The dynamic effect of public debt on economic growth in the era of Macroprudential policy regime: a Bayesian approach

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Abstract

Purpose – This study aims to test the dynamic impact of public debt and economic growth on newly democratized African countries (South Africa and Namibia) and compare the findings with those of newly democratized European countries (Germany and Ukraine) during the period 1990–2022.

Design/methodology/approach – The methodology involves three stages: identifying the appropriate transition variable, assessing the linearity between public debt and economic growth and selecting the order *m* of the transition function. The linearity test helps identify the nature of relationships between public debt and economic growth. The wild cluster bootstrap-Lagrange Multiplier test is used to evaluate the model's appropriateness. All these tests would be executed using the Lagrange Multiplier type of test.

Findings – The results signify the policy switch, as the authors find that the relationship between public debt and economic growth is characterized by two transitions that symbolize that the current stage of the relationship is beyond the U-shape; however, an S-shape. The results show that for newly democratized African countries, the threshold during the first waves was 50% of GDP, represented by a U-shape, which then transits to an inverted U-shape with a threshold of 65% of GDP. Then, for the European case, it was 60% of GDP, which is now 72% of GDP.

Originality/value – The findings suggest that an escalating level of public debt has a negative impact on economic growth; therefore, it is important to implement fiscal discipline, prioritize government spending and reduce reliance on debt financing. This can be achieved by focusing on revenue generation, implementing effective taxation policies, reducing wasteful expenditures and promoting investment and productivity-enhancing measures.

Keywords Africa, Bayesian approach, Economic growth, Europe, Newly democratized countries, PSTR, Public debt

Paper type Research paper

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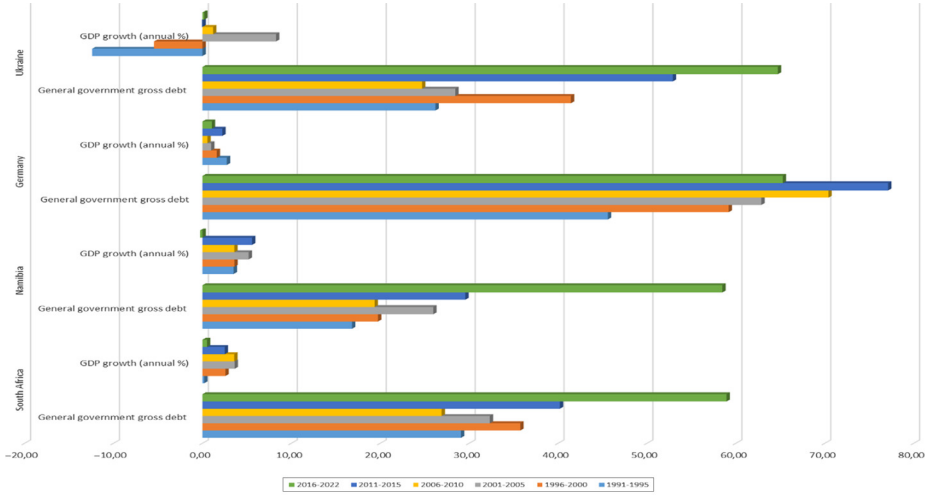
1. Introduction

Government expenditure (GEXP) has rapidly increased globally, leading to a fiscal imbalance and public indebtedness. This increase in public debt, particularly in African countries, is primarily due to expansionary policies like infrastructure investment, technology development and the rise of small and medium-sized enterprises. Policymakers are concerned about whether this increase improves or harms long-term economic prospects. Traditional theories suggest that a fair amount of debt for emerging countries could boost economic growth through efficient fiscal policy, focusing on growth-stimulating sectors such as infrastructure, education and technology (Lee and Ng, 2015). As countries gain independence, there is widespread anxiety about whether governments' and society's policies and behaviors will be strong enough to address socioeconomic issues such as low growth, high inequality, violence and poverty. This study aims to investigate the impact of public debt on economic growth in newly democratized African countries and compare their results with those of newly democratized European countries. The study defines newly democratized countries as those countries that gained independence from the 1950s to the present. As per the full definition, the category of newly democratized African countries contains 48 African countries, 20 European countries and 31 Asian countries that gained independence since the 1950s. However, when considering the threshold year for countries that gained independence in the 1990s, this reduces the number of countries to four, including South Africa, India, Ukraine and Germany. The main aim of restricting the definition to the 1990s was to track only those who had less than 40 years of independence. South Africa gained independence in 1910 and 1994, Namibia in 1990 and Ukraine in 1991. However, with Germany, it is quite different from the other three mentioned countries. Since Germany as a country did not achieve independence in a single instance or on a specific date, however, it took decades and decades for Germany to gain independence. The journey toward a unified and independent Germany was a complex and gradual process that spanned several centuries. The first German unification began in 1871, following Prussia's victory in the Franco–Prussian War. The German Empire was formed when the majority of Europe's German-speaking nations unified under the Kingdom of Prussia. The second unification happened in 1990, following the Cold War's conclusion when West Germany and East Germany merged to become one country. Therefore, we then look at the new unified Germany and regard it as a newly democratized country. This, we believe, would yield an interesting argument, especially looking at the level of public debt after West Germany and East Germany formed one country. It is this work for Germany to reduce its debt level over time that has benefited Germany's growth. The study's findings highlight the challenges faced by newly democratized countries in addressing their economic growth and crime rates.

Figure 1 graphically demonstrates the mean of general public debt and economic growth covering a five-year period (1990–2022). The graph demonstrates that the public debt has been rising in all countries, as can be seen.

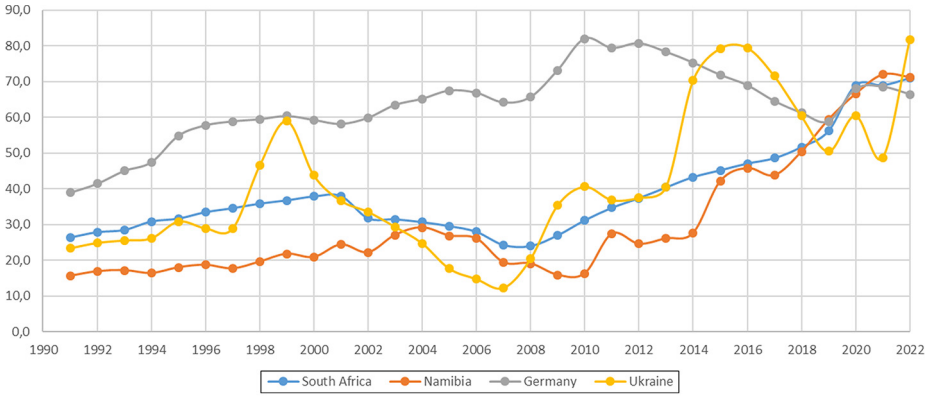
However, the insight gained is that there is an inverse relationship between public debt and economic growth, as it can be seen that in all cases where there is high public debt, growth is low, while in cases where there is low public debt, growth is high. This raises a concern: how much level of debt is required to improve growth? Figure 2 graphically demonstrates the trend of general public debt covering the period (1990–2022).

The public debt trend during the 1990s showed an upward slope in all countries, but it started to decline in the late 1990s, except for Germany. In 2007, the financial crisis led to another spike, and in 2021, the COVID-19 era further increased public debt. Ukraine continues to experience an upward trend, with borrowing primarily for a coronavirus fund



Source: Authors' illustration based on WDI (2023)

Figure 1.
Graphical analysis of the five year mean average of public debt and economic growth from 1990 to 2022



Source: Authors' illustration based on WDI (2023)

Figure 2.
Graphical analysis of the mean public debt from 1990 to 2022

and later acting as an energy fund. The Russia–Ukraine war has further exacerbated the situation.

The literature on the debt-growth relationship has revealed four strands of studies that create a strong paradox. The first strand, based on neoclassical theory, argues that government debt is detrimental to growth (Alves, 2014; Asteriou *et al.*, 2021). The second strand, based on endogenous growth models, claims that government debt promotes economic growth (Ale *et al.*, 2023; Abille and Kiliç, 2023). The third strand, based on nonlinear relationships, also presents contradictions. Some studies find the invented U-shape relationship (Augustine and Rafi, 2023; Mqolombeni *et al.*, 2023), while others find the U-shape relationship (Ferreira, 2009; Saungweme and Odhiambo, 2019).

The last strand, based on inconclusive relationships, believes in an inconclusive relationship (Ferreira, 2009; Saungweme and Odhiambo, 2019). The heterogeneity in the results can be attributed to the different model specifications, data sets and estimating methodologies used in the existing literature. The increase in demand for public debt due to various problems, such as the Great Depression, financial crises and COVID-19, has triggered numerous existing studies on the subject matter. However, these studies have contributed to a strong paradox in the impact of public debt on economic growth.

This study builds on the work documented by Mqolombeni *et al.* (2023) on smooth transition regression in 12 African developing countries. In their model, they control employment in industry and the services sector. The current study aims to contribute to their study in four ways: to compare the findings of newly democratized African countries [1] with those of newly democratic European countries [2]. The idea is that when countries gain independence, they will rely more on public debt to fund infrastructure investment and entrepreneurship development, depending on the process by which they gain independence. This would help African countries learn from European countries, especially those that recently gained independence. The study highlights a strong paradox contributed by the existing studies on the impact of public debt on economic growth. Second, the paper aims to differentiate between nonmacroprudential and macroprudential policy regimes, focusing on the periods 1990–1999 and 2000–2019. The challenge is that policy change dates vary across countries, so the study carefully checks when these countries adopted macroprudential policies. The data documented by Alam *et al.* (2019) is used to address these concerns. Third, we adopt Alam *et al.* (2019) prudential measures to identify policy change dates, providing valuable indicators for detecting policy shifts. The study also expands the public debt-growth relationship by incorporating borrower-related targeted institutions and financial institution-targeted instruments (FITI) to control macroprudential policies, which were omitted from their study. Fourth, specifically, to strengthen the smooth transition model, we combine it with the advantages of the spatial econometric model and Bayesian inference. The Bayesian method uses priori and posteriori information, resulting in improved estimation accuracy and resilience. This approach provides new insights into emerging literature and addresses the challenges of spatial data with cross-sectional correlation. Therefore, we developed the Bayesian spatial lag panel smooth transition regression (BSLPSTR) model to account for these challenges.

The BSLPSTR model argues that transition variables can vary across time and space, weakening the linear model's assumption that independent variables are constant. The data issue contributes to the contradiction arising from current legislation. The model offers new insights into the literature and corrects existing studies' weaknesses. Comparing results from newly democratized African and European countries can help identify strategies for promoting growth while maintaining low public debt.

The paper is organized as follows: a review of the literature is discussed in Section 2, while an overview of the model is found in Section 3. Sections 4 and 5 discuss the findings and concluding remarks of the study, respectively.

2. Empirical literature

Public debt's impact on economic growth is ambiguous, with four theories forming the theoretical basis: the endogenous growth model (Romer, 1986; Lucas, 1988; Barro, 1990), the neoclassical theory of growth (Krugman, 1988) and the nonlinearity (NRN) theory (Sachs, 1998). These theories produce divergent results in the debate surrounding government debt and economic growth. However, the current study is grounded in NRN theory (Sachs, 1998),

as it aims to test the NRN and threshold effect of public debt on economic growth in the era of macroprudential policy in newly democratized countries.

2.1 Theoretical literature review

The "endogenous growth model," pioneered by Romer (1986), Lucas (1988) and Barro's (1990), contends that public debt has a positive effect on future economic growth but ultimately relies on the form of public investments supported by debt incurred by the government. The neoclassical theory advocates for a strong fiscal policy to support sustainable macroeconomic conditions and long-term economic growth. The neoclassical theory further stresses that fiscal policy relaxation is harmful to output growth because it crowds out private investment. As a result, fiscal policy relaxation not only raises interest rates but also stifles business activity because the government typically focuses on wasteful spending with little scope for continuous improvement of macroeconomic conditions consistent with long-term economic prospects (Bardaka *et al.*, 2021). Krugman, a well-known economist, offered another approach in 1998. Krugman (1998) advocates the debt overhang theory, which basically states that debt overhang occurs when projected debt repayment falls short of the initial contractual debt. A new theoretic approach to NRN emerged from the work document by Sachs (1998). The argument on NRN is that debt overhang occurs because of excessive government borrowing that causes inefficiencies and eventually leads to diminishing effects on economic growth (Abdullahi *et al.*, 2016). Hence, the relationship between government debt and economic growth is nonlinear, according to this theory. This was further analyzed by Sachs (2002), using the debt Laffer curve to explain the nonlinear relationship between debt and economic growth. Contrary to this hypothesis, there is a point at which public debt supports economic growth and any extra debt has a detrimental impact. In accordance with this theory, once unpaid debt exceeds a certain level, the country's repayment ability begins to degrade (Savvides, 1992). More specifically, when a government takes on debt to pay budget deficits, it increases the availability of resources for investment activities, which may drive growth. Borrowing above the peak point, on the other hand, results in debt overhang and debt servicing issues.

2.2 Empirical literature

After critically evaluating the empirical literature on this subject matter, we found that there are three strands of studies that created a strong paradox on the relationship between government debt and economic growth following the controversies that emerged in the theoretical debate. The first strand is those studies that believed in the neoclassical theory, arguing that government debt is detrimental to growth (Checherita-Westphal and Rother, 2012; Alves, 2014; Swamy, 2015; Pegkas, 2018; Asteriou *et al.*, 2021). While the second strand believed in the endogenous growth model, claiming that government debt promotes economic growth (Spilioti and Vamvoukas, 2015; Burhanudin *et al.*, 2017; Jacobo and Jalile, 2017; Yang *et al.*, 2022; Ale *et al.*, 2023; Abille and Kiliç, 2023), The last strand believed in those studies that believe that government debt and economic growth are characterized by a nonlinear relationship in nature (Elbadawi *et al.*, 1997; Pattillo *et al.*, 2004; Perlo-Freeman and Webber, 2009; Kremer *et al.*, 2013; Seletenget *et al.*, 2013; Akhanolu *et al.*, 2018; Seletenget *et al.*, 2013; Alam *et al.*, 2019; Murungi and Okiro, 2018; Mensah *et al.*, 2019; Ndoricimpa, 2020; Makhoba *et al.*, 2022a, 2022b; Mqolombeni *et al.*, 2023; Augustine and Rafi, 2023); even among those studies on NRN, there are contradicting results, as some studies find the invented U-shape (Perlo-Freeman and Webber, 2009; Kremer *et al.*, 2013; Seletenget *et al.*, 2013; Ndoricimpa, 2020; Makhoba *et al.*, 2022a, 2022b; Augustine and Rafi, 2023; Mqolombeni *et al.*, 2023), while others find the U-shape relationship. While others

believed that there is no clear relationship between government debt and economic growth (Ferreira, 2009; Saungweme and Odhiambo, 2019).

Going as far as Elbadawi *et al.* (1997), who used a quadratic model in a panel of 99 developing countries in their study, the findings revealed that when the level of public debt exceeds 97%, the influence on growth turns negative. The contradiction emerged from the study by Pattillo *et al.* (2004), as they documented government debt increasing growth beyond the threshold (80%–90% of GDP) in a panel of 93 developing countries from 1969 to 1998 using the GMM method. The findings reported by Pattillo *et al.* (2004) were further supported by Checherita-Westphal and Rother (2012) in a panel of €12 area countries. In the same year, Spilioti and Vamvoukas (2015) conducted the same study using Greek data. Their results contradict each other, as Spilioti and Vamvoukas (2015) confirmed a positive relationship between the two variables, whereas Checherita-Westphal and Rother (2012) confirmed a negative relationship. Alves (2014) found that government debt is negatively related to economic growth; their findings contradict those reported by Spilioti and Vamvoukas (2015) but support the argument made by Checherita-Westphal and Rother (2012) for the twelve euro area countries. The study by Burhanudin *et al.* (2017) for Malaysia and Jacobo and Jalile (2017) for 16 Latin American countries contradicts the finding reported by Alves (2014), as these studies find a positive relationship between government debt and growth in the case of Malaysia and 16 Latin American economies.

Looking at the recent literature, these studies still contradict each other, as the study by Pekgas (2018) finds that public debt is negatively related to economic growth after a certain threshold in the case of Greece. Murungi and Okiro (2018) find the existence of a linear relationship between government debt and economic growth. A strong contradiction emerged from the study by Saungweme and Odhiambo (2019), as they reported that the relationship between public debt and economic growth in Zambia for the period from 1970 to 2017 is clear-cut. Their findings support the findings of Ferreira (2009). In the case of African countries, the debt-growth relationship was envisaged by Mensah *et al.* (2019) panel threshold-ARDL model. The results suggested that the public debt threshold ranges between 20% and 80% of GDP, and as debt grows beyond 50%–80% of GDP, public debt starts to be harmful to growth in Africa. A further investigation was drawn from the study by Ndoricimpa (2020) in the case of middle- and low-income countries and used a PSTR technique. The findings confirmed a threshold effect averaging 62%–66% for the whole sample and 58%–63% for all middle-income countries from 2012 to 2017. In the same year, a contradiction emerged from the study by Asteriou *et al.* (2021), confirmed by those studies that documented that public debt is detrimental to growth in a panel of selected Asian countries over the time span of 1980 to 2012. Yang *et al.* (2022) studied the impact of China's provincial government debt on economic growth and sustainable development during the period 2012–2019. Their results indicated a positive relationship between government debt and economic growth. The study by Makhoba *et al.* (2022a, 2022b) contradicts the study by Yang *et al.* (2022) in the case of China. The work documented by Makhoba *et al.* (2022a, 2022b) selected emerging and frontier SADC countries using the symmetric transition regression model and found an inverted-shape relationship between debt and growth in the case of South Africa. Meanwhile, for Botswana, Namibia, Zambia and Zimbabwe, they found a U-shape relationship between debt and growth. Mqolombeni *et al.* (2023) studied the same subject using panel data from 12 developing countries in Africa covering the period between 1991 and 2020 using the PSTR model. The results confirm a threshold of 60.5% of GDP, suggesting an inverted U-shaped relationship between the two variables.

3. Research method and the variable adopted for the study

In this paper, we use the data covering the period 1990–2022 to estimate an SLBPSTR model in newly democracies African countries. The study aims to investigate the dynamic effect of public debt on economic growth in the era of macroprudential policy. The current study seeks to adopt both the macroprudential policy measures documented by Cerutti *et al.* (2017) and Alam *et al.* (2019) for two significant reasons:

(1) the Cerutti macroprudential measures show the data of macroprudential policy instruments from 2000 to date; and

(2) the Alam macroprudential measures further identify the policy change dates from country to country.

Therefore, we believe that adopting these two measures in the public dept-growth model would provide reliable estimates and support our policy changes. Our variables include central government debt, total (% of GDP) to proxy for public debt (PUCDT), real GDP at constant prices to capture economic growth (Growth), and we further adopt GDP per capita at a constant price to proxy for economic growth or economic development (Growth2).

Our model then controls for macroprudential policy instruments, such as FITI, FX and/or countercyclical reserve requirements, general countercyclical capital buffer requirements and macroprudential index (0–12) (RMI_12). We also account for trade openness (TRP), which is calculated as import + export/GDP, the consumer price index as a proxy for inflation (INFL), gross fixed capital formation to account for investment (INVST), general government final consumption as a share of GDP to account for GEXP, employment in the service sector (EMSS) and tourism (TRM). All of our variables were chosen in accordance with the theoretical underpinnings and empirical literature that explain the connection under examination. For robustness and sensitivity testing, we used GDP per capita at constant prices as a proxy for economic growth or development (Growth2).

3.1 Spatial lag panel smooth transition regression model

The spatial lag panel smooth transition regression (SLPSTR) model was used to examine the potential NRN between public debt and economic growth. The current system assumes government policy as the primary policy for supporting economic development during downturns or funding major initiatives. The study aims to explore the effect of NRN between public debt and economic growth using the BSLPSTR model, which is constructed to divide two eras into macroprudential and nonmacroprudential policy regimes. The simplex BSPSTR approach:

$$Growth_{it} = \rho(WK)_{\mathrm{it}} + \beta_0 X'_{it} + \beta_1 X'_{it} g(q_{it}; \gamma, c) + \beta_2 z_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

$$i = 1, \ldots, N, \text{ and } t = 1, \ldots, T$$

where subscript i, t indicates an i-th cross-section and i-th period, respectively, $Growth_{it}$ is the dependent variable, $K = (k_{11}, k_{21}, \ldots, k_{\mathrm{N1}}, k_{12}, \ldots k_{\mathrm{NT}})'$ is $NT \times 1$ vector of dependent variables and W is the $NT \times$ NT spatial weight matrix, Z_{it} is the $k \times 1$ vector of independent variables (PUCDT, FITI, RMI_12, TRP, INFL, GEXP, EMSS and TRM) and β_0, β_1, β_2 are $k \times 1$ vector of coefficients, whereas μ_i represents the individual fixed effects and the random errors term is denoted by ε_{it}.

Following Gonzalez *et al.* (2017) and Granger and Terasvirta (1993), we present the transition function as follows:

$$\varepsilon_{it} \sim N(O, \sigma^2), g(q_{it}; \gamma, c) = \left(1 + \exp\left(-\gamma \prod_{j=1}^{m} (q_{it} - cj)\right)\right)^{-1} \quad (2)$$

and evidently we have $0 < g(q_{it}; \gamma, c) < 1$), where $c_j = (c_1, \ldots, c_m)'$, $e = (1,1,\ldots 1)'$ is the $m \times 1$ vector of location parameters, and $\gamma > 0$ is the scale parameter. Without loss of generality, we set $m = 1$ to simplify mathematical deduction.

3.2 Building a Bayesian estimation for the SLPSTR model

Following model (3), we then construct the Bayesian analytical framework in this study before providing a specific estimation step. Given (γ, c), let $A = (I - \rho W)$, then the likelihood function of model (5) is as follows:

$$L(Y|\Theta, \gamma, c, \sigma^2) \propto \sigma^{-NT}|A|exp\left\{-\frac{1}{2\sigma^2}(AY - Z\Theta)'((AY - Z\Theta)\right. \quad (3)$$

The prior distribution of parameter ρ is usually assumed to be a uniform distribution with probability density function $\pi(\rho) = \frac{1}{\lambda_{max}^{-1} - \lambda_{min}^{-1}}$, where λ_{ma} and λ_{min} are the maximum and minimum eigenvalues of a spatial weight matrix W, respectively, which indicates the $\rho \sim (\lambda_{min}^{-1}, \lambda_{max}^{-1})$. The prior distribution of parameter Θ is set to be multiple normal distribution $N(\mu_0, \Sigma_0)$, where μ_0 and Σ_0 are the prior expectation and covariance. We also assume the prior distribution of parameter σ^2 as inverse gamma distribution $IG(\mu_0, \Sigma_0)$, and set prior γ and c as gamma distribution and normal distribution, that is $\gamma \sim G(a, b)$, $(c \sim N(\mu_c, \Sigma_c)$. The technicality of this model can be traced back for the study by Dlamini *et al.* (2023) and from the study by Li *et al.* (2019).

4. Empirical analysis, data analysis and interpretation of results

4.1 Data analysis

Before running the BSLPSTR model in this study, we conducted several data inspections in the background to better understand our data. Table 1 displays the descriptive statistics for the various variables. Given the nature of the investigation, the panel unit root was not tested. The main reason for us not to test for stationarity is because of the nature of the

Table 1. Descriptive statistics

	Descriptive statistics							
Variables	Mean	SD	Minimum	Maximum	SKW	KUR	JB-ST	JB-P
Growth	24.88	7.87	30.50	63.50	– 0.68	3.68	26.64	0.00
Growth2	26.33	4.25	24.32	29.17	– 0.45	2.19	16.58	0.00
PUCDT	57.35	4.55	6.53	30.00	– 1.18	2.31	82.86	0.00
FITI	19.91	3.59	0.00	19.51	– 2.76	2.43	94.68	0.00
RMI_12	51.91	2.02	0.34	26.76	– 3.29	2.32	11.18	0.00
TRP	17.67	1.78	5.90	16.44	– 0.65	3.96	31.57	0.00
INFL	3.65	1.15	0.40	3.00	– 5.96	3.59	14.23	0.00
GEXP	19.83	2.89	6.63	10.91	– 0.09	3.01	0.43	0.80
EMSS	35.48	5.56	0.10	19.6	– 0.39	3.21	0.61	0.52
TRM	30.78	4.14	6.53	30.00	– 1.12	3.99	67.95	0.00

Source: Author's calculation results based on data from WDI, 2023

study, as we are investigating the nonlinear impact of public debt on economic growth. According to Güriş (2019), the traditional unit root tests display a tendency to be nonstationary in the case of structural breaks and NRN. On the other hand, the study further omitted the unit root test, following the argument made by Ndoricimpa (2020), Reinhart and Rogoff (2010), Besnik *et al.* (2020) and Topal (2014). According to descriptive statistics, these nations' average total public debt is approximately 13.35%, 4.19% and 3.19%, respectively, while economic growth is around 43.88%. As indicated, all of the variables are determined to be negatively skewed.

Kurtosis values for all variables, on the other hand, were within the required range of 2% to 3%. Except for GDPCP and EMSS, all of these variables reject the alternative normality hypothesis by demonstrating that they are not normally distributed. The probability values of the Jarque–Bera tests for these variables, with the exception of GEXP and EMSS, are less than 10%; the implications may be due to country-specific factors supporting the rejection of the alternative hypothesis of normal distribution.

To assess the variables used in this study, we evaluated at the partial existence of the for cross-sectional dependence and cointegration, as proposed by Friedman (1937), Frees (1995) and Pesaran (2004). The findings of cross-sectional dependency and Pedroni cointegration are shown in Table 2.

The null hypothesis of no cointegration and cross-sectional reliance on variables is strongly rejected by both the cross-sectional reliance tests, as well as the Pedroni cointegration test. After assessing the data, the BSLPSTR proceeded through testing the three stages of the model, which include identifying the appropriate transition variable among all the candidate variables, testing the linearity and determining the sequence for selecting the order m of the transition function using the LM-type test, with the proposed wild-cluster bootstrap (WCB) and wild-bootstrap (WB) serving as robustness checks before estimating our model. The results of the three phases are presented in the subsequent sections.

4.2 The results of the transition variable, homogeneity test and selection of the order m of the BSLPSTR

Following Gonzalez *et al.* (2017), we investigated all variables included in our model as potential candidates for the appropriate transition variable. The BSLPSTR preestimation was evaluated, and the results are shown in Table 1. The model, as is well known, had three preestimated tests, the first of which was the suitable transition in the panel regression of public debt and economic growth. The suitable transition results, as indicated in the first column of Table 1, suggest that public debt is the most appropriate choice of transition variable for the study in both regions, as both the p values of the LM_F test (7.678e–31) and the LM_X test (4.987e–28) for NDAC and the LM_F test (9.290e–20) and the LM_X test (5.842e–23) for NDEC are smaller in size compared to other variables encompassed as candidates. The homogeneity test is the second pre-test. The homogeneity outcomes are presented in the 2nd column of Table 3, indicating that there is certainly a nonlinear relationship between public debt and economic growth across both these two regions, as both the p-values of the LM_F test (4.112e–23) and the LM_X test (0.00023) for NDAC and the LM_F test (2.922e–19) and the LM_X test (4.687e–10) for NDEC disregard the null hypothesis of linearity. The results of the LM_X and LM_F are further supported by the results of the WCB and WB as their p-values are 0.00 indicating that there is an existing NRN between public debt and economic growth. These results on the homogeneity point of view are in line with studies (Elbadawi *et al.*, 1997; Seletenget *et al.*, 2013; Akhanolu *et al.*,

Table 2.
Cointegration and cross-sectional independence tests

Regions (s)	Pedroni tests for cointegration			Tests for cross-sectional independence		
Newly democratic African countries	Augmented Dickey–Fuller *t*	4.99	Pr = 0.008	Friedman's test	154.94	Pr = 0.00
	Modified Phillips–Perron *t*	3.20	Pr = 0.003	Frees' test	2.95	Pr = 0.00
	Phillips Perron *t*	4.65	Pr = 0.040	Pesaran's test	16.00	Pr = 0.00
Newly democratic European countries	Augmented Dickey–Fuller *t*	6.03	Pr = 0.000	Friedman's test	124.11	Pr = 0.00
	Modified Phillips–Perron *t*	2.00	Pr = 0.000	Frees' test	3.56	Pr = 0.00
	Phillips Perron *t*	5.19	Pr = 0.000	Pesaran's test	18.40	Pr = 0.00

Source: Author's calculation results based on data from WDI, 2023

Table 3.
Results of selecting the transition variable, linearity and selection order *m*

Regions	Test		Transition variable PUCDT $m=1$	$m=2$	$m=3$	Results of the H_0 $m=2$	m = 1; H_{01}^{*}	Selecting order m m = 2; H_{02}^{*}	m = 3; H_{03}^{*}
Newly democratic African countries	LM_F	Fs	5.00	6.90	2.17	30.12	20.91	8.34	50.30
		pv	7.678e–31	0.0002	0.00020	4.112e–25	3.002e–02		3.875e–24
	LM_χ	Fs	30.67	13.77	12.04	12.53	89.30	9.63	45.20
		pv	4.987e–28	3.129e–25	2.062e–06	0.00023	3.002e–02		4.435e–20
	WB	pv	–	–	–	0.00	–	–	–
	WCB	pv	–	–	–	0.00	–	–	–
Newly democratic European countries	LM_F	Fs	4.50	4.39	4.19	22.98	70.69	10.13	60.45
		pv	9.290e–20	6.247e–13	5.998e–30	2.922e–19	5.985e–20	0.71	4.949e–22
	LM_χ	Fs	41.00	16.00	15.34	9.40	90.56	7.21	40.56
		pv	5.842e–23	5.679e–22	4.985e–11	4.687e–10	8.765e–33	0.80	6.658e–14
	WB	pv	–	–	–	0.00	–	–	–
	WCB	pv	–	–	–	0.00	–	–	–

Notes: Dependent variable is the Growth. All variables PUCDT, IMFIN, IMFDTI, TRP, INFL, GEXP, EMSS, TRM and PG were included as candidates for identifying the appropriate transition variable using the LM-type test. *Reflect the 10% level of significance. p-v are the *p*-values, and Fs denotes the F-statistic
Source: Author's calculation results based on data from WDI, 2023

2018; Murungi and Okiro, 2018; Mensah *et al.*, 2019; Ndoricimpa, 2020; Makhoba *et al.*, 2022a, 2022b; Mqolombeni *et al.*, 2023; Augustine and Rafi, 2023).

The third pre-test yields interesting results in terms of selecting the sequence of order m in the model. These results are interesting as they yield that both these regions are in the second order of the transition, which was never reported in the history of the public debt-growth relationship. When $M = 2$, the findings reject H_O in both the LM_F and LM_χ indicating that when PUCDT was chosen as the optimal transition variable, the model had two regimes that separated the low and high levels of public debt. Following Teräsvirta (1994), the researcher used the WCB and WB to analyze the LM_F and LM_χ results.

4.3 Model evaluation and the estimated threshold of the BSLPSTR model

The following sections show the outcomes of the model assessment as well as the anticipated BSLPSTR threshold. Continuing in the footsteps of Eitrheim and Teräsvirta (1996), the study first assessed the accuracy of selecting order $m = 2$ as the ideal transition variable for our model using two types of misspecification tests: parameter consistency (PC) and no remaining NRN (Gonzalez *et al.*, 2017).

Table 2 shows the PC, NRN and predicted threshold results. The PC findings are presented in Table 2 first part. The parameter constancy p-values of the LM_F and LM_ X indicate that the parameters are constant, while the second section of Table 2 displays the results of both the WB and WCB tests, which account for both heteroskedasticity and possible within-cluster reliance, indicating that the model estimate with a single transition is satisfactory. Finally, Table 4 final part reveals the predicted threshold findings for the baseline model and robustness model.

The results show that the estimated fiscal policy threshold for Public debt is 65% of GDP for newly democratic African countries, while it is 72% of GDP for newly democratic European countries. As per the results reported in Table 3, it shows that our model is characterized by $m = 2$, which means our study is in the second wave.

For newly democratized African countries, when the level of debt as a percentage of GDP is below the threshold of 65% of GDP, fiscal policy involvement through the public debt is necessary to boost growth; however, it hinders growth if it is above the threshold. For Newly democratic European countries, we find that below the threshold level of public debt (72% of GDP), it improves growth; above the threshold, it reduces economic growth. When looking at Table 5 it illustrates that all these countries above their estimated threshold when we look the current level of public debt for each countries. Therefore, this might have several potential negative effects on a country's growth, such as the fact that a government with high debt may face challenges in attracting private investment, leading to higher interest rates and reduced credit availability. This can discourage private sector businesses, slow economic growth and reduce investor confidence. Additionally, limited fiscal space for policy responses can limit a government's ability to implement expansionary policies, such as increased infrastructure spending or tax cuts, which may prolong economic downturns and hamper growth. The findings challenge fiscal policy decisions for these countries and reinforce the need to keep the level of public debt within the threshold, as that can be beneficial to growth.

4.4 Empirical results of the BSLPSTR models

Table 6 displays the projected findings based on the BSLPSTR, which is a lag of a two-regime model in two groups of regions: African and European newly democratized nations. First, the BSLPSTR model results in macroprudential policy regimes demonstrate that the direct influence of public debt on economic growth, as measured by β_{0j}, is positive and

Table 4. Results of the evaluation test and the estimated threshold

LM test	Newly democratic African countries		Newly democratic European countries	
	Macroprudential policy regime	Nonprudential policy regime	Macroprudential policy regime	Nonprudential policy regime
Parameter constancy test				
LM_F	5.982 (4.873e–04)	1.998 (2.889e–05)	8.917 (15.098e–17)	7.987 (0.0000)
LM_χ	40.712(3.223e–10)	60.948 (4.341e–09)	80.734 (8.932e–08)	50.253 (0.000)
No remaining nonlinearity				
WB	1 (*p*-value)	1 (*p*-value)	1 (*p*-value)	1 (*p*-value)
WCB	1 (*p*-value)	1 (*p*-value)	1 (*p*-value)	1 (*p*-value)
Results of the estimated threshold for all models				
c	65.00*** (5.93)	50.00*** (10.01)	72.00*** (11.81)	60.01*** (3.11)
γ	15.12*** (4.40)	18.01*** (5.92)	10.13*** (5.92)	14.09*** (8.22)

Notes: Growth is the dependent variable, whereas government spending is the independent variable. ***Signify the level of significance of 1%
Source: Author's calculation results based on data from WDI, 2023

considerable in both the newly democratized African countries and European countries. Table 1 shows that the data confirm the homogeneity test: the effects of public debt on economic growth appear to be nonlinear in both regions. The coefficient of the nonlinear element of the model, β_{1j}, is negative and highly significant, while the impact appears to differ in the nonprudential policy regime, as the findings show that the immediate impact of public debt on growth, as measured by β_{0j}, is negative and significant. This finding shows that as the public debt variable ranges from low to high, changes in economic growth vary from $\beta_{0j} + \beta_{1j}$. The transition between these extreme regimes occurs at the endogenous location parameter c.

When both policy regimes are compared, the execution of macroprudential regulations has a considerable influence on the correlation between public debt and growth, with the nonprudential regime revealing a U-shape and the prudential regime revealing an inverted U-shape in both regions. Even when the magnitude of the effects of prudential and nonprudential policy regimes is compared, it is evident that public debt has a significant adverse effect on growth in a prudential policy regime compared to a lower regime in a nonprudential policy regime.

The findings illustrate that, even in the high regime of public debt, the size of the impact of public debt remains dominant because it has a significant influence on the common man in the prudential policy regime compared to the nonprudential policy regime. The magnitudes of the effects of public debt below the threshold are 6.07 and –2.20, respectively, but they are –8.87 and 3.12 above the threshold in the NDAC. While NDEC is 4.30 and –3.03 below the threshold and –6.79 and 5.90 above the threshold. The reported magnitude is drawn from both prudential and nonprudential policy regimes. These findings provide two key policy implications. First, accounting for monetary policy actions taken during financial crises and COVID-19 is critical to understanding the association between public debt and GDP growth, particularly in countries that use macroprudential regulations. This is because the findings show that implementing these regulations prompted the relationship by restraining growth. Second, to mitigate the negative effects of high public debt on economic growth, policymakers need to implement fiscal discipline, increase tax revenues, attract foreign investment, promote economic diversification, improve productivity through infrastructure and education, implement structural reforms and ensure efficient debt management. These actions stabilize the economy, reduce borrowing costs, foster private sector growth and restore investor confidence. This finding is consistent with previous empirical studies that indicated a considerable, both positive and negative, influence of public debt on economic growth, such as those done by Perlo-Freeman and Webber (2009), Ndoricimpa (2022), Makhoba *et al.* (2022a, 2022b), Augustine and Rafi (2023),and Mqolombeni *et al.* (2023). The logic beneath the inverted S-shape relationship between public debt and economic growth suggests that initially, as public debt increases, economic growth also rises due to increased government spending. However, beyond a certain point, higher levels of debt lead to reduced economic growth as debt servicing costs and reduced

Table 5.
The current level of public debts for both regions and the estimated threshold

	Newly democratic African countries		Newly democratic European countries	
	South Africa	Namibia	Germany	Ukraine
Threshold	65% of GDP	65% of GDP	72% of GDP	72% of GDP
Level of public debt	70.10% of GDP	73% of GDP	80% of GDP	80% of GDP

Source: Author's illustration based on data from countries economic outlook 2023 and WDI 2023

Table 6. Public debt and economic growth; BSLPSTR, African and European countries

	Newly democratic African countries (NDAC)				Newly democratic European countries (NDEC)			
	Model 1: prudential policy regime		Model 2: nonprudential policy regime		Model 3: prudential policy regime		Model 4: nonprudential policy regime	
	LR $\beta_{0j} \times 100$	HR $(\beta_{0j} + \beta_{1j}) \times 100$	LR $\beta_{0j} \times 100$	HR $(\beta_{0j} + \beta_{1j}) \times 100$	LR $\beta_{0j} \times 100$	HR $(\beta_{0j} + \beta_{1j}) \times 100$	LR $\beta_{0j} \times 100$	HR $(\beta_{0j} + \beta_{1j}) \times 100$
PUCDT	6.07 ** (2.00)	−8.87** (3.98)	−2.20** (0.89)	3.12 ** (0.30)	4.30 ** (0.50)	−6.79 (1.11)	−3.03 ** (1.40)	5.90 *** (1.50)
IMFIN	−2.40 ** (0.79)	−1.78** (0.12)			2.40 ** (1.00)	3.59 ** (1.40)		
IMFDTI	−2.50 ** (0.20)	−3.90 ** (1.10)			4.70 ** (1.24)	2.34 ** (0.90)		
TRP	3.20 ** (1.38)	2.10 ** (0.99)	5.30 ** (2.22)	3.10 ** (1.44)	2.00 ** (0.90)	2.36 ** (0.80)	4.70 ** (1.29)	2.70 ** (0.70)
INFL	−3.53 ** (1.13)	−2.0*** (0.70)	−2.33 *** (0.50)	−2.00 *** (0.44)	−1.60 ** (0.20)	2.50 ** (0.99)	2.44 * (0.49)	1.50 ** (0.50)
GEXP	4.89 *** (2.20)	−2.00 ** (0.88)	1.44 ** (0.50)	−3.35 ** (1.77)	3.88** (1.28)	2.05 ** (0.67)	2.65 ** (0.99)	3.99 ** (1.30)
EMSS	3.47 ** (1.76)	2.98** (0.60)	2.56 (0.90)**	3.01 *** (2.00)	2.23** (0.10)	2.70 (0.43)***	3.22 ** (0.23)	1.89 ** (0.25)
TRM	2.07 ** (0.39)	3.41** (0.38)	2.11** (0.48)	1.35 *** (0.69)	3.76** (1.70)	1.80 ** (0.38)	1.91 ** (0.22)	−3.91 ** (1.23)
PG	−2.05** (0.49)	−1.89** (0.89)	−1.89** (0.89)	−3.12** (1.99)	1.44** (0.10)	−2.98** (0.20)	3.60** (1.66)	1.00** (0.03)
Dum	Yes	No	No	No	Yes	No	No	No

Notes: Dependent variable is the Growth. The numbers in brackets denote the standard errors in brackets are obtained by using the cluster-robust and heteroskedasticity-consistent covariance estimator, allowing for error dependency within individual countries. ***, **, *Reflect the 1, 5, 10% level of significance, respectively. The pv are the *p*-values, LR and HR stand for lower regime and high regime, respectively

Source: Author's calculation results based on data from WDI, 2023

confidence in the economy hinder investment and private sector activity. Thus, there exists an optimal level of public debt for sustainable economic growth.

The current research then examines the impact of collaborative macroprudential policy tools such as financial capital-related and debt-to-income instruments on the current issue. Countercyclical or time-varying capital needs, time-varying or dynamic provisioning and profit distribution constraints are examples of financial capital-related tools. The findings reveal that the financial capital-related instrument (IMFDTI) has a statistically negative influence on economic growth in both low and high regimes of public debt in newly democratized African countries but a positive and statistically significant influence in newly democratized European countries. The loan-to-debt macroprudential ratio is found to be stable in newly democratized African countries, while it is found to improve growth in newly democratized European countries. The logic behind the negative impact of borrower-related macroprudential policies on NDAC, such as stricter lending regulations, can limit access to credit, leading to reduced consumer spending and investment. This can lower aggregate demand, hamper economic growth and potentially exacerbate recessions or slowdowns in the economy. Our findings are in line with the paper published by Biljanovska *et al.* (2023) in the IMF.

TRP has a favorable and statistically significant impact on economic growth in both regimes and both regions. These findings indicate that strengthening trade policy in these countries will function as a driver of economic growth. This supports the findings reported by Keho (2017). The favorable impact emanates from the fact that TRP promotes efficiency, competition, specialization and access to new markets, leading to increased productivity, investment and ultimately economic growth. Considering that the current study deals with the issue of public debt, which we believe translates to inflation when those borrowed funds are used to fund social spending or create employment, this allows us to control for inflation in our model. In the prudential policy regimes of NDAC, inflation (INFL) has a negative and statistically significant influence on economic growth in both low and high regimes of public debt. The logic is that high inflation erodes purchasing power, reduces investment and creates uncertainty, hindering economic growth and development in Africa. However, in nonprudential policy regimes, inflation is reported to be growth-beneficial in the low regime of public debt; however, growth is detrimental in the high regime of public debt. For NDEC, inflation is found to be beneficial in the low regime, and growth is stable in the high regime of public debt during the prudential policy regime. However, during the nonprudential policy regime in both regimes, inflation is found to be beneficial. The findings are in line with the results documented by Bick (2010) for developing countries.

GEXP has a statistically detrimental impact on economic growth in the high regime of public debt in both nonprudential and prudential policy regimes, whereas it promotes economic growth in the low regime in the NDAC. The notion is that trade in emerging economies benefits the relative income shares of the extremely poor but not necessarily all of the poor. In most industrialized economies, trade increased income inequality, with outliers driving the effect. However, for newly democratized European countries, we documented different results, as we found that during the low regime, it reduced growth, while in the high regime, it reduced economic growth. The findings are in line with the results documented by Zungu and Greyling (2022) for African emerging economics.

In both policy regimes and across all regions, EMSS has a positive influence on economic growth in the lower regime and the high regime. EMSS boosts economic growth as it creates income, increases consumer spending and enhances productivity. This discovery aligns with the findings described by Mqolombeni *et al.* (2023). In both policy regimes, tourism (TRM) is found to boost economic growth, as we find that it has a positive impact on

economic growth in the lower regime and the high regime, in both the nonprudential and prudential policy regimes across the region. Even the fixed effect supports the two variables' negative association. This discovery aligns with the findings described by Ivanov *et al.* (2007). Finally, population growth (PG) has a negative impact on economic growth in both regimes and in both prudential and nonprudential policy in newly democratized African countries. The findings support the empirical studies documented by Headey and Hodge (2009). However, for NDEC it was found to increase economic growth in the low regime of public debt, but growth was detrimental in the high regime during the prudential policy regime, which contradicts the finding made during the nonprudential policy regime, as we document that population growth is beneficial in both low and high regimes of public debt.

4.5 Sensitivity analysis and robustness checks

The findings reveal that, regardless of the variable used to quantify economic growth, the effect of public debt on economic growth is nonlinear in both regions. In our approach, we used GDP per capita to capture both economic growth and economic development. This is the first study to attempt to use GDP per capita as a proxy for economic growth in the debt literature. We hope to see some intriguing findings in the public debt literature, given that most studies use GDP per capita in the income inequality literature (Zungu *et al.*, 2022). Following Yusuf and Mohd (2023), the researcher introduced the foreign reserve position variable to the model as an extra control variable for the sensitivity analysis. This was done to check if the initial technique's results were insensitive to the variables used as control variables. Table 7 highlights the BSLPSTR model's robustness and sensitivity analysis results in both regions for both policy switches. The variables are defined similarly to the baseline methodology. All of the models' testing techniques were followed once again.

NDAC Model 5: Macroprudential policy regime	NDEC Model 6: Macroprudential policy regime
$\text{Growth2} = 5.50\text{PUCDT}^{**} - 2.18\text{IMFIN}^{**} - 3.33\text{IMFDTI}^{*} + 3.74\text{TRP}^{**} - 1.00\text{INFL}^{**} - 3.19\text{GEXP}^{**} + 2.00\text{EMSS}^{**} + 2.64\text{TRM}^{**} - 1.78\text{PG}^{**} - 2.77\text{FRP}^{**} [19.02^{**}_{\gamma}, 64, 77^{***}_{C}] - 6.00\text{PUCDT}^{**} - 3.80\text{IMFIN}^{**} - 5.20\text{IMFDTI}^{*} + 2.00\text{TRP}^{**} - 2.40\text{INFL}^{**} - 2.00\text{GEXP}^{**} + 3.99\text{EMSS}^{**} + 2.44\text{TRM}^{**} - 2.12\text{PG}^{**} - 3.00\text{FRP}^{**}$	$\text{Growth2} = 4.00\text{PUCDT}^{**} + 3.00\text{IMFIN}^{**} + 2.12\text{IMFDTI}^{*} + 4.88\text{TRP}^{**} - 2.10\text{INFL}^{**} + 2.100\text{GEXP}^{**} + 1.60\text{EMSS}^{**} + 2.52\text{TRM}^{**} + 2.00\text{PG}^{**} - 1.40\text{FRP}^{**} [14.02^{**}_{\gamma}, 71, 00^{***}_{C}] - 5.20\text{PUCDT}^{**} + 2.43\text{IMFIN}^{**} + 2.33\text{IMFDTI}^{*} + 1.99\text{TRP}^{**} - 1.55\text{INFL}^{**} + 2.88\text{GEXP}^{**} + 2.22\text{EMSS}^{**} + 2.33\text{TRM}^{**} - 1.12\text{PG}^{**} - 2.87\text{FRP}^{**}$

Note: The ***, ***, * denotes the level of significance at 1, 5 and 10%, respectively
Source: Author's calculation results based on data from WDI, 2023

Table 7.
Public debt and economic growth: robustness checks model

The estimated findings showed that the proxy for economic growth and the control variables included in the model, had no influence on the nonlinear effects of public debt on economic growth. Indeed, the results were very similar to those found in the baseline model.

5. Concluding and policy recommendations

This study aims to contribute to the literature by empirically exemplifying the impact of public debt on economic growth in newly democratized African countries and comparing their findings with those of newly democratized European countries using the BSLPSTR model. According to the researcher's knowledge, no studies have, as yet, investigated the effect of public debt on economic growth by comparing the era of the macroprudential

policy regime to the nonmacroprudential policy regime and further comparing the results of those countries that have recently gained their independence. According to this study, they are regarded as newly democratized countries. We believe this study is crucial for these countries, as it is believed that they require more assistance from international countries or from the IMF and other fund agencies. Which then pushes up their level of public debt. We then further seek to compare the results by tracing whether these countries are at the same level of growth or economic development. If not, what prevents others from reaching a similar level of growth?

The study further seeks to find out how macroprudential policy regimes trigger the relationship between public debt and economic growth. The results are interesting as they show that, indeed, the policy switch has a significant impact on the public debt and economic growth relationship. As can be seen in Table 5 of the main results, during the prudential policy regime, the magnitude of the impact of public debt is high compared to the nonprudential policy regime in newly democratized African countries. However, for newly democratized European countries, the impact is significant but with a smaller magnitude than in African countries. However, the results are not bad for newly democratized African countries, as we report that the policy switch from a nonprudential policy regime to a prudential policy regime was beneficial for African growth. The results show that for newly democratized African countries, the threshold during the first waves was 50% of GDP, represented by a U-shape, which then transited to an inverted U-shape with a threshold of 65% of GDP. Then, for the newly democratized European case, it was 60% of GDP, which is now 72% of GDP. The threshold reported in this study for newly democratized African countries is below the current level of public debt as per the economic outlook for 2023, which means that for South Africa, the level of public debt is 70.10% of GDP, Namibia is 73% of GDP and for newly democratized European countries, it is above the current level of public debt, which is 80% of GDP for both Germany and Ukraine. The estimated threshold for newly democratized African countries is in line with the threshold found by Ndoricimpa (2020), where they found the threshold ranging from 62% to 66% of GDP, whereas Reinhart and Rogoff (2010) found that public debt is in the medium-high range (between 60% and 90%). While for newly democratized European countries, our estimated threshold is in line with the threshold of 71.90% of GDP documented by Besnik *et al.* (2020) for European transition countries, Topal (2014) found the estimated threshold values to range from 71.66% to 80.21% of GDP for €12 zone economies. The first wave (U-shape) and the second wave (inverted U-shape) indicate that the impact of public debt on economic growth is in the second wave now, with two transitions that form an S-shape as it goes beyond the Laffer curve and the Kuznets inverted U-shape of development. The S-shape relationship between public debt and economic growth can be explained by the concept of diminishing returns. Initially, public debt can stimulate economic growth by funding infrastructure development and providing liquidity to the market. This leads to increased investment, employment and productivity. However, as the debt level rises, there comes a point where the government's ability to service the debt becomes restricted. High debt burdens can result in increased borrowing costs, reduced private sector investment and crowding out of productive spending. Consequently, economic growth starts to slow down. This pattern forms an S-shape curve, where debt initially has a positive impact on growth, but beyond a certain threshold, it begins to impede economic progress. For the NDA case, as macroprudential policy variables are found to have a negative impact on growth, this suggests implementing a balanced approach that considers both financial stability and economic growth goals while continuously monitoring and evaluating the impact of such regulations to achieve better outcomes. A policy recommendation would be to prioritize measures that aim to

reduce or manage the level of public debt. This could be achieved through a combination of strategies such as increased government revenues, expenditure cuts and more efficient use of resources. Implementing fiscal discipline and responsible borrowing practices would also play a crucial role. By reducing public debt, governments can free up resources that can be redirected toward productive investments, infrastructure development and social programs. This, in turn, would stimulate economic growth by creating jobs, attracting private investments and improving overall economic competitiveness. It is crucial for policymakers to address the negative impact of public debt on economic growth to ensure sustainable and inclusive development.

Notes

1. South Africa and Namibia.
2. Germany and Ukraine.

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