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**Article**

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# Exports, government debt and economic growth in sub-Saharan Africa

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## ABSTRACT

Exports in sub-Saharan Africa have struggled to generate the kind of growth witnessed in Southeast Asia on the background of rising government debt. This article considers the extent to which government debt, which has tripled since 2008, may have constrained export-led growth in the region. Further examined is the extent to which debt reduction is possible through revenue growth and expenditure cuts. From a sample of 44 sub-Saharan countries observed between 2004 and 2023, the impact of exports on economic growth is found to be stronger in countries with low to moderate levels of debt and weaker in countries with high debt. To achieve robust economic growth from exports, sub-Saharan countries need to keep debt below 45% of GDP. From the results, this requires cutting expenditure on GDP by 2–10 percentage points or raising revenue (excluding grants) by 2–12 percentage points. These estimates are in line with the primary balance adjustment of at least 2 percentage points recommended by the IMF. Estimates further indicate that cutting government expenditure reduces debt more than raising revenue. Counterfactual scenarios show that cutting government expenditure on GDP by 15 percentage points would reduce government debt from 55 to 45% of GDP.

## IMPACT STATEMENT

This paper addresses the question of why trade has hardly accelerated growth in sub-Saharan Africa and the importance of managing government debt as a moderating factor. The empirical evidence from a panel of 44 countries demonstrates the importance of prudent fiscal policies and debt management strategies as the growth effect of exports is constrained by high government debt. This evidence is consistent with the IMF's policy stance on the need for urgent debt management strategies in the sub-Saharan region.

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## 1. Introduction

The relationship between exports and economic growth is one of the widely researched topics in development economics. A general lesson from this literature is that the impact of exports on economic growth depends on several factors such as the composition of exports, regional context, model specification and variable measurement (Srdelić & Dávila-Fernández, 2024; Trošt & Bojnec, 2016). The current article contributes to this empirical evidence by examining how the level of government debt influences the impact of exports on economic growth in sub-Saharan Africa. It explores the possibility of a non-linear association in which exports impact economic growth strongly and positively at low levels of government debt and weakly at high levels of government debt.

There are several reasons why government debt can non-linearly influence the impact of exports on economic growth. These non-linearities can be explained either in the context of the gap filling theory, the likely heterogeneity in the use of low and high debt, and the likelihood of other growth drivers being

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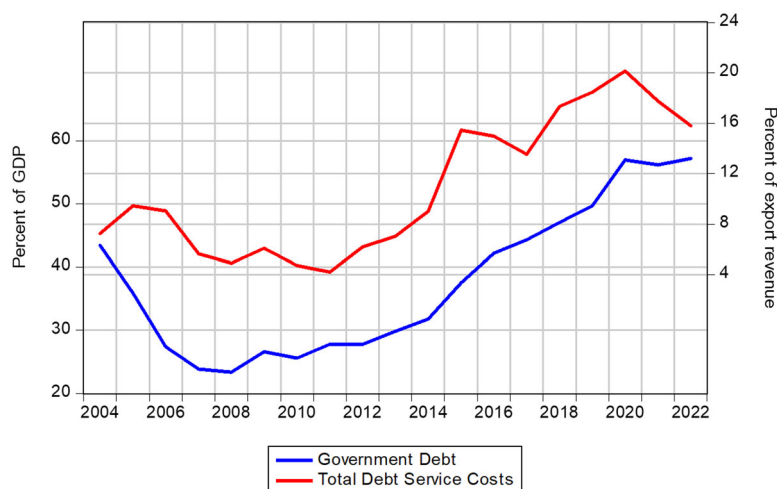
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dependent on the level of debt.<sup>1</sup> The most compelling case relates to debt interest payments. At lower levels of government debt, interest payments are typically low hence governments can allocate resources towards the more efficient export sector thus raising aggregate productivity (Emery, 1967). At high levels of government debt, debt service costs take away much of what could otherwise be channelled towards investment. This is especially relevant in countries where government debt is foreign currency-denominated and guaranteed by future export earnings. The experiences of highly indebted countries such as Eritrea and Liberia are illustrative. As Feder (1983) and Juhász et al. (2023) allude, firms in these countries generally respond by reallocating resources from the productive tradable sector to the less productive non-tradable sector, leading to a decrease in aggregate productivity. High debt service costs also reduce the supply of foreign currency relative to the domestic currency. This facilitates a currency depreciation, which ultimately slows down economic activity by increasing the cost of importing intermediates.

Few places provide a richer ground for examining the interplay between government debt, exports, and economic growth than sub-Saharan Africa. Most sub-Saharan countries face high borrowing costs and continue to grapple with ongoing debt vulnerabilities. Nineteen out of 35 low-income countries in sub-Saharan Africa are currently in debt distress (IMF, 2024). In some of the region's most debt-distressed economies, such as Eritrea, Liberia, São Tomé and Príncipe, and Cabo Verde, government debt averaged 224, 132, 109, and 102% of GDP, respectively, between 2004 and 2023. In addition, government interest payments for the region as a share of total revenue have worrisomely doubled in the last decade (Figure 1) and are expected to increase over the next two years (IMF, 2024). These disturbing facts raise the question of how government debt could be hindering export-led growth as the region integrates into global trade.

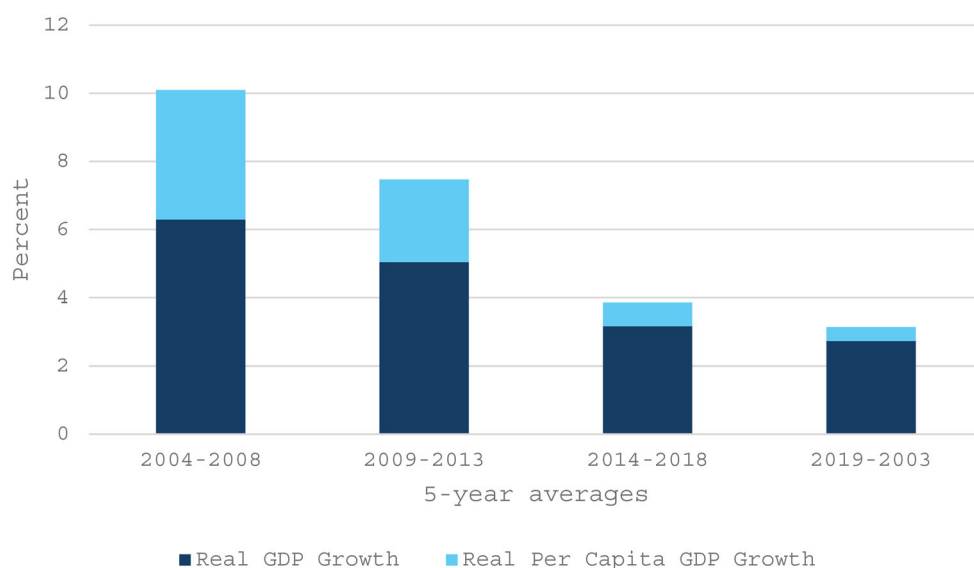
Compounding the region's worsening debt profile is GDP growth that has been slowing since 2004 (Figure 2). Average annual real GDP growth declined from 6.3% between 2004 and 2008 to 2.7% between 2018 and 2023. Similarly, average annual real per capita income growth fell from 3.8% between 2004 and 2008 to a mere 0.14% between 2018 and 2023. What could be undermining the region's economic growth momentum? In this analysis, the possibility of high debt pulling down the region's ability to benefit from export-driven growth is considered.

Within the literature, this article combines two strands of literature. The first strand comprises studies addressing the effect of exports on economic growth (Bozatli et al., 2023; Fosu, 1990; Islam, 2023; Myrodias, 2024; Rangasamy, 2009; Sunde, 2017). Methodologically, these studies either regress growth measures on export intensity or rely on Granger causality tests. A unidirectional causality running from exports to growth is usually taken as evidence of export-led growth. The second strand of literature comprises studies analyzing the non-linear effect of government debt on economic growth. These studies include Reinhart and Rogoff (2010), Nduricimpa (2020), Liu and Lyu (2021), Law et al. (2021), and Shah et al. (2024). An inverted U-shaped relationship is confirmed in these studies, suggesting that small



**Figure 1.** Sub-Saharan Africa's government debt and service costs.

Source: Own computation using data from the IMF.



**Figure 2.** Growth dynamics in sub-Saharan Africa 2004–2023.

Source: Own computation using data from the IMF.

to moderate levels of government debt promote economic growth while high levels of debt could be detrimental.

The current study differs by estimating the impact of exports on economic growth below and above an estimated threshold level of government debt. Unlike Reinhart and Rogoff (2010), this analysis considers a different type of non-linearity between government debt and economic growth. Common approaches available for achieving this objective include the Panel Smooth Transition Regression (PSTR) and the Hansen's (1999) threshold model. Although these models have widely been applied in the literature, they require exogeneity in all covariates, including the threshold variable<sup>2</sup> (Seo & Shin, 2016). This is a strict assumption, given the potential endogeneity of both exports and government debt. It has been argued in the literature that debt is endogenous since low economic growth can attract government debt (Woo & Kumar, 2015). Some of the studies have also argued a reverse causation from growth to exports. The PSTR and the Hansen approach are additionally static, which makes them incapable of capturing the dynamic process of economic growth.

After considering these caveats, this analysis uses two dynamic threshold models proposed by Kremer, Bick, and Nautz (2013) and Seo and Shin (2016). The former accommodates the endogeneity of regressors, which is welcome given that most of the drivers of economic growth are endogenously determined. The latter accommodates the endogeneity of both the regressors and the threshold variable. Reporting results from both models allows the analysis to evaluate the sensitivity of the results to the exogeneity and endogeneity assumptions of the threshold variable. Collectively, compared to previous approaches such as the Hansen (1999) and Caner and Hansen (2004) models, these two models have the advantage of simultaneously accommodating nonlinear asymmetric dynamics, endogeneity, and cross-sectional heterogeneity (Seo & Shin, 2016). The preferred dynamic threshold models are applied to a more recent dataset, which makes the analysis capable of capturing sub-Saharan Africa's recent export, growth, and government debt dynamics.

The results show that exports affect economic growth positively and strongly when government debt is 44–45% of GDP and below. Above this threshold, the impact of exports on economic growth is positive but weaker. This result is robust to the use of real GDP growth and real GDP per capita growth, as well as the inclusion of control variables. In policy senses, the result suggests that government debt in sub-Saharan Africa, which closed 2023 sitting at 61% of GDP, could be constraining the possibility of export-led growth in the region.

In the second part of the article, an attempt is made to establish the extent to which government revenue growth and government expenditure cuts can reduce government debt in the region. The aim is to isolate the effect of each policy option on government debt while holding the other constant. The

IMF (2023) recently showed that most (though not all) countries will need to adjust their primary balances in the region of 2 to 3% of GDP over the next five years for the median country, and much larger in a few cases. Using a variety of estimators, this analysis finds the need for similar policy adjustments if an average sub-Saharan country is to lower its government debt to below 45%. The evidence suggests that an average sub-Saharan country ought to cut the share of government expenditure on GDP in the region of 2 to 15 percentage points or raise the share of government revenue (excluding grants) in the region of 2 to 12 percentage points.

These results can be used to guide fiscal policy formulation and debt restructuring in sub-Saharan countries with high levels of debt, such as Eritrea, Liberia, Cabo Verde, São Tomé and Príncipe, Seychelles, Mozambique, and Burundi. They also improve our understanding of how fiscal outcomes indirectly influence the possibility of export-led growth in sub-Saharan Africa.

The rest of the article is organized as follows. Section 2 reviews theoretical and empirical literature. Section 3 outlines the methodology (data description and model specification). Section 4 presents the regression results. Section 5 summarizes the analysis, provides policy implications, and suggests areas for further research.

## 2. Literature review

In theory, government debt can influence growth in the short and long run through various complicated channels. A useful starting point is the conventional aggregate demand in which aggregate demand (GDP) is expressed as a function of consumer spending (C), investment (I), government expenditure (G) and net exports (X-M), that is,  $GDP = C + I + G + X - M$ . In the short run, it is argued that government debt can stimulate aggregate demand through the Keynesian multiplier effect of expenditure components. The long run effect can either be positive or negative. The negative effect is generally explained by the attendant increase in interest rate which crowds out private investment as discussed in Miller and Modigliani (1961), Gale and Orszag (2003) and Baldacci and Kumar (2010). On the other hand, the positive impact may occur in countries where government debt is spent on productive sectors of the economy and capital accumulation. The use of government debt to improve roads, airports and energy capacity among others for example can facilitate economic growth in the long run through enhancing productivity growth (Elmendorf & Mankiw, 1999).

The positive productivity effect of government debt allocated to capital accumulation may not be guaranteed, however (Adam and Bevan, 2005; Aizenman et al., 2007; Saint-Paul et al., 1996). High government debt may hamper long run growth even when spent in productive sectors of the economy. The argument is that high stock of government debt may induce distortionary taxation to pay the debt, which consequently lowers future potential economic growth. In addition, high government debt may take away the ability of governments to implement countercyclical fiscal policies which leads to higher volatility and lower long run growth (Aghion & Kharroubi, 2007; Woo, 2009). Others have shown that high government debt may culminate in a sovereign debt crisis which can fuel currency crises (Burnside et al., 2001; Hemming et al., 2003).

One area that, until recently, has hardly received a fair share of scholarly attention is the moderating role of government debt on export-led growth. In the main, it has been argued that governments that guarantee debt repayments on future export earnings may constrain long run growth. This channel is especially true in countries such as Zimbabwe where governments have in place export surrender policies which compel exporters including private players to pay a portion of their foreign currency earnings to government. This argument can be reconciled with literature proposing a non-linear association between government debt and economic growth. This literature includes Reinhart and Rogoff (2010), Ndoricimpa (2020), Liu and Lyu (2021), Law et al. (2021), and Shah et al. (2024). The argument raised in these studies is that low levels of debt can enhance growth while high levels of debt (above an estimated threshold point) may negatively affect growth.

The non-linear association between government debt and economic growth raises two theoretical possibilities. One is that if government debt affects economic growth through influencing other components of aggregate demand such as investment, household consumption and net exports, then the impact of these aggregate demand components on economic growth may differ depending on the levels of government debt. The resulting implication (which is the second possibility) is that either

government debt may have an interactive effect with other determinants of economic growth or other growth determinants may be regime dependent, that is, their impact on economic growth may depend on whether debt is below or above an estimated threshold. For exports in particular, the intuition could be that below a debt threshold, export earnings can have a larger multiplier effect and governments can use export earnings to finance investments. Above a threshold point, interest payments are higher and much of export proceeds may be used to repay debt which diminishes the positive impact of exports on economic growth.

Empirically, the above theoretical discussion comes with the challenge of identification since both government debt and exports are most likely endogenous. In addition, it has been argued in the literature that growth in sub-Saharan Africa is constrained by many other factors which may be correlated with government debt. An approach used to mitigate this endogeneity problem is to treat both the threshold variable (government debt) and exports as endogenous while controlling for relevant macro-economic variables for better identification. Using a dynamic panel threshold model that addresses endogeneity this way, Ndoricimpa (2020) finds evidence supporting the regime dependence of nearly all drivers of economic growth. The evidence in Ndoricimpa (2020) particularly show that the impact of domestic investment, trade openness, foreign direct investment and terms of trade depends on whether government debt is below or above 61–65% of GDP.

Similarly, and more recently, Shah et al. (2024) use a dynamic panel threshold model and confirm that inflation negatively affects the public debt-growth relationship above the threshold levels of 14.03% (whole sample), 15.101% (lower middle-income economies), and 9.628% (upper-middle-income economies), respectively. This finding has a virtue of supporting the notion that the impact of growth determinants may differ depending on whether government is below or above an estimated threshold level.

In line with the above reasoning, the current article focuses on the impact of exports. It empirically tests the hypothesis that exports may have a marginal effect on economic growth once government debt exceeds an estimated threshold level. It improves existing studies such as Michaely (1977), Donges and Riedel (1977), Balassa (1978), Tyler (1981), Emery (1967), Donges and Riedel (1977), Weaver (1993), Hultman (1967), Fosu (1990), Trošt and Bojnc (2016) and more recently Srdelić, and Dávila-Fernández (2024) by treating exports as a regime dependent variable whose effect on growth depends on whether government debt is below or above an estimated threshold.

### 3. Materials and methods

This section presents the methodological setup of the article. The section has two main subsections. It describes the data involved and specifies the empirical models.

#### 3.1 Data description

Guided by data availability, the analysis uses an unbalanced panel dataset comprising 44 sub-Saharan countries observed annually between 2004 and 2023.<sup>3</sup> The total sample contains 868 annual observations. The right-hand side variables of interest are exports and government debt. Both variables are percentages of GDP. Economic growth is the dependent variable, and it is proxied by real GDP growth and real per capita GDP growth. Data on all variables are sourced from the International Monetary Fund (IMF). The methodology is divided into two parts. The first part, section 3.1.1, examines how the impact of exports on economic growth is influenced by the level of government debt. The second part, section 3.2.1, determines the extent to which government revenue growth and government expenditure cuts reduce government debt in sub-Saharan Africa. The variables used in this latter section are therefore government debt, government expenditure and government revenue excluding grants. All variables are percentages of GDP.

##### 3.1.1 Model specification

The baseline model is the panel dynamic threshold model proposed by Kremer et al. (2013). It improves Hansen's (1999) specification by relaxing the exogeneity of regressors including lags of the dependent variable. Applying the forward orthogonal deviations transformation of Arellano and Bover (1995) to circumvent endogeneity in a dynamic setup, Kremer et al.'s (2013) model combines the instrumental



variable estimation of Caner and Hansen (2004) with the panel threshold model of Hansen (1999). The model takes the following form.

$$GROWTH_{i,t} = u_i + \theta_1 exports_{it} I(DEBT_{it} \leq \gamma) + \theta_2 I(DEBT_{it} \leq \gamma) + \theta_3 exports_{it} I(DEBT_{it} > \gamma) + \theta_4 x_{it} + \varepsilon_{it} \quad (1)$$

$$i = 1, \dots, 44; t = 2004, \dots, 2023$$

where  $GROWTH_{i,t}$  denotes real GDP growth and real GDP per capita growth for country  $i$  in period  $t$ , exports are total exports as a percentage of GDP, DEBT is government debt as a percentage of GDP,  $x$  is a vector of control variables including the lagged dependent variable,  $u_i$  is unobserved heterogeneity,  $\theta_1, \dots, \theta_4$  are unknown parameters to be estimated,  $\gamma$  is the threshold point and  $\varepsilon_{it}$  is the error term. In this specification, DEBT is the threshold variable, and exports are the only regime dependent variable. Specified this way,  $\theta_1$  captures the effect of exports on economic growth when government debt is at most  $\gamma$  while  $\theta_3$  captures the impact of exports on economic growth when government debt is above  $\gamma$ . Control variables are assumed to be regime independent. This assumption is relaxed in the robustness exercise under the dynamic threshold model of Seo and Shin (2016). Following Arellano and Bover (1995), government debt, exports and the lagged dependent variable are instrumented using their own lags.

To test the robustness of the results, the alternative dynamic model proposed by Seo and Shin (2016) is applied. In this robustness check, both exports and the control variables are assumed to be regime dependent. The estimated dynamic panel threshold model takes the following form:

$$GROWTH_{i,t} = (1, x'_{it}) \theta_1 1(DEBT_{it} \leq \gamma) + (1, x'_{it}) \theta_2 1(DEBT_{it} > \gamma) + \varepsilon_{it} \quad (2)$$

$$\varepsilon_{it} = \alpha_i + v_{it},$$

$$i = 1, \dots, 45; t = 2004, \dots, 2023,$$

where  $GROWTH_{i,t}$  is either annual real GDP growth or annual real GDP per capita growth for country  $i$  and period  $t$ ,  $x'_{it}$  is a  $k_1 \times 1$  vector of time-varying regressors including  $GROWTH_{i,t-1}$  and a measure of export intensity,  $1(\cdot)$  is an indicator function,  $DEBT_{it}$  is the transition variable,  $\gamma$  is the threshold parameter,  $\theta_1$  and  $\theta_2$  are regime-dependent parameters to be estimated, and  $\varepsilon_{it}$  is an error term defined as the sum of unobserved country heterogeneity  $\alpha_i$  and idiosyncratic shocks,  $v_{it}$ . Since the dynamic term  $GROWTH_{i,t-1}$  and the unobserved country heterogeneity invite the Nickell bias (Nickell, 1981) by design, the first difference transformation of Arellano and Bond (1991) is applied to circumvent this resulting endogeneity. This transformation leads to the following specification.

$$\Delta GROWTH_{i,t} = \delta' \Delta x_{it} + \lambda' x'_{it} 1_{it}(\gamma) + \Delta \varepsilon_{it} \quad (3)$$

where  $\Delta$  is the first difference operator,  $\delta_{k_1 \times 1} = (\theta_{12}, \dots, \theta_{1, k_1+1})'$ ,  $\lambda_{(k_1 \times 1) \times 1} = \theta_2 - \theta_1$ , and

$$x_{it} = \begin{pmatrix} (1, x'_{it}) \\ (1, x'_{it-1}) \end{pmatrix}_{2 \times (1+k_1)} \& 1_{it}(\gamma) = \begin{pmatrix} 1(DEBT_{it} > \gamma) \\ -1(DEBT_{it-1} > \gamma) \end{pmatrix}_{2 \times 1}$$

The first difference transformation creates an additional correlation between the transformed regressors and the error term. To circumvent this endogeneity,  $l \times 1$  vector of instruments,  $(z'_{it0}, \dots, z'_{iT})$  for  $2 < t_0 \leq T$  are required, such that either,

$$E(z'_{it0} \Delta \varepsilon_{it0}, \dots, z'_{iT}, \dots, z'_{iT} \Delta \varepsilon_{iT})' = 0,$$

or, for each  $t = t_0, \dots, T$ ,

$$E(\Delta \varepsilon_{it} | z_{it}) = 0$$

Contained in  $z$  are internal instruments namely the lagged values of  $x_{it}$  and  $DEBT_{it}$ . To test for linearity, the following null hypothesis is considered.

$$H_0 : \lambda = 0, \text{ for any } \gamma \in \Gamma$$

Against the alternative hypothesis,

$$H_0 : \lambda \neq 0, \text{ for some } \gamma \in \Gamma$$



The test statistic is,

$$\sup W = \sup_{\gamma \in \Gamma} W_n(\gamma)$$

where  $W_n(\gamma)$  is the standard Wald statistic for each fixed  $\gamma$  i.e.,

$$W_n(\gamma) = n\hat{\lambda}(\gamma)' \hat{\Sigma}_\lambda(\gamma)^{-1} \hat{\lambda}(\gamma)$$

where  $\hat{\lambda}(\gamma)$  is the estimated value of  $\lambda$  given the threshold parameter obtained from the FD-GMM, and  $\hat{\Sigma}_\lambda(\gamma)$  is the consistent asymptotic variance estimator for  $\hat{\lambda}(\gamma)$ . Exogeneity of government debt is tested using a Hausman type test developed in Seo and Shin (2014). The null hypothesis is that the threshold variable, government debt, is exogenous.

When estimating the impact of government debt and exports on economic growth, it is necessary to control for third variables that may jointly affect these variables. In finding these variables, caution should be exercised not to include variables that may be possible channels through which the right-hand side variables of interest may affect economic growth. This reasoning means that the inclusion of investment and human capital stock variables as predicted by the augmented Solow-growth model in the model may be counterintuitive as these variables are likely to be mechanisms through which government debt affects economic growth in the long-run. The analysis therefore controls variables that are less likely to serve as debt and export channels and they include savings (as a percentage of GDP), a 3-year rolling standard deviation of terms of trade proxying external shocks,<sup>4</sup> real effective exchange rate, inflation, and net foreign direct investment. Savings are expected to affect economic growth positively through spurring investment (Cesaratto, 1999). Terms of trade shocks are expected to have a negative effect on economic growth through increasing uncertainty, macroeconomic instability, and distorting government revenues (Hadass & Williamson, 2003; Mendoza, 1997). An appreciation of the real effective exchange rate is expected to reduce economic growth through facilitating a reallocation of resources from the more productive tradable sector to the less productive non-tradable sector (Eichengreen, 2007; Elbadawi et al., 2012). Low levels of inflation may enhance economic growth through greasing the economy while high levels of inflation may increase macroeconomic uncertainty which distorts investment (Sarel, 1996). Its coefficient is therefore expected to be negative or positive depending on whether sub-Saharan countries experienced high or low rates of inflation during the sampling period. Lastly, although the impact of net foreign direct investment is debatable in the literature, most accounts (Borensztein et al., 1998; Moudatsou, 2003) report a positive effect on economic growth that reflects technological spillovers and job creation.

In the second part, the analysis determines the extent to which expenditure cuts and government revenue growth reduce government debt in sub-Saharan Africa. This line of inquiry follows Kollias et al. (2004), Small et al. (2020) and Reis (2022) and the IMF (2023). Some of the key methodological caveats drawn from this literature is that the relationship is likely dependent on the time horizon i.e., short run and long run, potential heterogeneity in debt dynamics, treatment of endogeneity since government debt naturally influences government revenue and expenditure, and the accommodation of cross sectional dependence given the likely presence of common factors such as the 2009 Global Financial Crises, COVID-19 and global commodity price shocks which commonly affect sub-Saharan countries. Wary of these caveats, this analysis employs a variety of estimation approaches that address these challenges. These include the pooled mean group estimator<sup>5</sup> of Pesaran et al. (1999), the instrumental dynamic common correlated effects of Ditzgen (2018), the panel dynamic ordinary least squares estimator<sup>6</sup> of Saikkonen (1991) and Stock and Watson (1993) extended to panel data by Kao and Chang, and the system generalized method of moments are applied of Arellano and Bover (1995) and Blundell and Bond (1998). The PMG estimator builds from the following dynamic model.

$$DEBT_{it} = \sum_{j=1}^p \lambda_{ij} DEBT_{i,t-j} + \sum_{j=0}^q \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (4)$$

$$i = 1, \dots, 44; t = 2004, \dots, 2023$$

where  $\lambda_{ij}$  is a scalar,  $x$  is a vector of two variables, government revenue (excluding grants) and government expenditure,  $\delta$  is the corresponding vector of slope coefficients to be estimated,  $\mu_i$  captures time-invariant heterogeneity and  $\varepsilon_{it}$  is the idiosyncratic term and DEBT is as defined before. Equation (3) can

be reparameterized into an error correction representation which reconciles long run information with short run dynamics.

$$\Delta DEBT_{it} = \phi_i DEBT_{i,t-1} + \beta'_i x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta DEBT_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

where,

$$\begin{aligned} \phi_i &= -\left(1 - \sum_{j=1}^p \lambda_{ij}\right), \quad \beta_i = \sum_{j=0}^q \delta_{ij}, \quad \lambda_{ij}^* = -\sum_{m=j+1}^p \lambda_{im}, \quad j = 1, 2, \dots, p-1; \\ \delta_{ij}^* &= -\sum_{m=j+1}^q \delta_{im}, \quad j = 1, 2, \dots, q-1 \end{aligned}$$

Stacking the time-series observations for each country yields,

$$\Delta DEBT_{it} = \phi_{i,-1} + x_{it} \beta_i + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta DEBT_{i,-j} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta x_{i,-j} + u_{it} + \varepsilon_i \quad (6)$$

Parameter  $\phi_i$  should be less than zero to ensure dynamic stability and a cointegrating relationship defined by,

$$DEBT_{it} = -\left(\frac{\beta'_i}{\phi_i}\right) x_{it} + \eta_{it} \quad (7)$$

For each  $i = 1, 2, \dots, N$  where  $\eta_{it}$  is a stationary process. The long-run coefficients  $\theta_i = -\left(\frac{\beta'_i}{\phi_i}\right)$  are homogenous across countries i.e.,  $\theta_i = \theta, i = 1, 2, \dots, 44$ .

The PMG ignores the possibility of cross-sectional dependence that is likely to arise from unobserved factors common across countries. If unobserved-common factors are correlated with fiscal variables, then OLS parameters become inconsistent (Everaert & De Groote, 2016). Cognizant of this caveat, the analysis supplements the PMG results with the instrumental variable dynamic common correlated effects. This approach has the advantage of simultaneously addressing endogeneity and cross-sectional dependence. The instrumental variable DCCE approach considers the model,

$$DEBT_{it} = \alpha_i + \lambda_i DEBT_{i,t-1} + \beta'_i x_{it} + u_{it} \quad (8)$$

where,

$$u_{it} = \gamma'_i f_t + e_{it}$$

here,  $f$  denotes an unobserved common factor,  $\gamma_i$  is a heterogeneous factor loading,  $\alpha_i$  captures country specific heterogeneity, and  $e_{it}$  is a cross-section unit-specific independent and identically distributed error term. Because the lagged dependent variable is not strictly exogenous, the floor of  $\sqrt[3]{T}$  lags of the cross-sectional averages for both the dependent variable and the strictly exogenous variables are added to gain consistency (Chudik & Pesaran, 2015). The model then becomes,

$$DEBT_{it} = \alpha_i + \lambda_i DEBT_{i,t-1} + \beta'_i x_{it} + \sum_{l=0}^{P_T} \delta'_{il} \bar{z}_{t-l} + e_{it} \quad (9)$$

where  $\bar{z}_t = (\overline{DEBT}_t, \bar{x}_t)$  and  $P_T = \lfloor \sqrt[3]{T} \rfloor$ . By stacking  $\lambda_i$  and  $\beta_i$  into  $\pi_i = (\lambda_i, \beta_i)$ , the mean group (MG) estimates are,

$$\hat{\pi}_{MG} = \frac{1}{N} \sum_{i=1}^N \hat{\pi}_i$$

To test for cross-sectional dependence, the CD test statistic for unbalanced panels developed by Pesaran (2015) is applied.

$$CD = \sqrt{\frac{2}{N(N-1)}} \left( \sum_{i=1}^{N-1} \sum_{j=i+1}^N \sqrt{T_{ij}} \hat{\rho}_{ij} \right)$$

where  $\hat{\rho}_{ij}$  is the correlation coefficient. The null hypothesis of the test is that the error term (or variable) is weakly cross-sectional dependent where weak cross-sectional dependence means that the correlation between units at each point in time converges to zero as the number of cross sections goes to infinity. To address endogeneity, government revenue and government expenditure are instrumented using their own lags. Because debt is an accumulation of fiscal deficits, the use of lagged fiscal variables as instruments may be questionable. To address this potential criticism, the system generalized method of moments is applied. This approach uses internally constructed instruments to exogenize variation in government revenue and government expenditure.

$$\Delta DEBT_{it} = \lambda + \delta \Delta DEBT_{it-1} + \omega \Delta X_t + \Delta \varepsilon_{it} \quad (10)$$

where the first difference operator  $\Delta$  eliminates the unobserved time-invariant heterogeneity. To control for endogeneity of government expenditure and government revenue embedded in vector  $x$  as well as the correlation between the differenced dynamic term and the differenced error term, Blundell, and Bond (1998) and Arellano and Bover (1995) recommend combining the first differenced equation with the equation in which the level regressors are instrumented by their first differenced terms. The Sargan test for over-identifying restrictions and the Arellano and Bond test for AR (1) and AR (2) autocorrelation are used to validate the system GMM estimates.

Lastly, the panel dynamic ordinary least squares method (PDOLS) is considered due to its desirable properties when  $T$  is not considerably large. The PDOLS uses leads and lags of first differenced endogenous regressors to address endogeneity as follows,

$$DEBT_{it} = \beta_0 + \sum_{i=1}^n \beta_i x_{i,t} + \sum_{i=1}^n \sum_{j=-k_1}^{k_3} \gamma_{i,j} \Delta x_{i,t-j} + \varepsilon_t \quad (11)$$

where the additional term  $\sum_{i=1}^n \sum_{j=-k_1}^{k_3} \gamma_{i,j} \Delta x_{i,t-j}$  captures the leads and lags of first differenced regressors (government revenue and government expenditure). Both the optimum lead and lag are automatically selected using the Akaike information criterion.

Since the PDOLS and the PMG are cointegrating estimators, it is necessary to first conduct panel unit root tests. Out of the several tests available for panel unit root testing, this analysis uses the Im et al. (2003), and Fisher-type (Choi 2001) tests. These tests are selected since they are applicable in cases of unbalanced panels. After unit root testing, cointegration is then tested using the residual-based test proposed by Pedroni (2001) and the error-correction based method by Westerlund (2007) to determine whether a long run relationship exists between government debt, government revenue and government expenditure. The Westerlund test is based on structural rather than residual dynamics, which makes it less restrictive as it does not impose any common factor restriction. The Pedroni test accommodates the heterogeneity among the members of the panel. Other robustness exercises included the standard panel VAR with an orthogonal forward transformation and the Bayesian VAR. Specifications of these latter models are deliberately excluded in the interest of brevity.

The penultimate section of the study considers counterfactuals based on three policy scenarios. The three scenarios include cutting government expenditure (as a percentage of GDP) by 5 percentage points, 10 percentage points and 15 percentage points. These three scenarios imply cutting expenditure from a baseline scenario of 24–19, 14 and 9%, respectively. The baseline scenario is essentially the average share of government expenditure in sub-Saharan Africa between 2004 and 2023. The three scenarios are based on a structural equation in which government debt relies on government revenue (excluding grants). The aim is to determine the level of debt that is consistent with each of these three counterfactual scenarios. A welcome scenario will be one that brings government debt below the threshold level estimated in Eq. (1).

#### 4. The empirical results

Table 1 presents summary statistics. Real GDP growth averaged 4.1% annually while real GDP per capita averaged 1.5%. This suggests that much of sub-Saharan Africa income growth between 2004 and 2023 may not have culminated in significant per person welfare gains. Government debt averaged 55% of GDP with a standard deviation of 51. The sheer size of the standard deviation indicates the high

**Table 1.** Summary statistics.

Variable	Obs	Mean	Standard deviation
Real GDP Growth (%)	868	4.065084	5.256813
Real per capita GDP Growth (%)	868	1.518947	5.106325
Government Debt (% of GDP)	868	55.09071	50.60136
Exports (% of GDP)	868	29.79627	19.05622
Government revenue (% of GDP)	868	18.46809	9.666097
Government expenditure (% of GDP)	868	23.97862	9.898043

variability of debt profiles across the 44 sub-Saharan countries from the fiscally disciplined Botswana to the most indebted Eritrea. Exports were, on average, 30% of GDP which is 2 percentage points higher than the global average. Government expenditure and government revenue were, on average 24 and 19% of GDP, respectively.

The 44 sub-Saharan countries are ranked by average values of exports, government debt, and real GDP growth in [Figures 3, 4, and 5](#), respectively. Top 5 exporters were Angola, Benin, Botswana, Burkina Faso, and Burundi in descending order. The bottom 5 comprised São Tomé and Príncipe, Tanzania, Togo, Uganda, and Zambia in descending order. Angola's exports were primarily driven by oil production. Benin's exports were largely driven by unprocessed agricultural products (cotton and cashew nuts). Botswana's high share of exports was primarily supported by the mining sector. It benefited heavily from the expansion of diamond exports.

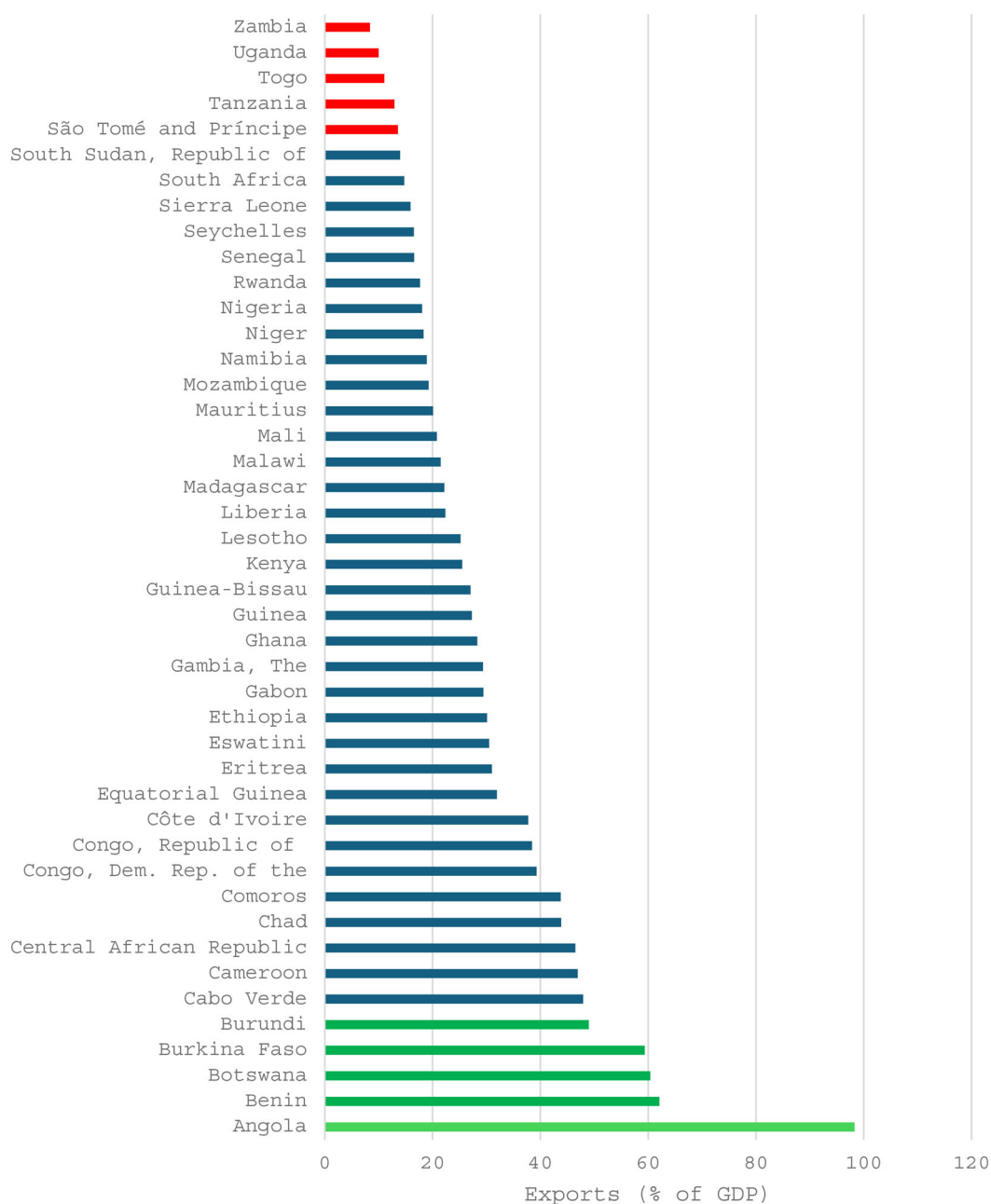
Burkina Faso's exports were spurred by gold and cotton production. The former accounted for at least 70% of total export earnings during the sampling period. Burundi benefited from coffee and gold exports, which account for 25.9 and 25% of total exports, respectively. Other significant exports were tea and cigars. Zambia's exports, which mainly consist of copper, suffered successive years of declining copper prices. Uganda's trade was largely constrained by the heavy presence of non-tariff barriers, including administrative and bureaucratic inefficiencies, poor infrastructure, and complicated sanitary and phytosanitary conditions.

[Figure 4](#) ranks the countries by the average government debt. The top five indebted countries were Eritrea, Liberia, São Tomé and Príncipe, Cabo Verde, and Guinea-Bissau in descending order. Government debt in these countries averaged above 90% of GDP. Eritrea has recently tightened its fiscal policy to improve its debt profile. Liberia's high debt reflects revenue losses and fiscal deficits. The least indebted countries were Botswana, Equatorial Guinea, Eswatini, Nigeria, and Comoros in descending order. In these countries, debt averaged below 30% of GDP.

In [Figure 5](#), the 44 countries are ranked by average annual real GDP growth. The fastest-growing economies were Ethiopia, Rwanda, Tanzania, The Democratic Republic of the Congo, and Uganda in descending order. Real GDP in these countries grew in excess of 6% on average annually. Growth in Rwanda was primarily driven by policy reforms and foreign direct investment, while Ethiopia benefited from public infrastructure investments. The slowest-growing economies were South Sudan, the Central African Republic, Lesotho, Equatorial Guinea, and South Africa.

[Table 2](#) presents the results from four regression variants. The statistic SupWStar reported at the bottom of the table tests the null hypothesis of no threshold effect in the model. Since the statistic SupWStar is statistically significant at the 5% level across all the regression variants, the analysis concludes that a threshold effect exists in the estimated regression models.

The first variant uses real GDP growth as the dependent variable, excluding control variables. The second variant enhances the first by including control variables. The third variant excludes control variables and uses real GDP per capita growth as the dependent variable. The fourth and final variant enhances the third by adding control variables. Overall, the results indicate a strong positive correlation between exports and economic growth in the short run when government debt is below 46% of GDP. Below this threshold, a one percentage point increase in exports is projected to boost annual average economic growth in the short run by 13–15 basis points, all else being equal. This is in line with Fosu (1990) and more recently Kalaitzi and Chamberlain (2020) who identify a positive correlation between exports and economic growth in the short term. [Table 2](#) also indicates that the impact of exports significantly decreases from 13 to 15 basis points to just 4–7 basis points when government debt as a percentage of GDP surpasses the 45% threshold.

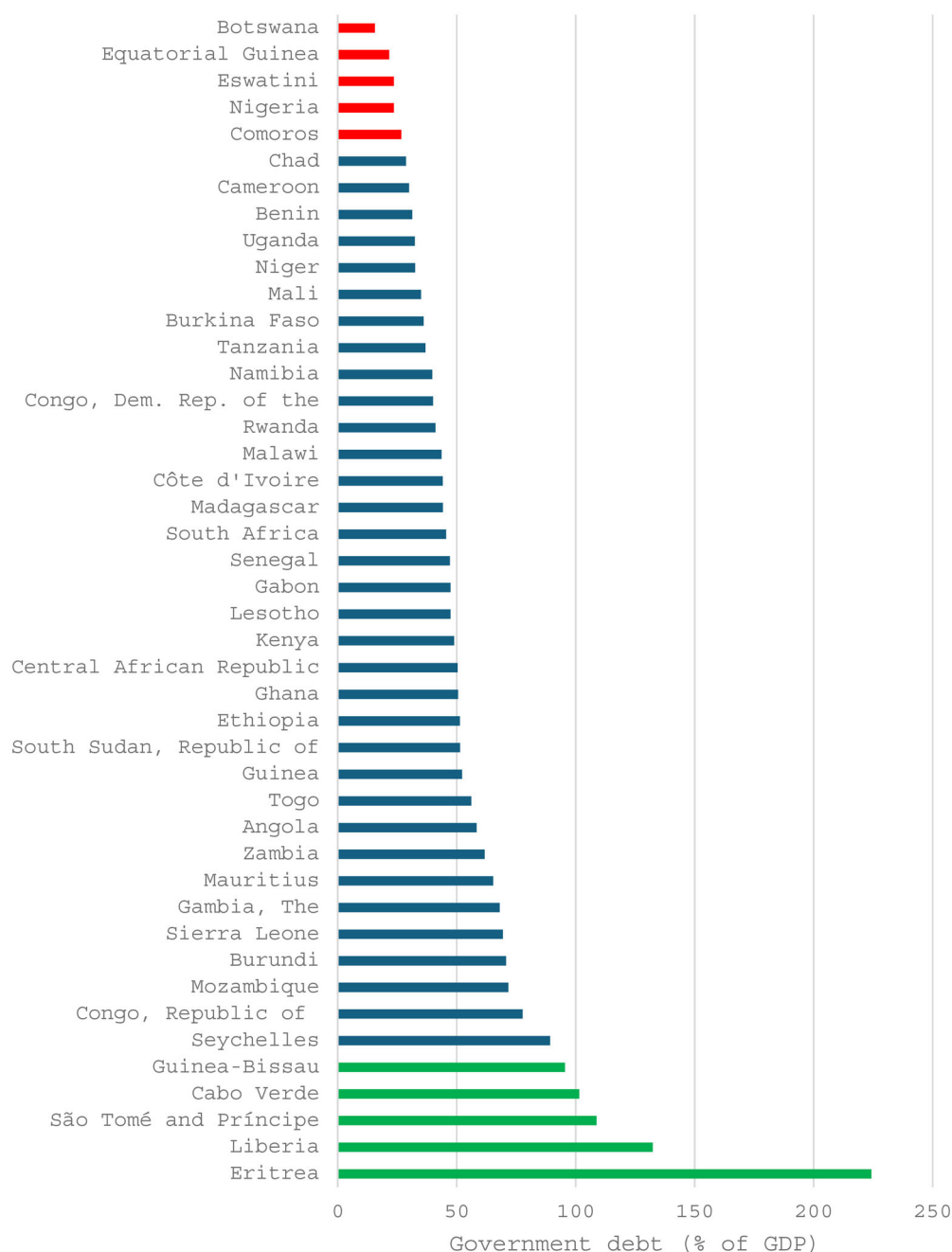


**Figure 3.** Average Exports (% of GDP) (2003–2023).

Source: Own computation using data from the IMF.

In the long run, a one percentage point increase in exports raises average annual growth by 11–14 basis points when government debt is below 46% of GDP. The range of 11–14% notably includes the point estimate of 12.3% as reported in Fosu (1990), who utilized the pooled least squares estimator on a sample of 54 African countries. However, beyond the estimated threshold, the long-term marginal growth effect of increasing exports declines from 14 basis points to just 4 basis points. Changing the dependent variable from real GDP growth to real per capita GDP growth and incorporating control variables does not significantly change the main finding that export-driven growth is more robust in economies with low to moderate debt levels and weaker in heavily indebted countries.

Debt has a negative and significant effect on economic growth, validating the general result that government debt is detrimental to economic growth. This result is consistent with Adedeji et al.'s (2023) finding that public debt has an adverse effect on economic growth in sub-Saharan Africa. The World Bank (2023) proposes several possible reasons for this negative effect, and they include inadequate debt



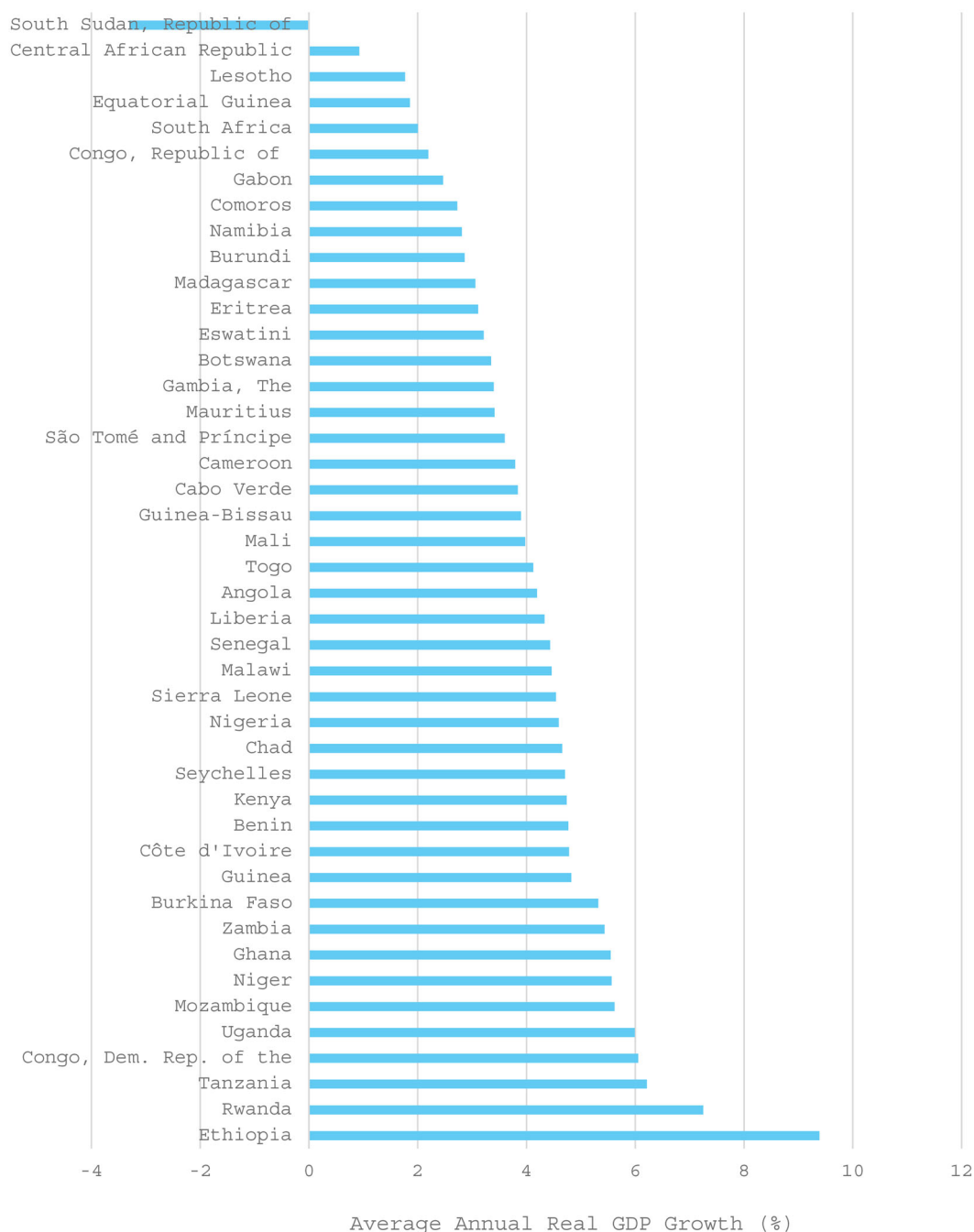
**Figure 4.** Average Government Debt (% of GDP) (2004–2023).

Source: Own computation using data from the IMF.

management systems, considerable debt transparency difficulties, and bad macro-fiscal management, along with growing reliance on costlier sources of financing.

All the control variables enter with expected signs. According to the findings, external shocks are deleterious to both short- and long-run economic growth in Sub-Saharan Africa, which is consistent with Mendoza (1997). Most sub-Saharan African economies are commodity-dependent, with little to no effect on global commodity prices. A terms of trade shock consequently affects economic growth negatively by increasing macroeconomic volatility and lowering government income. According to the findings, a one-standard deviation rise in terms of trade diminishes short-term average annual economic growth by 2.5 basis points. This is slightly lower than the 8.8 basis point decline in yearly growth reported in Toulaboe (2011).

As predicted, the share of savings on GDP has a favorable and large impact on economic growth. Although consistent with expectations, the marginal effect of 0.11 is less than the 0.310 estimated by



**Figure 5.** Average Real GDP (%) Growth (2004–2023).

Source: Own computation using data from the IMF.

Rodrik (2008) in a large sample of developing nations. The relatively modest marginal effect is unsurprising given that sub-Saharan projects are mostly funded by grants and foreign aid.

Inflation has a negative sign which is statistically significant at 1%. The negative and statistical significance of inflation emphasizes the necessity of price stability in promoting economic progress in sub-Saharan Africa. The coefficient of  $-0.059$  is not far from the  $-0.027$  estimated in Toulaboe (2011).

The real exchange rate, although carrying the expected negative sign reported in Rapetti et al. (2012), and Elbadawi et al. (2012), enters with marginal significance in only one specification. Net foreign direct investment has a positive but small marginal effect on economic growth. A percentage point increase in net foreign direct investment raises the average short run growth on impact by 3–4 basis points. This result agrees with literature that reports a positive but modest effect of foreign direct investment on economic growth in sub-Saharan Africa. Bekere and Bersisa (2018) for instance find FDI positive and



**Table 2.** Government debt, exports and economic growth.

	Dependent variable			
	(1) Real GDP growth (%)	(2) Real GDP growth (%)	(3) Real per capita GDP growth (%)	(4) Real per capita GDP growth (%)
Real GDP growth (%) (–1)	–0.0951*** (0.0306)	–0.116*** (0.0311)	–	–
Real per capita GDP (%) (–1)	–	–	–0.0991*** (0.0305)	–0.126*** (0.0312)
below_thres_b	0.151*** (0.0236)	0.145*** (0.0226)	0.136*** (0.0230)	0.132*** (0.0221)
above_thres_b	0.0445** (0.0224)	0.0730*** (0.0226)	0.0408* (0.0220)	0.0704*** (0.0221)
Debt (% of GDP)	–0.0036*** (0.00012)	–0.0053*** (0.00128)	–0.0050*** (0.00147)	–0.00717*** (0.00113)
ToT_sd3	–	–0.0252* (0.0150)	–	–0.0248* (0.0147)
Savings (% of GDP)	–	0.111*** (0.0265)	–	0.106*** (0.0259)
lnREER	–	–2.538* (1.427)	–	–1.882 (1.393)
FDI (% of GDP)	–	0.0363*** (0.0136)	–	0.0339*** (0.0133)
Inflation (%)	–	–0.0591*** (0.0116)	–	–0.0569*** (0.0113)
Constant	1.672** (0.737)	11.78* (6.642)	–0.704 (0.725)	6.328 (6.490)
Threshold debt	45%	44%	44%	44%
SupWStar test ( <i>p</i> -value)	0.0000	0.0001	0.0000	0.0031
Observations	824	824	824	824
Number of countries	44	44	44	44

Standard errors in parentheses.

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ .

insignificant under the fixed effects approach and positive but marginally significant under the GMM technique.

The lagged terms of the dependent variable are all statistically significant suggesting that modelling economic growth using static models risks model underfitting and an omitted variable bias. The negative sign associated with the lagged dependent variable indicates that a rise in economic growth in the current year is accompanied by a slowdown in economic growth in the subsequent year. This result confirms the turbulent nature of economic growth patterns in sub-Saharan Africa.

Table 3 shows the results of a different dynamic threshold model proposed in Seo and Shin (2014). In this table, the symbols b and d are used to indicate the effect of variables below and above a specified threshold level. In this alternative model, the threshold level of government debt is 44% of GDP in all specifications. When government debt is equal to or less than 44% of GDP, exports are positively and significantly related to economic growth. A one percentage point increase in exports as a percentage of GDP is estimated to increase economic growth by 17 to 37 basis points when government debt is below 45%. When government debt surpasses 44% of GDP, the impact of exports is positive but statistically insignificant in the first two specifications and statistically negative in the last two specifications. The last two specifications indicate that exports expansion in fact reduces economic growth when government debt surpasses 44% of GDP.

The bootstrap probability value is lower than the 1% level of significance indicating that government debt non-linearly influences the impact of exports on economic growth.

The main result is that exports have a larger impact on economic growth when government debt is below 46% of GDP. Above this limit, exports have a weaker effect on economic growth at best. In the next set of results, the countries were separated into three groups. Informed by the average values of government debt displayed earlier in Figure 4, the first group comprises countries in the bottom 5. These countries are Eritrea, São Tomé and Príncipe, Guinea-Bissau, and Cabo Verde, Liberia. The second group comprises countries in the top 5 and they are Botswana, Equatorial Guinea, Eswatini, Nigeria and Comoros. The third group comprises countries with moderate average levels of debt, and they are Gabon, Lesotho, Kenya, South Africa and Senegal.

**Table 3.** Government debt, exports and economic growth.

	Dependent variable			
	(1) Real GDP growth (%)	(2) Real GDP growth (%)	(3) Real per capita GDP Growth (%)	(4) Real per capita GDP Growth (%)
Lag_y_b	0.470*** (0.0892)	−0.215* (0.126)	0.0515* (0.0302)	−0.123* (0.0691)
ToT_sd3_b	—	0.0264*** (0.0060)	—	0.0451 (0.0995)
Savings (% of GDP)_b	—	0.00230 (0.0982)	—	−0.00485 (0.0610)
lnREER_b	—	−0.0989** (0.0485)	—	−0.0444*** (0.0158)
Inflation (%)_b	—	−0.0531 (0.128)	—	−0.0239 (0.0537)
FDI (% of GDP)_b	—	0.205 (0.246)	—	−0.00464 (0.0441)
Exports (% of GDP)_b	0.170*** (0.0495)	0.237* (0.121)	0.368*** (0.0230)	0.371*** (0.0484)
cons_d	−6.908*** (2.301)	−2.124 (8.530)	4.888*** (0.647)	−2.919 (7.486)
Lag_y_d	−0.564*** (0.0908)	0.0318 (0.143)	−0.0832** (0.0370)	0.0952 (0.132)
ToT_sd3_d	—	0.0969 (0.0789)	—	0.948*** (0.181)
Savings (% of GDP)_d	—	0.141 (0.120)	—	0.573*** (0.0988)
lnREER_d	—	−0.0785*** (0.0152)	—	−0.0503*** (0.0166)
Inflation (%)_d	—	−0.205 (0.147)	—	−0.225 (0.163)
FDI (% of GDP)_d	—	0.169 (0.233)	—	0.240** (0.104)
Exports (% of GDP)_d	0.0432 (0.0553)	0.0924 (0.113)	−0.215*** (0.0156)	−0.108*** (0.0417)
r	44.55*** (6.995)	42.86** (18.14)	42.34*** (9.293)	43.58*** (6.795)
Bootstrap <i>p</i> -value for linearity test	0.0000	0.0000	0.0000	0.0000
Number of countries	44	44	44	44

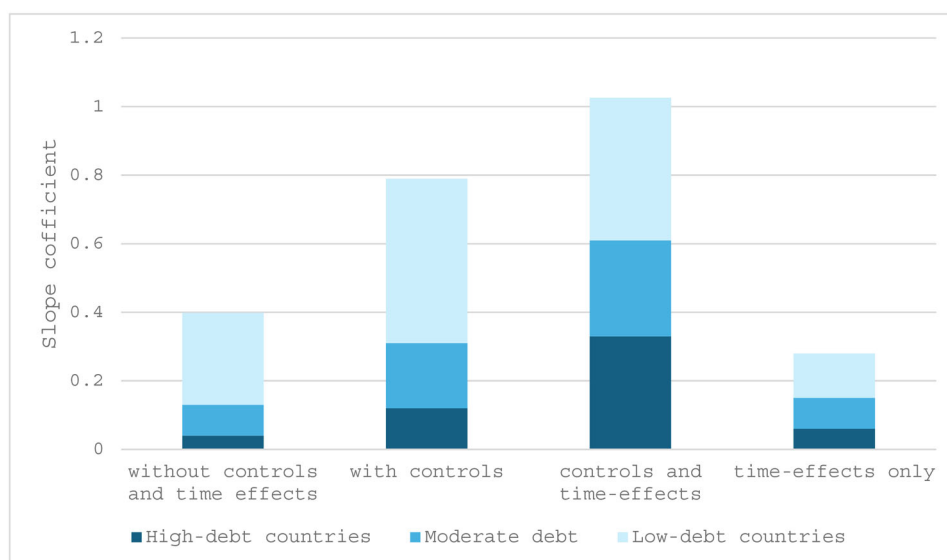
Standard errors in parentheses.

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ .

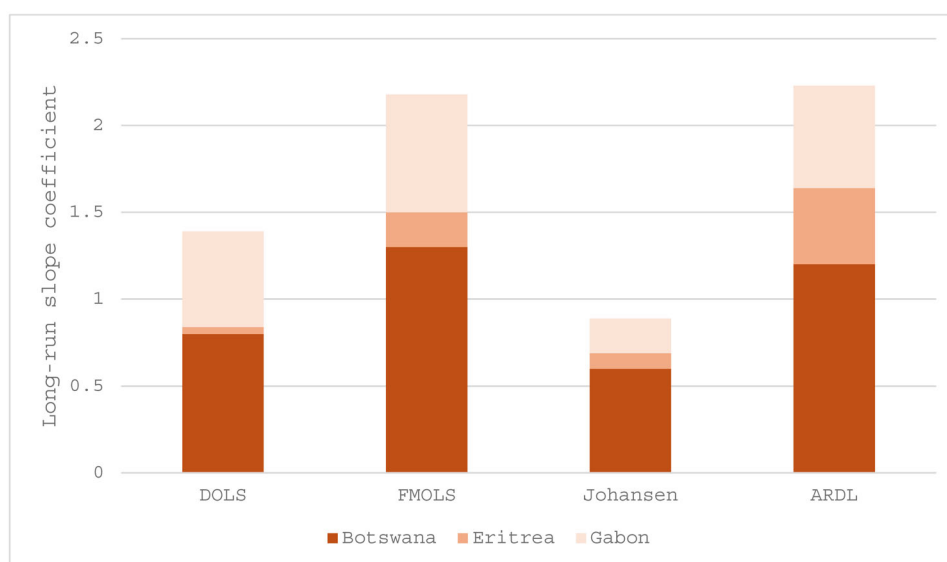
Each set has 5 countries which translates to a panel time series in which  $T$  is considerably smaller than  $N$ . To address unobserved heterogeneity, the Nickel-Bias, and the potential endogeneity arising from the feedback effect, and omitted time-varying factors nested in the error term, the analysis implements the Anderson and Hsiao estimator with a bias approximation suggested by Bun and Kiviet (2003). In these estimations, the control variables are similar to those reported in Table 3. Government debt does not appear in these estimations since the categorization itself groups countries into high-debt, moderate and low-debt countries. The intention is to infer if the effect of exports on economic growth is heterogeneous across the three groups.

Figure 6 reports the slope coefficients for the three government debt categories. The estimated coefficient of export is higher in low-indebted countries (Botswana, Equatorial Guinea, Eswatini, Nigeria and Comoros) than in high-indebted countries (Eritrea, São Tomé and Príncipe, Guinea-Bissau and Cape Verde, Liberia). The inclusion of controls and time effects changes the size of the coefficients, but not the original result that exports have a weaker impact on growth in countries with high government debt.

To further examine the robustness of this result, estimates are considered for the country with the lowest government debt (Botswana), the middle country (Gabon), and the country with the highest (Eritrea). These estimations use alternative datasets from the respective central banks and the World Development Indicators (WDI) covering the period 1980–2023. This time, the outcome variable is real per capita income in logarithm form (i.e., base 10). The independent variable of interest is still the percentage of exports of goods and services on GDP. For each specification, standard time series procedures were followed. Variables were subjected to unit root tests using the Augmented Dickey Fuller and



**Figure 6.** Estimations for high, moderate and low debt countries.



**Figure 7.** Time series estimations.

Notes: The DOLS uses 1 lead and 1 lag automatically selected by the AIC. The Johansen cointegrating vector uses 2 lags automatically selected by the AIC from an initially estimated VAR and VECM models. The ARDL uses 2 lags of the dependent variable and 1 lag of the independent variable of interest. The models passed standard diagnostic tests i.e., serial correlation, residual normality, model specification and heteroscedasticity. The VAR and VECM were dynamically stable.

the Phillips Perron tests. The general conclusion was that all variables were  $I(1)$  processes whose linear combination was  $I(0)$ .<sup>7</sup>

Figure 7 displays the estimated slope coefficients for the three countries. The main result still shows up in time series estimations. All the approaches (the dynamic ordinary least squares, the fully modified ordinary least squares, the autoregressive distributed lag model and the cointegrating vector under the Johansen approach) indicate that exports have a larger effect on economic growth (the log of real income per capita) in the case of Botswana (the low-debt country), a large effect in Gabon (a moderate debt country) and a small effect on economic growth in the highly indebted Eritrea. This result is both comforting and reassuring.

In the next step, the analysis determines the extent to which increasing government revenue and reducing public expenditure can reduce government debt in sub-Saharan Africa. The starting point involved testing for panel unit root tests. Government debt, government expenditure and government

revenue were all non-stationary processes.<sup>8</sup> The non-stationarity of government debt crudely suggests that government debt is, on average, unsustainable in sub-Saharan Africa. This is consistent with the experiences of most sub-Saharan countries. In the early 2000s for example, most sub-Saharan countries went into debt overhang as the median government debt-ratio peaked at about 80% of GDP. Upon realization of this non-mean reverting tendency of government debt, the international community intervened through multiple debt relief programs which included the Heavily Indebted Poor Countries (HIPC) initiative.

From the Pedroni cointegration test, seven out of eleven test statistics rejected the null hypothesis of no cointegration at the 5% level. This indicated the presence of a long run relationship between government debt, government expenditure and government revenue. Similarly, both null hypotheses of no cointegration for some panels and no cointegration for all panels were rejected by the Westerlund approach at the 5% level suggesting that government debt, government expenditure and government revenue can be modelled as a cointegrating relationship.

Given the indications of a cointegrating relationship, the analysis considered the PMG and the panel dynamic ordinary least squares method. These results were supplemented by additional non-cointegrating estimators namely the system GMM and the instrumental variable DCCE. The estimated results are presented in Table 4. In the long run, all estimators confirm that expenditure cuts have a larger effect on cutting debt compared to raising revenue. A percentage point cut in government expenditure is estimated to reduce government debt by 1.1–5.8 percentage points holding constant government revenue. To keep debt below 45% of GDP therefore, an average sub-Saharan country therefore needed to cut government expenditure by about 2–10 percentage points<sup>9</sup> (6 on average i.e.,  $2 + 10/2$ ) holding government revenue constant. Raising government revenue by one percentage point reduces government debt on impact by 0.8–4.5 percentage points holding constant government expenditure. To keep debt below 45% of GDP therefore, an average sub-Saharan country needed to alternatively raise government revenue by about 2–12 percentage points (7 on average i.e.,  $2 + 12/2$ ).

The estimated results presented in Table 4 show that government debt in sub-Saharan Africa is primarily driven by increases in government expenditure compared to decreases in government revenue. They also suggest that cutting government expenditure could be a more effective way of reducing government debt in sub-Saharan Africa compared to raising revenue (which in most cases requires governments to impose distortionary taxes).

The speed of adjustment under the PMG column is  $-0.139$  indicating that only about 14% of the disequilibrium is corrected each year when the government debt deviates from its long run equilibrium

**Table 4.** Government expenditure, revenue, and debt.

	Dependent variable			
	PMG (1, 2)	Government IV-DCC	debt (%) S-GMM	of GDP) DOLS (1) 1)
Expenditure	5.778*** (0.397)	2.319* (1.262)	1.0918*** (0.045)	3.144*** (0.355)
Revenue	-4.499*** (0.529)	-0.8115* (0.465)	-1.070*** (0.062)	-1.489*** (0.441)
Cointeq01	-0.139*** (0.029)	–	–	–
Debt (–1)	–	0.554*** (0.081)	0.896*** (0.011)	–
D (G. Debt (–1))	0.206*** (0.039)	–	–	–
D(Expenditure)	0.526*** (0.243)	–	–	–
D(Revenue)	-0.823*** (0.253)	–	–	–
Observations	780	736	824	797
Number of countries	44	44	44	44
A-B AR (1)			0.0013	
A-B AR (2)			0.6036	
Sargan			0.9868	
CD-statistic	45.99***	-0.64		

Standard errors in parentheses. The PMG (1, 2) was selected by the AIC.

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ .

level. Consequently, it takes up to 7 years for government debt to return to its equilibrium value in the event of a short-run shock. This slow speed of adjustment is consistent with the debt dynamics of most sub-Saharan countries. It is well known for example that most sub-Saharan countries have challenges honouring sovereign debt. The lagged dependent variable is, in both the instrumental variable DCCE and the system GMM, positive and statistically significant confirming the experiences of most sub-Saharan countries in which borrowing in current periods is generally followed by additional borrowing in subsequent years. The short-run coefficients under the PMG are considerably smaller indicating that efforts to cut government expenditure or raise government revenue to reduce debt are more rewarding in the long run compared to the short run.

An alternative approach, the system of equations approach, was pursued for robustness purposes. Compared to the single equation approach pursued in the previous tables, a system of equations captures the possible interdependencies among the variables. The analysis specifically estimated a three-variable panel vector autoregression using the forward orthogonal deviation transformation proposed by Arrellano and Bond. Informed by unit roots results discussed earlier, all variables were transformed into first differences to ensure dynamic stability. In addition, it is assumed that the coefficients associated with government debt, government expenditure, and government revenue in the system are common across the 44 countries and that unobserved heterogeneity is absorbed, in part, by the first difference transformation. Since the coefficients themselves are of little importance, the analysis proceeds to present results from the impulse response functions.

The ordering assumes that shocks in government revenue and government expenditure have a contemporaneous effect on government debt. This is reasonable since government debt in sub-Saharan is mostly sensitive to budgetary dynamics. By implication, government revenue and government expenditure are placed before government debt. Government revenue is placed before government expenditure since the former usually determines how much governments can spend. Panel granger causality results attached in appendix support this ordering. Causality is found running from government revenue to government expenditure and not the other way round. The evidence further confirms that government revenue and government expenditure granger cause government debt.

Figure 8 displays the impulse response functions based on the Cholesky ordering explained above. Consistent with the results observed earlier, a shock in expenditure is accompanied by an immediate spurt

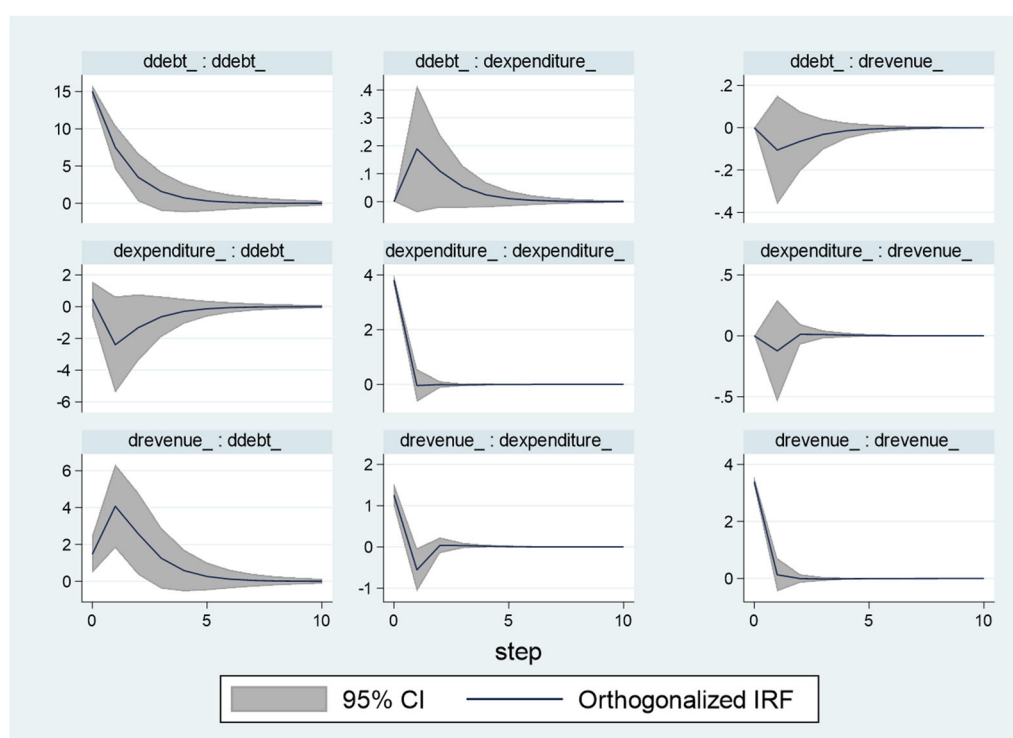


Figure 8. Impulse response functions.

in government debt which peaks in the second period, decays and vanishes after 6–7 years. This period of adjustment is consistent with the error correction term of  $-0.14$  in Table 4 which implied 7 years of adjustment in response to a short-run shock. A shock in revenue is also associated with a decrease in debt. This is expected since revenue growth and fiscal windfalls can be partially used to service debt. A visual inspection of the graph additionally confirms the prior result that government debt is more sensitive to changes in government expenditure dynamics than changes in government revenue.

The variance decomposition for debt is presented in Figure 9. The importance of debt's own shocks is excluded since interest is on expenditure and revenue. A cursory look at the graph is reassuring. Expenditure cuts play a bigger role on debt reductions than revenue growth.

The impulse response functions from a Bayesian VAR with Minnesota determined priors produced a similar pattern (see Figure 10) which is further comforting. Changes in government expenditure have a large effect on government debt than changes in revenue.

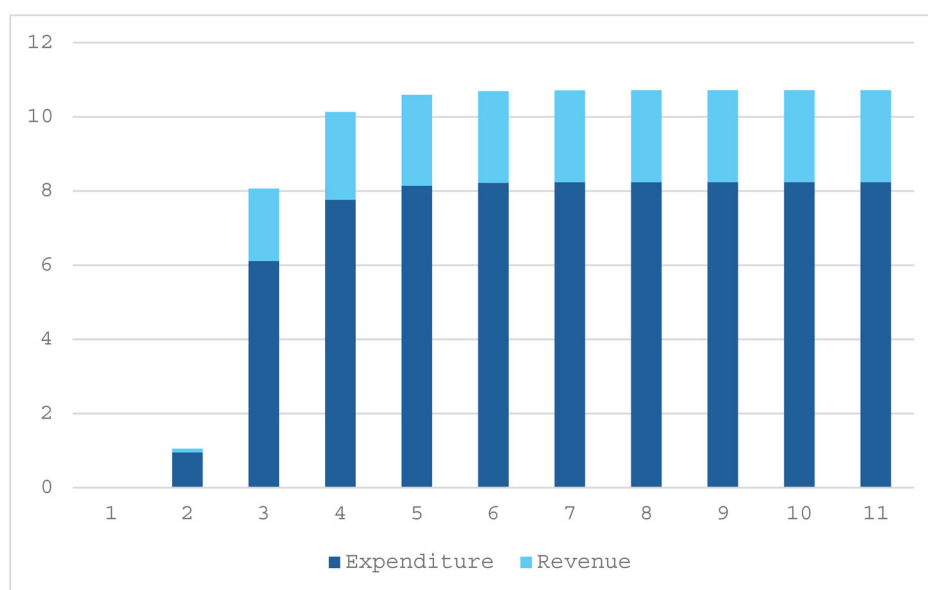


Figure 9. Variance decomposition.

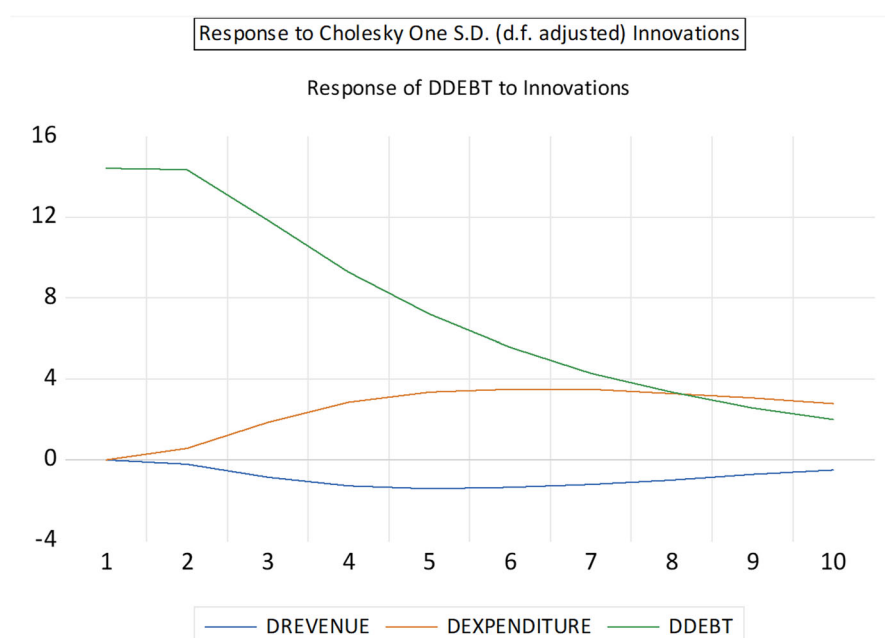


Figure 10. Impulse response functions from a Bayesian VAR.

Overall, the evidence suggests that high levels of government diminish the positive impact of exports on economic growth. Governments stuck in high debt, defined as debt to GDP ratio of 46% and above are less likely to experience robust economic growth from expanding the export sector. The larger effect of government expenditure on debt compared to the effect of revenue growth is consistent with the practice of most sub-Saharan governments and the historical policy advice from the IMF and the World Bank. The IMF has mostly advised indebted governments to exercise fiscal discipline and reduce wasteful fiscal expenditure.

Counterfactual scenarios in Figure 11 consider three alternative policy scenarios. The first, second and third scenarios consider cutting government debt (as a percentage of GDP) by 5 percentage points, 10 percentage points and 15 percentage points, respectively. The baseline scenario is the average debt of 55% of GDP and government expenditure of 24% of GDP. In this exercise, a simple structural equation is considered in which government expenditure is entirely financed by government revenue (excluding grants). Revenue from grants is omitted due to data unavailability. This omission is less likely to have strong consequences since we are not primarily interested in interpreting the marginal effect of revenue on government expenditure. The aim is to control for what is plausibly government's main source of revenue.

In general, governments decide to cut or raise expenditure for a specific reason. The latter may be encouraged by revenue windfalls (favorable commodity prices). The former may be motivated by a decline in revenue. In each of these cases, depending on whether the decision is to cut or reduce spending, the smaller (larger) shocks in government revenue would have been passed along from the auxiliary regression (which regresses government expenditure on government revenue), to shocks in debt due to the correlation between government expenditure and government revenue. The new level of debt would be the direct effect of a change in government expenditure in the debt equation plus the magnitude of the shock in government revenue.

By considering the afore mentioned policy scenarios, the analysis is essentially probing the effect on government debt if government expenditure as a percentage of GDP (which is considered endogenous) was exogenously cut by 5 percentage points, 10 percentage points and 15 percentage points. Methodologically, we cannot accurately determine how debt will respond to changes in government expenditure without first probing about changes in government expenditure holding constant shocks in government revenue. This is the primary reason why counterfactual scenarios are considered for this exercise.

Figure 11 interestingly shows that the three policy scenarios will reduce government debt from the baseline scenario of 55% of GDP to 52.7% of GDP, 48.8% of GDP and 45% of GDP. It is the third policy scenario (a government expenditure cut of 15 percentage points) which takes debt down to the

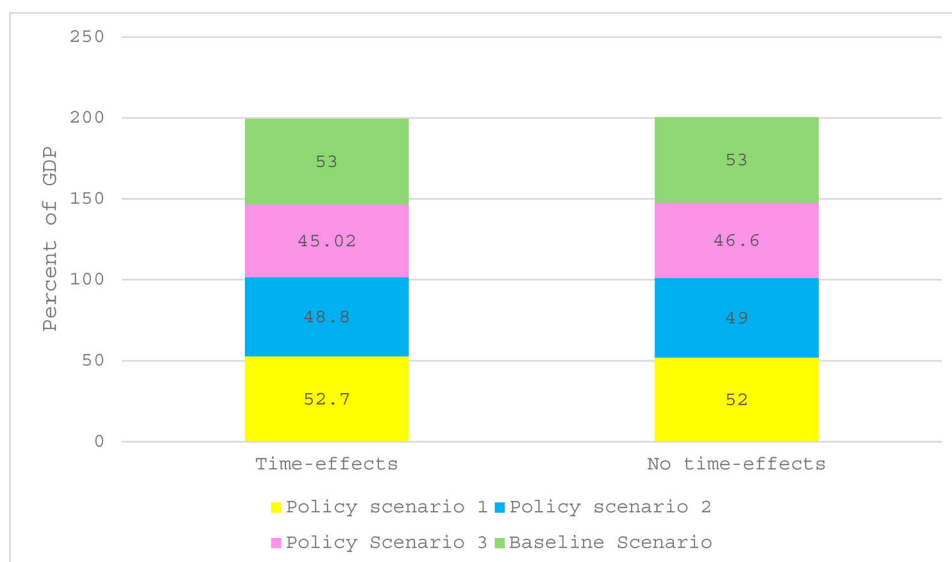


Figure 11. Government debt levels for different expenditure cuts.



threshold value of 45% estimated earlier. The 15 percentage points cut imply cutting government expenditure from the baseline scenario (the observed average share) of 24% of GDP to 9% of GDP.

In summary, the evidence suggests that high government debt hinders the impact of exports on economic growth in sub-Saharan Africa and that reducing debt will require cutting government expenditure on GDP by 2–15 percentage points. Aggressive expenditure cuts, that is, those close to 15 percentage points are more likely to bring government debt down to 45% of GDP.

## 5. Conclusion

From the results presented, it can be concluded that high government debt is an obstacle to export-led growth in sub-Saharan Africa. The most indebted governments between 2004 and 2023, such as Guinea-Bissau, Liberia, São Tomé and Príncipe and Cape Verde, saw a smaller contribution of exports to economic growth compared to countries with less debt. This result shows the importance of government debt management as a complementary measure to export orientation. The IMF's Economic Outlook predicts that sub-Saharan Africa's annual debt will increase from 61 to 59% of GDP in 2023, surpassing the estimated level of 44 to 45%. In this context, combined with the main result of this article, sub-Saharan countries with high debt are urged to pursue fiscal consolidation to unlock export-led growth. Additional evidence suggests that government expenditure cuts are more effective than raising revenue in reducing government debt. Fiscal audits may need to identify unnecessary bloated expenditures may be necessary in this regard. Public wage bills can be reduced in a manner that strikes a balance between cutting bloated expenditure and maintaining service delivery. Large public investments with limited economic returns can be downscaled or eliminated entirely. For further study, this work leaves room for improvement for future research. Firstly, it did not explicitly decompose the effects of debt on all possible channels of economic growth. It can be argued that debt may in fact promote growth if channelled towards productive sectors of the economy. Rather than treating growth drivers as regime dependent variables, it might be interesting to regress government debt on the key drivers of economic growth. In addition, the sample of sub-Saharan countries is heterogenous. In some of the countries, government debt has been well managed, and exports may have had a significant contribution on economic growth. This raises a possible future need for using quantile regressions to establish how the distributional effects of debt on growth between poor and better managed economies. Lastly, the 'exports-growth-government debt' may be expanded to understand the dynamics in capitalist economies where exports are primarily driven by the private sector and governments debt repayment may be independent of export earnings.

## Notes

1. According to the gap theory, governments prefer a specific structure of their debt maturity. Aggregate supply changes coupled with the investors' preference for long-term debt can change the relative price between short- and long-term debt. To lower the expected funding costs, governments are prepared to adjust their long-term debt supply. Regarding the heterogeneity in the use of debt, one could argue for instance that low debt could be easy to manage and utilize efficiently compared to large stock of debt. As documented in the literature, large stock of debt may also invite incidences of corruption and abuse of government resources.
2. Caner and Hansen (2004) accommodate the endogeneity of covariates but still assume exogeneity of the threshold variable, debt.
3. The 44 countries included in the analysis are Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Dem. Rep. of the Congo, Republic of Côte d'Ivoire, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Republic of São Tomé and Príncipe, Tanzania, Togo, Uganda and Zambia.
4. Use of a 5-year rolling standard deviation of terms of trade did not significantly alter the main results.
5. The Hausman specification test preferred the pooled mean group estimator over the mean group estimator and the dynamic fixed model.
6. Panel DOLS is fully parametric and possesses computational convenience compared to the alternative panel 'fully modified' OLS estimator of Phillips and Moon (1999).
7. Tables of unit root tests are available upon request. They are not reported here for the sake of brevity.

8. Tables of unit root roots are available upon request. They are not reported here for the sake of brevity.
9. The estimated threshold is 45%. The average level of debt between 2003 and 2023 was 55%. Bridging this gap therefore required decreasing debt by about 10 percentage points.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author, [BTM], upon reasonable request.

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