in 2010 and a low of 27.2 percent in 2012. Guinea's public debt level has been relatively low relative to other WAMZ countries. The debt relief granted by the International Monetary Fund (IMF) and other creditors in 2012, significantly reduced Guinea's external debt stock by about \$2.1 billion, lowering the ratio from 58.1 percent in 2011 to 27.2 percent in 2012. Like Guinea, Liberia has a relatively low public debt level which has been below the WAMZ average for the most part of the period 2010 to 2022. The debt to GDP ratio of Liberia increased from 2010 to 2022, reaching a peak of 58.7 percent in 2020. The data also reveals some fluctuations in the ratio over the years. For example, the ratio decreased from 48.5 percent

⁴ UN (2023), A world of Debt A growing burden to global prosperity, July 2023

in 2018 to 37.1 percent in 2019, which could suggest that the country reduced its debt burden or increased its economic output in that year. However, the ratio rose sharply again in 2020 and 2021, possibly due to the impact of the COVID-19 pandemic on the country's public finances and economic activity.

Figure 2:1: Trend of Public Debt to GDP in the WAMZ



Source: Underlying Data is from World Economic Outlook Database April 2023, IMF

Nigeria has the lowest public debt levels for the review period. The data indicates that Nigeria's debt to GDP ratio has increased steadily over the years, from 9.4 percent in 2010 to 37.4 percent in 2022. The recent increase in Nigeria's debt to GDP may be attributed mainly to its dependence on oil exports, which makes it vulnerable to fluctuations in oil prices and demand; and low tax revenue, which limits its ability to finance its developmental needs and service its debt obligations.

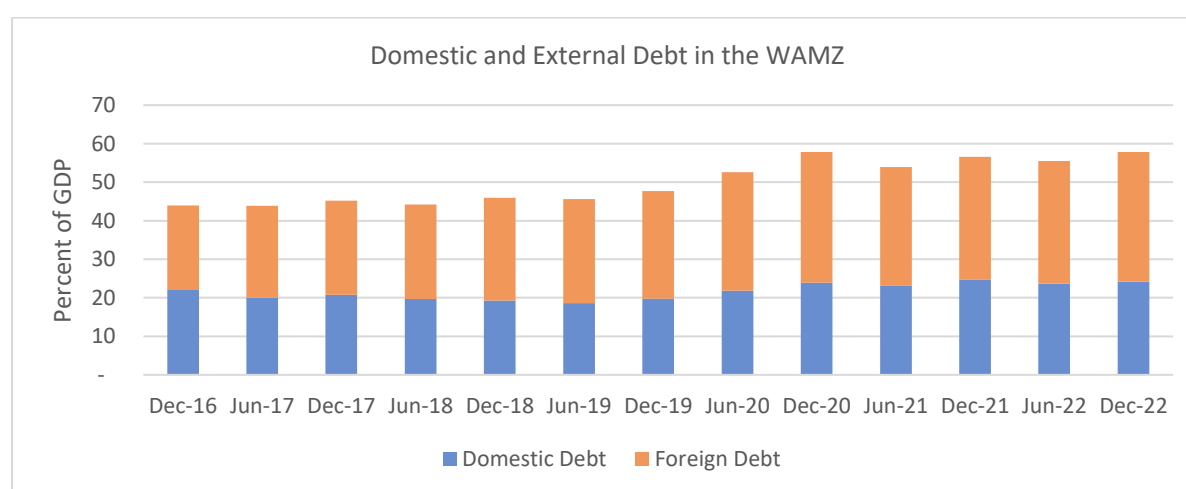
On the contrary, Sierra Leone's debt level is very high and for the most part of the review period it is above the WAMZ average. Sierra Leone's debt to GDP ratio has fluctuated significantly over the past 12 years, reaching a peak of 81.8 percent in 2022. This implies that the country's public debt is equivalent to more than 80 percent of its annual economic output, which poses a serious challenge for its fiscal sustainability and development prospects. The reason for the high debt levels may include: the impact of the Ebola outbreak in 2014-2016, the low and volatile prices of the country's main export commodities and weak institutional capacity limiting the country's ability to mobilize domestic revenue.

In sum, high public debt levels pose a serious problem for the WAMZ countries, as they can undermine macroeconomic stability, crowd out private sector investment, increase borrowing costs, and reduce fiscal space for development spending. Moreover, high public debt levels can create negative spillover effects and derail the macroeconomic convergence process in the zone, which is a prerequisite for achieving monetary integration. Therefore, it is imperative that the WAMZ countries implement prudent fiscal policies and structural reforms to enhance revenue generation, rationalize unproductive expenditures, improve debt management, and diversify their economies.

2.2 Composition of Public Debt in the WAMZ 2016 to 2022

In making fiscal policy decisions, it is important that the level and trajectory of the components of public debt is well understood. Recently, the importance of Domestic debt component has been recognized as more focus was placed on external debt. It is not surprising that it is very difficult to find long time series data on domestic debt for some countries. From Figure 2.3, it is evident that domestic debt has gradually become as important as external debt in the WAMZ. In 2016, domestic debt and external debt were both 22 percent of GDP in the WAMZ, but both increased to 24 percent and 34 percent of GDP respectively in 2022. Domestic debt peaked in December 2021 at 25 percent whilst external debt peaked in December 2020 and December 2022 at 34 percent of GDP.

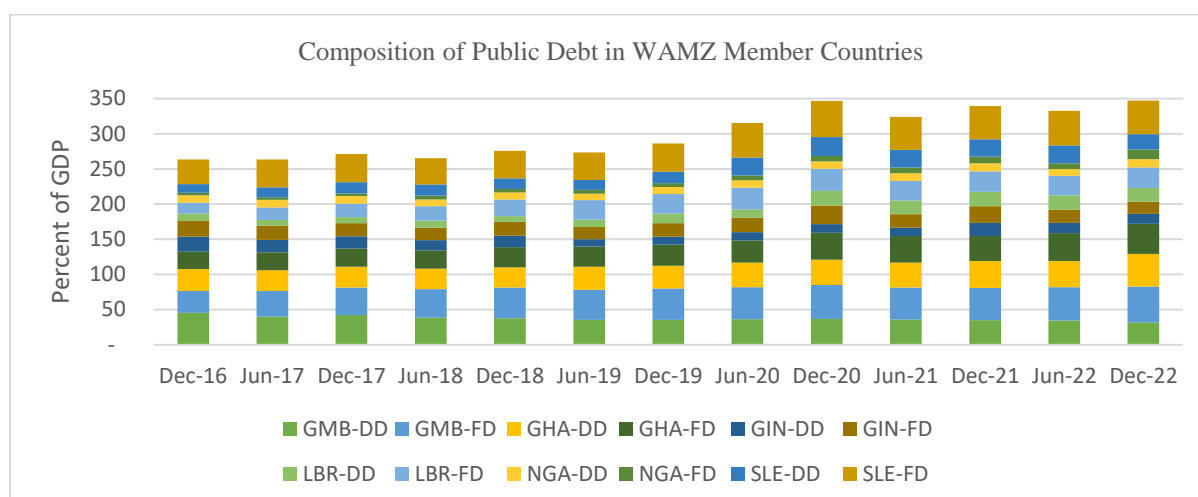
Figure 2:2 Composition of Public Debt in the WAMZ (Dec-2016 to Dec-2022)



Source: Underlying Data is from WAMI database (Multilateral Surveillance and Trade Department)

Nonetheless, foreign debt continues to be the greatest contributor to public debt for most WAMZ member countries. Foreign debt was on average 28 percent of GDP for the WAMZ whilst domestic debt was on average 22 percent of GDP for the period December 2016 to December 2022. Figure 2.3 below shows the composition of public debt in WAMZ member countries. The figure shows that most WAMZ members rely largely on external debt to finance their activities. Nigeria is the only country that has more domestic debt than foreign debt in the WAMZ during the review period except for December 2022. The implication for this is that WAMZ countries are exposed to external shocks. For example, external shock that leads to currency depreciation will automatically increase the debt burden in local currency terms leading to higher debt service cost. High debt service cost reduces the fiscal space, thus limiting the financing of highly needed developmental projects.

Figure 2:3 Composition of Public Debt in the WAMZ December 2016 December 2022



Source: Underlying Data is from WAMI Database

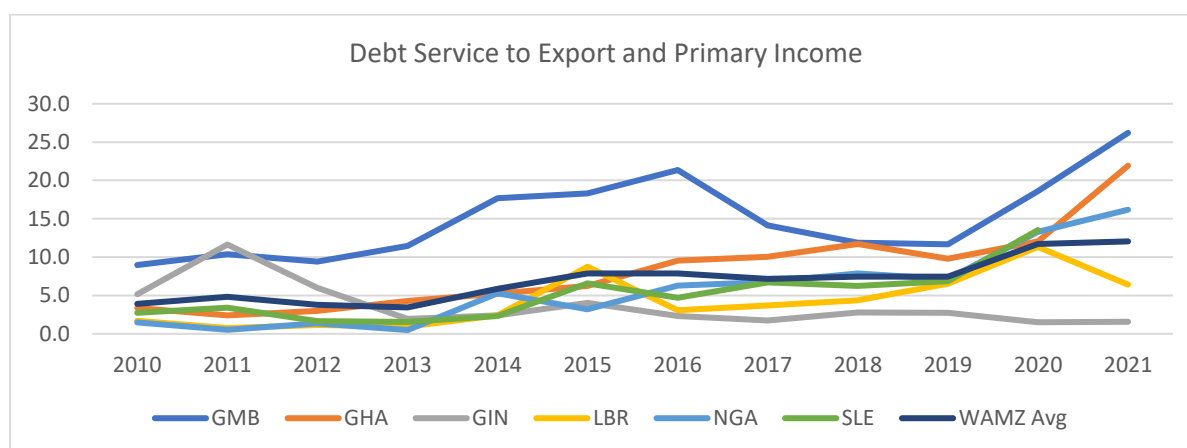
However, WAMZ countries have different levels of domestic and foreign debt relative to their GDPs. For example, in 2022, Gambia has the highest foreign debt ratio (51.1%) and the second highest domestic debt ratio (31.8%) among the WAMZ countries, indicating a high overall debt burden. On the other hand, Nigeria has the lowest domestic debt ratio (11.8%) and the lowest foreign debt ratio (13.9%) among the WAMZ countries, indicating a relatively low overall debt burden. In contrast, Ghana has the highest domestic debt ratio (46.3%) and the third highest foreign debt ratio (43%) indicating a high overall debt burden.

In sum, it is important to analyse not only the trends but also the magnitudes of domestic and foreign debt in the WAMZ to assess their impact on economic growth, debt sustainability and vulnerability. This is because though domestic debt can help mobilize domestic savings, develop local financial markets, and reduce currency risk, it can also crowd out private sector investment, increase inflationary pressures and limit fiscal space. Similarly, foreign debt can help finance development projects, diversify sources of funding and lower borrowing costs but can also expose the country to exchange rate risk, debt rollover risk and external shocks. Thus, it is prudent to investigate the debt growth threshold for both domestic and foreign debt.

2.3 Debt Service to Export and Primary Income

The ratio of debt service to exports of goods, services and primary income is one of the indicators of public debt sustainability as it measures the ability of a country to generate foreign exchange earnings to service its external debt obligations. Figure 2.4 shows the trend of debt service to export ratio in WAMZ member countries for the years 2010 to 2021 using data from the World Bank’s World Development Indicators database. According to the data, the average debt service to export ratio for the WAMZ increased from 3.91 percent in 2010 to 7.45 percent in 2019, before increasing further post COVID-19 Pandemic to 12.05 percent in 2021. This implies that the WAMZ countries spent more of their export earnings on servicing their debt over time, which could pose challenges for their fiscal and external balances.

Figure 2:4 Debt Service to Export and Primary Income in the WAMZ 2010 to 2021



Source: Underlying Data is from WDI, World Bank

However, there is significant variation among the WAMZ countries in terms of their debt service to export ratios. For instance, in 2021, Gambia had the highest ratio of 26.2 percent, followed by Ghana with 21.9 percent, while Guinea had the lowest ratio of 1.6 percent, followed by Nigeria with 6.4 percent. The differences in the ratios reflect the differences in the levels and composition of external debt, as well as the export performance of each country.

The trend of debt service to export ratio in the WAMZ also depends on the global and regional economic conditions that affect both the demand and supply of external financing and exports. For example, the terms of trade shocks in 2014 led to a rise in external borrowing and debt service payments by some WAMZ countries, while the COVID-19 pandemic in 2020 reduced their export revenues and increased their need for external support. In sum, the trend of debt service to export ratio in the WAMZ shows that public debt sustainability remains a key policy issue for the region, especially considering the ongoing economic recovery from the COVID-19 shock. The WAMZ countries should continue to pursue prudent fiscal and debt management policies, as well as enhance their domestic revenue mobilization and export diversification, to reduce their vulnerability to external shocks and ensure long-term debt sustainability.

3.0 Literature Review

3.1 Theoretical Review

Borrowing has been seen as one means through which Countries can enhance their productive capacity and spur economic growth. The Keynesian school of thought promotes government borrowing, asserting that public debt acquisition for expenditure financing has a multiplier effect on income and output. They further explain that government borrowing helps stimulate economic activities and facilitates economic rebound during recession. Similarly, Modern economists believe that public debt drives economic growth and that it is only a question of efficient management or productive use of the borrowed funds. On the other hand, the Classics view public debt acquisition as a sign of mismanagement, they further propounded that public debt impedes economic growth by undermining financial discipline in planning and budgeting as well as limits the private sector access to credit. The Neoclassicals see public debt as an

impediment to investment and growth, due to its crowding-out effect on the private sector. They explain that rising public debt bring to bear an increase in interest rates, which has a bearing on private investment and consequently economic growth. In another view, the Monetarists assert that government borrowing is mostly driven by political interest rather than economic reasons, which upset business expectation and productivity. Like the Neoclassicals, the monetarist believed that increasing government debt has a downside effect on the private sector.

From the Rational expectation (REH) perspective, which was also view as the opposing theories, stipulated that public debt impact on economic growth is neutral, positing that public debt does not have any effect on growth, and that government borrowing today is simply an opportunity cost against tax increases. Government will in the future increase taxes to pay off its debt, thus public debt has no lasting effect on economic growth. Modern monetary theory supposes that public debt impact on growth can't be seen as neutral since sovereign government has the power to print their own currency. Their argument is more from the angle of debt denoted in local currency, claiming that policies should not be shaped by the fear of rising domestic debt since they are the monopoly issuer of their currency and can print money substituting for taxes and future borrowing.

In another vein, public debt-growth nexus can be explained in a threshold or nonlinear effect theory. The theory posits that increasing public debt have positive impact on growth if the debt levels are low, but the effect is negative when debt levels surpass a certain threshold level (Reinhart and Rogoff 2010). The theory was first popularized by Krugman (1988) who argued that below certain threshold of public debt, the crowding-in effect of government debt dominates the crowding-out effect. Thus, under such circumstance, an increase in public debt will optimize growth. Inversely, above certain threshold of public debt, the crowding-out effect dominates the crowding-in effect, and thus debt increase beyond that point will negatively affect growth. Sachs (1989) share similar sentiments and argues that the negative effect of increasing public debt beyond certain limit was due to expected future tax increases.

The impact of public debt on growth has been of serious concern to policymakers. The nature of the nexus between public debt on economic growth has been a point of debate in both theoretical and empirical literature. This is because Economists have not arrived at a consensus on the issue, and it is still a topical issue in the empirical literature (see UN 2023; IMF 2023). A set of economists believe that public debt has a negative impact on economic growth. This view is postulated by the debt overhang hypothesis (Myers, 1977). According to this hypothesis, public debt accumulation limits the ability of the private sector to make future investment decisions that are optimal. It has its foundation on neoclassical endogenous growth theories which posit that public debt increases future tax burden and erode fiscal discipline.

3.2 Empirical Review

There are different thoughts on how borrowing or a country's level of indebtedness can impact its growth and its ability to grow over time. The Keynesians are of the view that effective public debt is not a burden to neither the current nor the future generation because it generates investment. The idea is that the increase in investment due to debt is more proportionate and in

turn encourage increase in production due to the stimulating effect debt has on demand. This view is supported by empirical works of Saungweme and Odhiambo (2019), Ewaida (2017), Owusu-Nantwi (2016), Eberhardt and Presbitero (2015), Krugman (1988) and Barro (1979). From the Rational expectation (REH) perspective, Ricardo (1951) argues that the real economy is independent of the revenue mobilization choices of the government i.e., it does not matter whether government raise revenue through taxes or debt issuance. This was the conclusion of few empirical works on the subject including that of Kourtellos et. al. (2013), Panizza and Presbitero (2012), and Schclarek (2004).

Debt dynamics in terms of composition as well as how it transmits to other macro variables is key in digesting its relationship with output growth. For instance, the accumulation of external debt can be of additional burden to the economy during periods of currency depreciation, which could also lead to unsustainable balance of payments and widen budget deficit. (Ibrahim 2015), in an empirical analysis of East African Countries (EAC) for the period 1981 to 2014, using the fixed effect and random effect model estimation technique, found that external public debt had an adverse effect on economic growth in EAC countries, while domestic debt had no significant effect. Specifically, local currency depreciation was the main driver of high external debt levels. In another paper, (Aminu et. al. 2013), it was seen that in Nigeria, domestic debt had a significantly positive impact on growth, while external debt was seen to be detrimental to economic growth. The paper applied the ordinary least square method to estimate for the period 1970 to 2010, to establish the relation between the public debt components with output growth. The variables were tested using augmented Dickey Fuller technique and Granger causality to establish the stationarity and causation.

Moreover, structural differences may also influence how much debt burden a country can carry without distress to its output potential. Senadza, Fiagbe and Quartey (2018), asserted that external debt impact on growth is more prevalent in developing economies like Sub-Saharan economies, than in the western economies. This can be further explained by Krugman P. (1988), pointing out that while public external debt has the propensity to enhance growth, it could also impede economic growth by lowering private sector investment through its crowding-out effect, as well as price increases (exchange rate, interest rate, inflation). As postulated above, the level of development in a country or region is also a factor to consider in assessing the public debt-growth nexus as well as threshold levels. Ehigiamusoe and Lean, (2019), in a study assessing the effect of financial development on growth in West Africa, revealed that an increase in financial development doesn't automatically equate to economic growth in the long run unless there is considerable reduction in government fiscal deficit and public debt. The paper also found that the marginal effect on financial development on growth is negative when public debt and fiscal deficit exceeds the respective threshold levels of 48.6 percent and 13.5 percent of GDP.

The reduction of fiscal deficit and public debt levels which relates to the issue of governance has been a major concern for Countries, especially Sub-Saharan countries in this post Covid-19 era. A recent study (Assoum and Alinsato, 2023) explored the mediating role of governance in the relationship between public debt and per capita income in 39 Sub-Saharan African economies, over the period 2002-2019, using the dynamic panel threshold model and a

neoclassical production function. The paper found that public debt impact on per capita income depended on the level of governance quality, establishing a minimum threshold level of 21.78 points on the scale of 100, at which public debt impact on per capita income is significantly positive. The paper also identified transparency and accountability, political stability, corruption control and government effectiveness, and absence of violence, as the most critical dimensions of governance for optimal public debt- per capital income relationship.

Sovereign debt ratings were also seen as a factor that influences external debt supply and its relationship to growth. In a study conducted covering 145 advanced and developing economies (Hung, 2021), over the period 1990 to 2019, using cross-section regression, the paper revealed that a higher supply of external debt decreases debt ratings, thus lower economic growth rate. However, with a high enough supply of debt, debt ratings are increased, and growth rate is improved which showed a U-curve relationship. Results were considered robust when controlled for various determinants of economic growth.

A considerable amount of research has been conducted on the relationship between public debt and growth, however, research assessing the component of public debt and its impact on growth seems scarce and hasn't been thoroughly explored. With regards to external public debt-economic growth relationship, situations arising from debt-overhang, liquidity constraint and the direct effect may exist. In the debt-overhang situation, high external debt stock will have people relinquishing on future investment because of the fear of higher income taxes. The liquidity constraint situation explains that high external debt will lead to high debt service repayment which reduces resources for investment. In the situation of the direct effect, high external debt may limit productive capacity therefore reducing output growth.

The nonlinear relationship between public debt and economic growth can be theoretically explained using the debt Laffer curve. The theory postulates that there is a point up to which debt accumulation is optimal for growth (Sachs 2002). The theory further explains that when debt is accumulated to finance budget deficit, more resources are made available for investment activities, however, as debt increases beyond a particular threshold, it hampers the country's debt service ability, and the issue of debt overhang arises (Savvides 1992). Hilton, (2021), also examined the casual relationships between public debt and economic growth in the Ghanaian economy, over the period 1978-2018 using the ARDL model as result revealed that there's no causal relationship between the two in the short run. However, Public debt impact output growth in the long run.

They are also of the view that public debt prevents the future generation from accumulating wealth due to its negative effect on investment. This view was shared by economists such as Buchanan (1958), Modigliani (1961) and Diamond (1965). This view has been supported by a sizeable portion of empirical studies on the nexus between public debt and economic growth including Gómez-Puig and Sosvilla-Rivero (2017), Ahlborn and Schweickert (2016), Wellington (2015), Szabo (2013), Égert (2012) among others.

Evidence on public debt threshold lever have been mixed, however, several empirical literatures on developing African Countries have revealed that public debt above a threshold level of around 60 to 70 percent of GDP takes a toll on economic growth. Mqolombeni, Tewari

and Ilesanmi, (2023), carry out a cross country panel data approach for 12 developing countries in Africa for the period 1991 to 2020, using the panel smooth transitional regression approach to establish the threshold effect. The paper found a threshold level of 60.5 percent, in a lower debt regime, public debt appears to boost growth, while in a higher debt regime, surpassing the peak point, public debt impact appears to be disruptive to growth. Additionally, Awadzie, Garr and Tsoekeku (2022), in a study done to estimate the debt threshold level detrimental for Ghana's economic growth found public debt and growth not to be linear. Results from the threshold autoregression model indicated a public debt threshold of 57.09, above which growth was believed to be retarded, below the threshold, there was a significant positive relationship between public debt and economic growth.

Ndoricimpa, (2020), a study re-examining the threshold effect of public debt on economic growth in Africa from a sample of 39 African countries between the period 1980 to 2012, using the PSTR approach advanced by Gonzalez et al. (2017), result revealed public debt threshold estimate range from 62 to 66 percent, below the threshold debt impact on growth was found to be neutral. However, when the paper applied the Dynamic panel threshold model of Seo and Shin (2016), to deal with potential debt endogeneity, the threshold was estimated at 74.3 percent, above this threshold debt was seen to have a negative impact on growth, and below the threshold level debt impact on growth was positive. Finally, the threshold or nonlinear effect theory has been confirmed by many other empirical studies including Lau et. al (2022), Sydney Chikalipah (2021), Alshammary et. al. (2020).

4.0 Estimation Technique, Model Specification and Data Description

4.1 Estimation Technique

This paper aims to investigate the relationship between public debt and economic growth in WAMZ member countries by testing for the existence of a threshold effect using a Dynamic Panel threshold regression framework. To do so, we adopted the Dynamic panel threshold model developed by Soe and Shin (2016). This model is an improvement to the Dynamic Panel threshold model developed by Kremer et al (2013). However, unlike Kramer et al (2013) model which prescribed that the transition variable should be exogenous, Soe and Shin (2016) model are more robust and can accommodate both endogenous transition and explanatory variables.

However, to ensure that the results of Seo and Shin (2016) are robust in estimating the public debt- economic growth threshold effect and in dealing with the problem of endogeneity in the model, five other alternative estimation techniques are used in the paper. Thus, we begin by estimating a panel fixed effects model because it alleviates the endogeneity problem that might arise due to policy idiosyncratic effects. However, the panel fixed effect model mitigates only a limited form of endogeneity through the individual countries fixed effects π_i . Second, we estimate the panel two-stage least square (FE-2SLS) model to address the shortcomings of the panel fixed effect model to make meaningful inference in the Public Debt-growth relationship. The FE-2SLS model has the advantage of treating endogeneity bias arising from the correlation of regressors and the error term including unobserved entity effects. However, FE-2SLS has the disadvantage of not capturing the dynamic effect of economic growth. Therefore, we

estimated an additional model to capture the dynamic effect of growth namely First Differenced Generalised Method of Moments (FD-GMM).

Nonetheless, the above models do not provide a framework to test for the presence of potential nonlinear response of growth to changes in public debt in WAMZ member countries. More importantly, the relationship between Public Debt and economic growth has the potential to be nonlinear which necessitate the use of the dynamic panel threshold model of Seo and Shin (2016) as applied by Seo, Kim and Kim (2019) to capture the nonlinear effect. This model allows us to estimate both static and dynamic panel threshold models with an endogenous threshold and explanatory variables. The dynamic panel threshold model, adopted from Seo et al. (2019) is of the following form:

$$y_{it} = x'_{it}\beta + (1, x'_{it}) \delta I\{q_{it} > \gamma\} + \mu_i + \varepsilon_{it}, \quad i = 1, \dots, n; t = 1, \dots, T, \quad (1)$$

where x'_{it} is a vector of independent variables including the lagged dependent variable, q_{it} is the threshold/ transition variable, γ is the threshold value and μ_i is the incidental parameter.

To estimate equation (1), we employed the FD-GMM estimator allowing both the threshold variable and other regressors to be endogenous whilst eliminating μ_i . In implementing FD-GMM nonlinear estimation, the second lag of growth is treated as instrument of the first lagged growth term introduced in the dynamic model as an additional regressor. Similarly, the second lag of public debt and other endogenous variables are treated as instruments for these endogenous variables.

4.2 Model Specification

The Cobb-Douglas production function has been widely used in the literature to empirically estimate the public debt growth nexus while controlling for other explanatory variables. Similarly, our model in this study is based on the log-linearized Cobb-Douglas production function. The model is specified below in a panel data framework:

$$Y_{it} = \alpha_0 + \beta' X_{it} + \gamma' Q_{it} + \mu_i + \mu_j + \varepsilon_{it} \quad (2)$$

Where the dependent variable, Y_{it} is the measure of economic growth, X_{it} is a vector of different measures of public debt (total, domestic, external, and service) which is our variables of interest. Q_{ijt} is a vector of control variables that influences economic growth and includes current account balance, investment to GDP, growth in terms of trade, population growth, foreign direct investment, corruption index and openness. Assoum and Alinsato (2023) following Krugman (1988) posits that public debt can promote economic growth in the low public debt regime below a certain threshold parameter but inimical to growth if public debt exceeds the threshold i.e., a high public debt regime. In line with theory, it is expected that investment to GDP, growth in terms of trade, population growth, FDI and openness will have a positive sign whilst corruption index is expected to have a negative sign.

4.3 Description of Data

The study uses panel data covering all the six WAMZ countries (The Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone) for the period 1996 -2022. The study period was dictated by the availability of data for all countries. The dependent variable, GDP per capita growth is the log of the growth rate of GDP per capita and it was sourced from the IMF World Economic Out (WEO) database and the World Development Indicators (WDI) database. The threshold variable, Public Debt has four measures in the study. The first is total public debt to GDP which is the general government gross debt as a percentage of GDP sourced from WDI database. Second, is the external debt to GDP which is the external debt stock as a percentage of GNI and was sourced from WDI database. Third is the domestic debt to GDP measured by the domestic debt stock as a percentage of GNI and was computed as a residual from the total debt stock and the external debt stock. The final measure is the total debt service to GNI which is the total debt service as a percentage of GNI sourced from WDI database. The control variables are Current account balance, investment to GDP ratio, growth rate of terms of trade, population growth, foreign direct investment, corruption index and openness to GDP. All the above control variables were sourced from WDI except FDI and CAB that was sourced from WDI and IMF. The investment to GDP ratio was proxied by the share of gross capital formation in GDP. The terms of trade (TOT) were computed as the ratio of the price level of exports to the price level of imports whilst the growth in TOT was computed as the first difference of the logarithm of TOT. Population growth was computed as the first difference of the logarithm of total population.

Table 4:1 Description of Variables and Sources

Main Variable(s)	Variable Code	Description	Sources
GDP per capita growth	rgdp	GDP per capita growth	IMF's World Economic Outlook (WEO and World Development Indicators (WDI).
Threshold Variables			
Total Public Debt to GDP	tdebtgdp	General government gross debt (% of GDP)	IMF's World Economic Outlook (WEO)
External Debt to GDP	exdebtgdp	External debt stocks (% of GDP)	World Development Indicators (WDI)
Domestic Debt to GDP	dodebtgdp	Domestic debt stocks (% of GDP)	Authors' Computation as a residual
Total debt service to GNI	debterv	Total debt service (% of GNI)	World Development Indicators (WDI)
Control Variables			
Current account balance	cab	Current account balance (% of GDP)	World Development Indicators (WDI).
Investment to GDP ratio	gfcfgdp	Share of gross fixed capital formation in GDP.	World Development Indicators (WDI)
Growth in terms of trade (TOT)	dltot	Computed as the ratio of the price level of exports to the price level of imports and growth in TOT as the first difference of the logarithm of TOT.	World Development Indicators (WDI)
Population growth	dlpop	First difference of the logarithm of total population.	World Development Indicators (WDI)
Foreign direct investment	fdii	Foreign direct investment, net inflows (% of GDP)	WAMI databases and World Development Indicators (WDI).
Corruption index	nconcor	Corruption index	World Bank Governance Index (WGI)
Openness to GDP	opengdp	Share of GDP accounted for by exports and imports	World Development Indicators (WDI).

Source: Authors' Compilation

5.0 Presentation and Discussion of Results

This section presents and discusses the empirical findings on the possible existence of different compositional effects of public debt threshold above which debt turn out to be harmful to growth in Member States of the WAMZ. Different estimation models are used to achieve the objectives of the study by determining the dynamics debt and presence of such threshold effects in the WAMZ covering the period of 1996-2022. A suitable starting point is to consider the time series properties of all the variables used to estimate the models since this approach requires that all the variables are stationary. In trying to fulfil this requirement, we estimated the models using the ratio of debt among other variables to GDP as shown in equation (2). This empirical specification is consistent with recent empirical studies that have applied the dynamic panel threshold model (Assoum and Alinsato, 2023; Seo et al., 2019 and Seo and Shin, 2016). In this study, we have not extended the study period to pre-1996 because of data unavailability for key variables of interest for some Member States.

5.1 Descriptive Statistics

The descriptive statistics for the variables used in the regression during 1996-2022 is presented in Table 5.1. The statistics show significant variations in the variables of interest (GDP per capita, different components of debt and other control variables) for the six WAMZ countries over time. The mean of GDP per capita is 1.48, with minimum being -30.7 and maximum being 19.46, indicating wide variation in GDP per capita across WAMZ countries during the review period. The Table also reveals significant heterogeneity in different components of average debt levels, with mean values ranging from 92.16 for total public debt to GDP, to 10.6 for external debt to GDP over the study period. Similarly, other control variables vary substantially across countries and overtime. It points to a potential nonlinear association between different components of debt levels and economic growth in the WAMZ.

Table 5:1 Descriptive Statistics

Variables Name	Variable Code	Obs	Mean	Std. dev.	Min	Max
GDP per capita growth	rgdp	162	1.480	4.947	-30.700	19.460
Current account balance (% of GDP)	cab	162	-7.673	13.090	-65.260	46.310
Total public debt (% of GDP)	tdebtgdp	162	92.160	118.200	7.276	600.100
External debt (% of GDP)	exdebtgdp	162	10.600	11.670	0.751	58.420
Domestic debt (% of GDP)	dodebtgdp	162	67.900	25.100	0.842	183.000
Total debt service (% of GDP)	debtv	162	12.760	18.480	0.411	119.700
Population growth	dlpop	162	0.427	0.994	-0.168	4.630
Gross fixed capital formation (% of GDP)	gfcfgdp	162	19.810	9.353	-2.424	52.420
Foreign direct investment, net inflows (% of GDP)	fdii	162	6.463	13.770	-0.840	103.300
Terms of trade (% of GDP)	dltot	162	-0.019	0.135	-1.191	0.204
Openness (% of GDP)	opengdp	162	59.430	21.220	20.720	122.700
Corruption index	nconcor	162	0.386	0.083	0.072	0.554

Source: Authors computation

Table 5:2 Correlation Matrix

Variables	rgdp	Cab	dlpop	gfcfgdp	fdii	dltot	opengdp	nconcor	tdebtgdp	exdebtgdp	dodebtgdp	debtv
rgdp	1.000											
cab	0.333	1.000										
dlpop	0.358	-0.169	1.000									
gfcfgdp	-0.122	-0.203	-0.288	1.000								
fdii	-0.276	-0.592	-0.020	0.249	1.000							
dltot	-0.134	-0.023	-0.179	0.100	0.059	1.000						
opengdp	-0.183	-0.232	-0.122	0.257	0.069	0.069	1.000					
nconcor	0.050	0.245	-0.224	-0.087	-0.052	-0.031	0.122	1.000				
tdebtgdp	0.017	-0.029	-0.228	0.160	0.044	0.042	-0.192	0.001	1.000			
exdebtgdp	-0.430	-0.406	0.174	-0.138	0.110	-0.120	0.097	-0.142	0.306	1.000		
dodebtgdp	0.052	-0.025	-0.208	0.147	0.075	0.050	-0.263	-0.043	0.978	0.236	1.000	
debtv	0.008	-0.022	0.137	-0.209	-0.095	-0.030	-0.136	0.019	-0.106	0.173	-0.154	1.000

Source: Authors computation

As shown in the other results Tables, public debt may likely be beneficial to economic growth up to a certain threshold, above which it can potentially dampen growth of these economies. Overall, the description of the variables of interest shows that there is significant variation in

different components of average public debt levels, gross fixed capital formation, growth rate of population, terms of trade, foreign direct investment, current account balance, openness and (governance measure (corruption index) over time. Table 5.2 shows the correlation matrix among the key variables of interest. It generally indicates that all the variables have low correlation with each other, except for total public debt and domestic debt which has very high correlations, as expected, since domestic debt is derived as residual of total public debt.

5.2 Unit Root Test

It is important for series to be stationary before using them to make statistical inference in econometric modelling. When used in a regression, non-stationary series can affect the validity of standard statistical tests and can lead to spurious regression. In a panel framework, stationarity tests are more important because they allow us to test both the time-series and cross-sectional dimension of the data for the presence of unit root. In this study, we tested for the presence of unit-root in the series using the Im-Pesaran-Shin (2003) and Levin-Lin-Chu (2002) tests. The results of the panel unit root tests are shown in Table 5.3. The results shows that some of the variables are non-stationary at level. However, after first differencing all the variables achieve stationarity at both the 1 and 5 percent significance levels for all six (6) countries. The stationarity of the series implies that the dynamic panel threshold model is a suitable estimation technique to determine the possible existence of the threshold effects of public debt at different components on economic growth in the WAMZ.

Table 5:3 Panel Unit Roots Test Result

Variables	IPS Level Statistic	At Prob.	At First Difference Statistic	Prob.	LLC statistics	at level Prob.	At first difference statistic	Prob.
RGDP	-4.153	0.000	-7.308	0.000	-7.791	0.000	-13.164	0.000
TDEBTGDP	-0.542	0.997	-4.092	0.000	-2.021	0.256	-8.506	0.000
EXDEBTGDP	1.060	1.000	-3.090	0.000	0.165	1.000	-5.395	0.014
DODEBTGDP	-1.337	0.666	-4.080	0.000	-3.461	0.304	-7.260	0.000
DEBTERV	-1.800	0.210	-5.654	0.000	-4.372	0.207	-9.968	0.000
CAB	-2.114	0.067	-5.170	0.000	-5.518	0.079	-10.418	0.000
GFCFGDP	-1.829	0.275	-5.277	0.000	-3.332	0.405	-9.509	0.000
DLTOT	-5.103	0.000	-9.291	0.000	-6.800	0.119	-14.481	0.000
DLPOP	-0.969	0.956	-1.222	-1.222	-8.534	0.000	-7.650	0.000
FDII	-2.273	0.032	-5.961	0.000	-4.503	0.240	-10.119	0.000
NCONCOR	-1.839	0.223	-4.381	0.000	-4.802	0.087	-4.381	0.000
OPENGDP	-2.267	0.024	-5.264	0.000	-5.349	0.015	-10.312	0.000

Source: Authors computation

5.3 Results of Estimated Static and Dynamic Models of Different Components of Debt

5.3.1 Fixed Effects Estimation Models

Table 5.4 presents the estimated results using the fixed effects (FE) and fixed effects 2 two stage least square (FE-2SLS) models for the different components of public debt. Column (2) reveals the fixed effects for total public debt, it shows that the coefficient of estimated marginal effects of total public debt-GDP ratio (0.539) is positive and statistically significant at the 10 percent level. This implies that increasing total public debt may likely augment the level of economic well-being among WAMZ countries, particularly when total public debt-GDP ratio is in a moderate level, *ceteris paribus*. The coefficient of other control variables in the model such as current account positions, population growth, and investment-GDP ratio indicate the expected positive signs and they are all statistically significant at 5 percent level. However, the effect of foreign direct investment, terms of trade, openness to GDP and governance indicator (corruption index) on economic well-being are contrary to a-priori expectations. This negative association, except governance indicator (corruption index), between these variables and economic well-being is surprising, which might be due to the attendant simultaneity bias that is not accounted for in the fixed effects model. The next model is presented in column (3) and it indicates the fixed effects for external debt. It reveals that the estimated effects of external debt-GDP ratio (-1.556) is negatively related to economic performance, and it is statistically significant at the 1 percent level. This implies that reducing external debt may likely improve the level of economic well-being among WAMZ countries, *ceteris paribus*. As noted in the total debt model, the coefficient of current account positions, population growth and investment-GDP ratio indicate the expected positive signs but only population growth is statistically significant at 1 percent level. The sign of governance indicator (corruption index) on economic well-being is in tandem with a-priori expectations but effect of foreign direct investment, terms of trade and openness to GDP are contrary to a-priori expectation and they are not statistically significant. Column (4) and Column (5) indicate the fixed effects for domestic debt and debt service, respectively. The two columns show the same patterns of estimated results with that of the total public debt, albeit with varying coefficients.

5.3.2 Fixed Effects Two-Stage Least Squares (FE-2SLS) Estimation Model

To tackle the possible simultaneity bias conundrum that can emanate from the fixed effects estimation technique, we estimated the model using the FE-2SLS approach, column (5). The 2SLS approach is based on instrumental variables techniques that can assist us to characterise the effects of different components of debt on economic performance in the WAMZ. The results in Table 5.4 clearly shows that the endogeneity bias problem significantly influences the effects of different components of debt on economic performance in the WAMZ⁵. Unlike the outcome in the fixed effects models, the estimated coefficient on openness and governance indicator (corruption index) turns out to be rightly signed in the model. Focusing on the effects of different components of public debt on economic performance in the WAMZ, the total public

⁵ Kindly note that we omitted domestic public debt from the 2-SLS model due to 2 reasons: (i) domestic public debt is derived as residual of the total and external debt; (ii) There is very high correlation between total public debt and domestic debt, hence the need to omit the domestic debt from this model.

debt as a ratio of GDP shows positive relationship with economic performance (0.991) and it is statistically significant at 1 percent level. This implies that increasing total public debt-GDP ratio may likely boost the level of economic well-being among WAMZ countries, all things being equal. However, the external public debt as a ratio of GDP and debt service shows negative relationship with economic performance (-2.116) and (-0.001), respectively, and they are statistically significant at 1 percent level. This suggests that increasing external public debt as a ratio of GDP and debt service may possibly dampen the level of economic well-being among WAMZ countries, all things being equal. In other words, reducing external public debt as a ratio of GDP and debt service through the adoption of different adjustment mechanisms across WAMZ countries would enable them to move towards closer fiscal convergence and economic performance in the Zone. As noted earlier, there is considerable heterogeneity in public debt levels across WAMZ countries. This result is similar to WAMI (2021) findings.

Table 5:4 Result of Static Models with Different Components of Debt (Fixed Effects and 2-SLS)

Models	(1)	(2)	(3)	(4)	(5)
VARIABLES	FE_TOTAL	FE_EXT	FE_DOM	FE_DSERV	2SLS_ALL
CAB	0.105*** (0.021)	0.032 (0.032)	0.104*** (0.020)	0.092*** (0.022)	0.028 (0.024)
DLPOP	1.818*** (0.350)	1.435*** (0.213)	1.894*** (0.355)	1.486*** (0.218)	1.976*** (0.285)
GFCFGDP	0.051** (0.024)	0.001 (0.019)	0.050** (0.024)	0.048** (0.023)	0.017 (0.016)
FDII	-0.024 (0.014)	-0.033** (0.014)	-0.024* (0.014)	-0.030** (0.014)	-0.023** (0.011)
DLTOT	-2.034* (1.067)	-1.376 (0.871)	-2.007* (1.057)	-1.385 (0.967)	-2.424*** (0.739)
OPENGDP	-0.006 (0.014)	-0.008 (0.014)	-0.001 (0.016)	-0.015 (0.010)	0.011 (0.015)
NCONCOR	6.547*** (2.244)	-1.422 (2.591)	7.958*** (2.619)	4.035* (2.262)	-5.554*** (1.414)
TDEBTGDP	0.539* (0.273)				0.991*** (0.164)
EXDEBTGDP		-1.556*** (0.246)			-2.116*** (0.171)
DODEBTGDP			0.506** (0.240)		
DEBTERV				-0.046*** (0.012)	-0.001 (0.011)
CONSTANT	5.887** (2.781)	13.868*** (0.835)	5.409* (2.862)	9.849*** (1.058)	8.189*** (1.729)
Observations	162	162	162	162	162
R-squared	0.395	0.471	0.411	0.367	

Source: Authors' Computation Using STATA 17 Software.

Note 1: Dependent variable is measured as per capita income. Robust Standard errors are reported in parenthesis. '***', '**' and '*' denote significant at 1%, 5% and 10 % respectively.

Note 2: Model 1 is Fixed Effects for the total public Debt; Model 2 is Fixed Effects for the external public Debt; Model 3 is Fixed Effects for the domestic public Debt; Model 4 is Fixed Effects for the Total Debt Service; and Model 5 is Two Stage Least Square (2-SLS) results for all components of public Debt.

5.3.3 Results of Dynamic Panel Models with Different Components of Debt (First Difference GMM)

In order to improve on the outcome and robustness of our results, we also estimated dynamic panel data model with different components of public debt in the first difference GMM models. As noted earlier, instrumental variables are prerequisite to ascertain the causal effects of public debt on economic performance in the WAMZ. However, the literature on the potential instruments to estimate the effects of these potentially endogenous variables is less developed, particularly in the region. To overcome this problem, we attempted one-period lag of the dependent variable, the GDP per capita growth, as well as different components of public debt, together with other explanatory variables. In addition, we utilized the 1-5 lagged variables of different public debt variables as instruments. The probability values of the Sargan-Hansen test statistic show that these instruments are valid. The standard errors are robust to mitigate the problems of heterogeneity, serial-correlation, and cross-sectional dependence. The results in Table 5.5 clearly point to the fact that all the components of public debt in the first difference GMM models have inherent negative relationship with per capita income. The coefficients of many of the control variables in the models such as current account positions, population growth, investment-GDP ratio, openness to GDP and governance indicator (corruption index) indicate the expected a-priori signs in all the estimated models (1) to (4). However, the effect of foreign direct investment and terms of trade on per capita income appears to be contrary to a-priori expectations, showing vulnerabilities of these economies to external shocks.

Specifically, total public debt, external public debt, domestic public debt, and debt service have coefficients of (-0.289), (-0.407), (-0.270) and (-0.006), respectively, and most of which are statistically significant at different percent level. This indicates that all the components of public debt have inbuilt negative effects on per capita income albeit at different intensity. A more critical examination of the estimated results shows that domestic public debt and debt service have the lowest negative coefficients while external public debt as a ratio of GDP has the highest negative coefficient. This suggests that increasing external public debt as a ratio of GDP may probably inhibit the level of economic performance more than other components of debt in WAMZ countries, all things being equal. In other words, domestic public debt as a ratio of GDP appears to have less negative dampening effects on per capita income than the external public debt as a ratio of GDP components of total public debt. This outcome may tend to support the recent initiatives of governments in the WAMZ where they are switching from foreign (external) public debt to more of domestic public debt. This strategic switch in debt policy accumulation can be explained from the relative ease of domestic debt mobilisation, as against foreign debt where there are a lot of rigidities and conditionalities to meet before accessing them. Also, since many WAMZ countries often experience huge domestic currency depreciation, hence, accumulating foreign debt tends to bring higher values of debt as a result of foreign exchange rate volatilities and exchange rate revaluation losses. On the domestic debt front, the major factor influencing it, is the domestic interest rates, which is largely under the control of the domestic monetary and fiscal authorities.

Table 5:5 Result of Dynamic Panel Models with Different Components of Debt (First Difference GMM)

Models	(1)	(2)	(3)	(4)
VARIABLES	FD_TOTAL	FD_EXT	FD_DOM	FD_DSERV
L.RGDP	-0.623*** (0.034)	-0.567*** (0.054)	-0.619*** (0.037)	-0.646*** (0.038)
CAB	0.016 (0.014)	0.014 (0.014)	0.018 (0.013)	0.020* (0.012)
DLPOP	1.305*** (0.110)	1.476*** (0.118)	1.267*** (0.113)	1.470*** (0.121)
GFCFGDP	0.040* (0.022)	0.044** (0.022)	0.037 (0.023)	0.044* (0.025)
FDII	-0.017* (0.009)	-0.014* (0.008)	-0.017** (0.008)	-0.010 (0.006)
DLTOT	-0.299 (0.762)	-0.819 (0.799)	-0.309 (0.760)	-0.624 (0.834)
OPENGD	0.057*** (0.011)	0.060*** (0.010)	0.057*** (0.011)	0.055*** (0.012)
NCONCOR	-11.759*** (2.448)	-11.618*** (2.301)	-11.566*** (2.383)	-11.155*** (2.162)
TDEBTGDP	-0.289*** (0.106)			
EXDEBTGDP		-0.407* (0.208)		
DODEBTGDP			-0.270*** (0.088)	
DEBTERV				-0.006 (0.009)
Observations	108	108	108	108
Number of yearID	27	27	27	27
Country Specific effect	YES	YES	YES	YES
Year effect	NO	NO	NO	NO
Hansen_test	25	25.43	24.90	24.36
Hansen Prob	0.018	0.014	0.019	0.025
Sargan_test	5.84	5.13	5.30	5.48
Sargan Prob	0.123	0.174	0.158	0.145
AR(1)_test	-3.193	-3.363	-3.265	-3.688
AR(1)_P-value	0.001	0.001	0.001	0.000
AR(2)_test	-1.072	-1.286	-0.876	-1.225
AR(2)_P-value	0.383	0.223	0.607	0.261

Source: Authors' Computation Using STATA 17 Software.

Note 1: Dependent variable is measured as per capita income. Robust Standard errors are reported in parenthesis. '***', '**' and '*' denote significant at 1%, 5% and 10 % respectively.

Note 2: Model 1 is First Difference GMM for the total public Debt; Model 2 is First Difference GMM for the external public Debt; Model 3 is First Difference GMM for the domestic public Debt; and Model 4 is First Difference GMM for the Total Debt Service.

5.3.4 Results of Panel Threshold Models with Different Components of Debt

In order to further improve on the outcome and robustness of our results, we investigate the nonlinear response of different components of public debt to economic performance in the WAMZ. This is to establish whether the results are sensitive to the estimation of the panel threshold model proposed by Seo and Shin (2016) and applied by Seo, Kim and Kim (2019) and Assoum and Alinsato, (2023). This model allows us to test for the presence of threshold effect in the different components of public debt (total, external and domestic) as well as debt service relationship to economic growth in a nonlinear form. The model assumes that there are two regimes, one with low debt and high growth, and another with high debt and low growth. The model has capacity to determine the threshold level of debt that separates the two regimes, as well as the slope coefficients for each regime. This model is clearly suitable for a study of

debt and growth nexus because it can capture the possibility of debt overhang effects and nonlinearities in the public debt-growth relationship. In view of equation (1), the threshold variable chosen, q_{it} (different components of public debt to GDP ratio between countries) is included in the vector x'_{it} of regressors. As earlier discussed, different components of public debt to GDP ratio is treated as the threshold variable since unsustainable public debt level is a major source of drag on economic growth among WAMZ countries. It also elicits debt accumulations/overhang and weakens the effectiveness of monetary policy to control inflationary pressure and the general capacity of governments to improve macroeconomic performance.

In order to estimate the panel threshold model, we utilise the first lagged of different components of public debt as instruments, as well as that of dependent variable, but the control variables defined above as exogenous variables. In the dynamic model, the one-period lagged economic performance (dependent variable) is included as an additional regressor and instrumented by its first lagged variable. To obtain the threshold values for each component of debt, it is important to determine whether there exists a nonlinear relationship among the key variables of interest. The bootstrap probability values used to test for linearity are obtained by the bootstrap algorithm with the trim rate set at the default of 0.4 using 100 bootstrap replications. The results are presented in Table 5.6, and it show that the p-value of the linearity test strongly rejects the null hypothesis of linearity in all the models. This implies that the results of the panel threshold models are preferred to the FE, FE-2SLS and FD-GMM, since the association between different components of public debt to economic performance in the WAMZ is confirmed to be nonlinear. The outcome is consistent with the findings from the policy study conducted by WAMI (2021) as well as Assoum and Alinsato, (2023) which illustrate strong non-linear relationships between public debt and economic growth.

Table 5:6 Result of Panel Threshold Models with Different Components of Debt

MODELS	(1)	(2)	(3)	(4)
VARIABLES	Total	External	Domestic	Servicing
LINEAR PART				
Lower Regime				
DLPOP	2.242*** (0.356)	1.401*** (0.473)	2.015 (2.458)	2.190*** (0.279)
GFCFGDP	0.095*** (0.015)	-0.119*** (0.017)	0.203*** (0.050)	0.091 (0.064)
OPENGDP	0.010** (0.005)	0.088*** (0.011)	-0.126*** (0.015)	-0.043*** (0.011)
NCONCOR	7.491 (6.088)	39.963*** (1.704)	15.943*** (2.591)	1.456 (14.274)
TDEBTGDP	1.466*** (0.468)			
EXDEBTGDP		2.025*** (0.305)		
DODEBTGDP			0.149*** (0.021)	
DEBTERV				0.557*** (0.181)
NON-LINEAR PART				
Upper Regime				
DLPOP	-3.199*** (0.362)	499.763*** (38.457)	59.852*** (12.750)	-1.149 (1.798)
GFCFGDP	0.163* (0.092)	0.120*** (0.042)	-0.463*** (0.056)	-0.959*** (0.241)
OPENGDP	0.078** (0.038)	-0.149*** (0.018)	0.268*** (0.014)	-0.133** (0.066)
NCONCOR	-71.367*** (18.607)	-35.361*** (1.866)	19.435*** (2.983)	203.180*** (54.612)
TDEBTGDP	-5.279*** (0.944)			
EXDEBTGDP		-1.343*** (0.436)		
DODEBTGDP			-0.143*** (0.021)	
DEBTERV				-0.514** (0.205)
Threshold Part				
CONSTANT	38.637*** (7.149)	21.096*** (6.112)	-14.167*** (2.824)	-61.869*** (18.713)
THRESHOLD	87.448*** (22.011)	12.708*** (0.004)	46.937* (25.642)	17.801*** (3.163)
LINEARITY TEST (BOOTSTRAP P-VALUE)	0.000	0.000	0.000	0.000

Source: Authors' Computation Using STATA 17 Software.

Note 1: Dependent variable is measured as GDP per capita growth. Robust Standard errors are reported in parenthesis. '***', '**' and '*' denote significant at 1%, 5% and 10 % respectively.

Note 2: Model 1 is Panel Threshold Model for the Total Public Debt; Model 2 is Panel Threshold Model for the External Public Debt; Model 3 is Panel Threshold Model for the Domestic Public Debt; and Model 4 is Panel Threshold Model for the Total Debt Service.

Turning to the estimation results in Table 5.6, the results in column (2), model 1 indicates a total public debt threshold value of 87.45 percent of GDP which is statistically significant at the 1 percent significance level. This finding suggests that implementing a mix of policies that would ensure that total public debt to GDP ratio is attained below the threshold of 87.45 percent would support economic growth. Above this threshold, total public debt to GDP ratio would be harmful to growth. This outcome is in line with the public debt WAMZ convergence criteria of 70 percent, and this is also reflected in the direction of total public debt effects on growth, which is consistent with the predictions on the debt-growth nonlinear relationship. The coefficient on total public debt in the low debt regime (1.466) below this threshold associated with the linear aspect of the estimation is positive and statistically significant. Above the threshold associated with the nonlinear component of the estimation, the effect on growth is negative (-5.279), reflecting detrimental growth effect of total public debt and it is also statistically significant at 1 percent level.

The results in column (3), model 2 shows an external public debt threshold value of 12.71 percent of GDP which is statistically significant at the 1 percent significance level. This outcome connotes that WAMZ countries that have external public debt to GDP ratio below the threshold of 12.71 percent may have external debt structure that can propel their growth. Thus, any external public debt to GDP ratio above this threshold, may be inimical to economic growth in the region. This is captured in the way external public debt influence growth, which is consistent with the predictions on the debt-growth nonlinear relationship. The coefficient on external public debt in the lower debt regime (2.025) below this threshold is related to the linear aspect of the estimation and it is positive and statistically significant. Above this threshold level is associated with the nonlinear component of the estimation, which is negatively (-1.343) related to growth, reflecting unfavourable growth effect of external public debt and it is also statistically significant at 1 percent level.

In a similar vein, the estimated findings in column (4), model 3 displays domestic public debt threshold value of 46.94 percent of GDP which is only statistically significant at the 10 percent significance level. The implication of this finding is that domestic public debt to GDP ratio below the threshold of 46.94 percent would boost economic growth level, while any domestic public debt to GDP ratio above this threshold, would adversely affect economic growth in the region. This is also shown in the direction in which domestic public debt impact growth, which is in line with the expectations on the debt-growth nonlinear relationship. The coefficient on domestic public debt in the lower debt regime is (0.149), below this threshold is related to the linear aspect of the estimation and it is positive and statistically significant. Above this threshold level is related to the nonlinear component of the estimation, with negative (-0.143) effects on growth, echoing adverse growth effect of domestic public debt and it is also statistically significant at 1 percent level.

Furthermore, the results in column (5), model 4 points to another important dimension of public debt, which is total debt service. It has a threshold value of 17.80 percent of GDP which is statistically significant at the 1 percent significance level. It alludes that implementing a mix of policies that would ensure that total debt service is attained below the threshold of 17.80 percent would support economic growth. Above this threshold, total debt service would be detrimental to growth. This result is revealed in the trend of total debt service effects on growth,

which is in tandem with the outlooks of debt-growth nonlinear relationship. The coefficient on total debt service in the lower debt regime (0.557) below this threshold is associated with the linear feature of the estimation and it is positive and statistically significant at 1 percent level. Above this threshold is associated with the nonlinear component of the estimation and it has negative effects of (-0.514) on growth, revealing harmful growth effect of total debt service and it is also statistically significant at 5 percent level.

In sum, the estimated results tend to be ratifying our propositions that different components of public debt have differentiating effects on economic growth performance in the WAMZ countries. It also confirms the findings from different policy studies elucidating strong nonlinear relationships between public debt and economic growth. Hence, ignoring these characteristics and consequent effects of different components of public debt on economic growth and performance may bias the expected policy outcome and obscure policy makers insight to debt dynamics in the region. Specifically, the results appear to support higher threshold debt level for domestic public debt (46.94) and relatively lower debt threshold for the external components of debt (12.71), portraying the possibility of accumulating more domestic debt as against the foreign (external) debt. In terms of threshold for debt service, given the fact that higher debt servicing dries up fiscal space and constraint government's ability to provide public infrastructures and other growth enhancing public services. It is, therefore, appropriate to have lower threshold value of (17.80) for debt service to GDP ratio in order to maintain sustainable level and not hurt economic growth in the region.

6.0 Conclusion and Policy Implications

There is growing awareness that huge public debt and brisk accumulation of debt are often stemmed from uncoordinated fiscal policies which may induce macroeconomic instability and undermine the credibility of a monetary union. High public debt levels suggest high debt servicing thereby shrinking the fiscal space for public investment in infrastructure and other growth enhancing sectors. It is, therefore, indispensable for countries to keep their public debt at a sustainable level in order not to harm economic growth. In this light, this study seeks to provide novel empirical evidence on the optimal public debt-growth threshold in the WAMZ over the period 1996-2022. Determining the public debt-growth threshold below which moderate public debt spurs growth, but above which public debt is detrimental to growth is very important for macroeconomic policy measures in the region to curb high public debt levels that can diminish the ability of governments to cushion adverse shocks. Although there is considerable empirical literature on this subject, however, previous studies on the WAMZ economies generally focused on only total public debt or external debt components, while ignoring the impacts of domestic and debt service on economic performance in the region. This paper contributes to this policy debate on the optimal public debt-growth nexus in three-folds. Unlike previous studies and to the best of our knowledge given extensive literature search, this study is the first study that will combine all the components of public debt (total, external, domestic and debt service) in a single study while utilising different estimation techniques and methods to evaluate the interrelationship between different components of public debt and economic growth in WAMZ countries. It also uses recent methodology of dynamic panel threshold model that allows for shifts among regimes (high and low) in determining the threshold public debt-growth for the WAMZ member states and lastly, it focuses on the recent

period of 1996-2022, hence, making the results of the study more policy relevant, by capturing recent macroeconomic and debt shocks experienced by the countries.

Preliminary estimates from the study show some interesting outcomes. The estimated results from dynamic panel using FD-GMM clearly points to the fact that all the components of public debt have inherent negative effects on per capita income. A detailed examination of the results show that domestic public debt and debt service have the lowest negative coefficients while external public debt as a ratio of GDP has the highest negative coefficient. This suggests that domestic public debt as a ratio of GDP appears to have less negative dampening effects on economic growth than the external public debt as a ratio of GDP. This tends to support the recent initiatives of WAMZ governments where they are switching from foreign (external) public debt to more of domestic public debt. This may be due to relative ease of domestic debt mobilisation arising from local interest rates determination, as against foreign debt where there are a lot of rigidities in raising funds through this channel and due to currency depreciation, foreign debt tends to have higher valuation values.

Similarly, the results from panel threshold regression models indicate total public debt threshold value of 87.45 percent of GDP, external public debt threshold value of 12.71 percent of GDP, domestic public debt threshold value of 46.94 percent of GDP and total debt service threshold value of 17.80 percent of GDP, and all are statistically significant at different levels. These findings suggest that implementing a mix of fiscal and monetary policies measures that would ensure that all the components of public debt to GDP ratio are attained below their threshold levels would support economic growth. Above that threshold, all the components of public debt to GDP would be harmful to growth. This outcome is in tandem with the public debt WAMZ convergence criteria of 70 percent, and this is also reflected in the direction of public debt effects on growth, which is consistent with the predictions on the debt-growth nonlinear relationship. Overall, the analysis suggests that one handy way for WAMZ countries to achieve higher per capita income and economic growth is to improve on macroeconomic convergence through reductions in different components of public debt, across countries.

The findings have important policy implications. One of such is that achieving sustainable components of public debt, as suggested by the threshold models, is one of the most veritable channels through which policymakers in the Zone can enhance their per capita income and ensure the sustainable participation in the proposed ECOWAS monetary union. One practical way to reduce public debt among countries is to strengthen mechanisms to ensure compliance with the convergence criterion of public debt ratio not exceeding 70 percent of GDP. Given these insights, one important policy action that WAMZ countries would need to implement is to strengthen fiscal consolidation measures to improve the primary balance and enhance capacity to reduce public debt to sustainable levels.

Also, since most of the components of public debt are found to have inherent negative effects on per capita income, WAMZ countries are encouraged to continuously explore other plausible revenue generations options before resorting to public borrowings, whether domestic or external. Similarly, they must commit explicitly to promoting effective utilisation of limited government resources and make efforts to expand taxes and revenue collections. In this case, WAMZ countries must cultivate the culture of better administration of borrowed funds by ensuring investments of such funds in worthy ventures that will generate better living standards

for the citizenry. Hence, WAMZ countries should continue to strengthen efforts geared towards combating corruption, by using technology and digitalization of government processes. Finally, WAMZ countries must ensure more fiscal reforms through institutionalising efforts of managing public debt by creating Debt Management offices and saddle them with responsibilities of minimising unrestricted high-ranking public officers' access to public funds, implementation of fiscal rules and Fiscal Responsibility Act. It must be noted that this study only carries out panel analysis across the WAMZ, it would be interesting to find out different dynamics of debt across countries and components. Hence, future research efforts must be geared towards understanding different components of public debt in each of the WAMZ countries as against panel study analysis in order to identify the uniqueness of each country debt dynamics. This can also be extended to compositions of revenues, expenditures, and drivers of public debt in individual WAMZ countries.

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