INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCE STUDIES
Vol: 15 **No: 0**1 **Year:** 2023 **ISSN**: 1309-8055 (Online) (**pp.** 142-163) **Doi:** 10.34109/ijefs. 202315108
Received: 01.08.2022 | **Accepted:** 12.03.2023 | **Published Online:** 01.04.2023

-RESEARCH ARTICLE-

DETERMINANTS OF PUBLIC DEBT IN SOUTH AFRICA: A REGIME-SWITCHING APPROACH

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Abstract:

This investigation investigates the causes of South Africa's public debt. In South Africa, rising public debt is accompanied by sluggish economic growth, high unemployment, high inequality, and proportionally high government expenditure. The study utilizes time series data collected from secondary online sources, namely the South African Reserve Bank, Quantec Easy Data, Statistics South Africa, and the World Bank, from 1990 to 2020. The study utilized a Simple Switching Regression Model and Granger Causality test to examine the determinants of South Africa's public debt. Government deposits, business confidence, inflation of consumer prices, government revenue, and unemployment are significant determinants of public debt in both Regime 1 and Regime 2. Government expenditure was discovered to be a negligible determinant of public debt in Regime 2, whereas the Gini coefficient is only an insignificant determinant of public debt in Regime 1. According to Granger causality, public debt has a causal effect on public debt. The study provided recommendations such as reducing South Africa's excessive reliance on public debt to fund fiscal stimulus.

Keywords: Public debt, Unemployment, Inflation, Economic Growth, South Africa.

JEL Specification: C4, H6, E62, F34

Citation (APA): Hlongwane, N. W., Daw, O. D. (2023). Determinants of Public Debt in South Africa: A Regime-Switching Approach. *International Journal of Economics and Finance Studies, 15* (01), 142-163. doi:10.34111/ijefs. 202315108

1. INTRODUCTION

(Calitz et al., 2019) Public debt is the aggregate of all outstanding financial liabilities of the public sector for which there is a primary legal obligation to repay the original amount borrowed and debt. The primary cause of public debt is the government's annual budget deficit, resulting from fiscal policy. There are two primary categories of public debt: domestic or internal debt and foreign or external debt. Internal debt refers to the debt incurred by the government when borrowing from domestic residents or institutions, i.e., when selling bonds on the primary capital market. It is denominated in domestic currency (Calitz et al., 2019). Foreign debt is incurred by the government when borrowing from foreign governments, residents, or institutions and is denominated in foreign currency (Calitz et al., 2019). In South Africa, rising public debt is accompanied by sluggish economic growth, high unemployment, high inequality, and proportionally high government expenditure.

Overview of the study: (Calitz et al., 2019) The Ricardian equivalence theory implies that the government need not be concerned with intergenerational equity because society will voluntarily effect this equity as desired. The Ricardian equivalence theory applies to this study because we consider the government to be the source of South Africa's public debt and seek to determine the effects of such actions on the remainder of the economy. Keynesian economists contend that when unemployment is high, debt-financed fiscal expansion is necessary to stimulate aggregate demand until it equals aggregate supply at the income level corresponding to full employment. However, when unemployment is low, Keynesian economists argue that deficit financing may be inflationary and that tax increases are required to restrain private spending. At any given time, the South African national debt represents the total quantity of the money borrowed by the government through the issuance of securities by the South African Treasury and other government entities. According to Treasury (2020), as of 2019 and 2020, the total South African government debt was R3,18 trillion. The International Monetary Fund estimated the country's debt-to-GDP ratio would be 82.76 percent in October 2020. In 2022 and 2023, the South African National Treasury expects the national debt to reach R4.38 trillion due to increased government expenditure and sluggish economic growth. In 2019 and 2020, nearly 90 percent of the national debt was denominated in South African Rands, decreasing the risk of borrowing due to currency fluctuations. By September 2020 (Treasury, 2020), South Africa's government debt was predicted to reach approximately 157 billion US dollars. Within seven months, the South African government's debt reached 100 percent of the National Treasury's estimate for the fiscal year ending in March 2022, increasing the likelihood that obligations will exceed official projections (Naidoo, 2021). According to the Quarterly Bulletin of the South African Reserve Bank, as of October 31, 2021, aggregate debt was R4.2 trillion (US$261 billion), or 97.3% of the government's projection. The National Treasury increased its debt projection for the current fiscal year from R4.38 trillion to R4.31 trillion, or 69.9 percent of GDP, in the third quarter medium-term budget policy statement.

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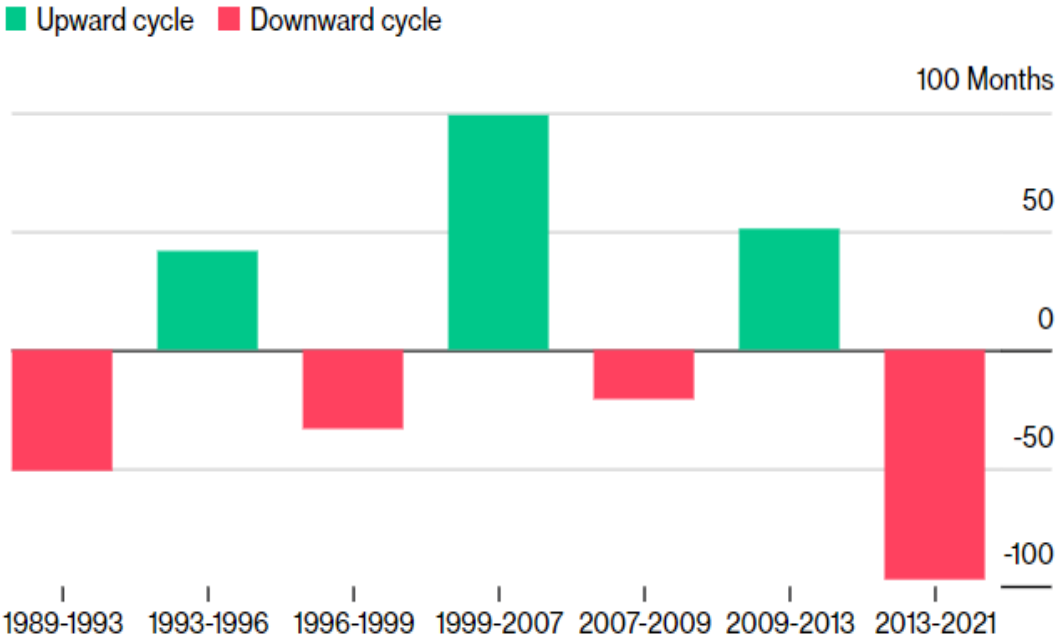

Figure 1. South Africa's economy has been stuck in the most extended downward phase since 1945
Source: South African Reserve Bank

The South African economy has been in a downward cycle for the most extended period since 1945, between 2013 and 2021, as depicted in Figure 1. The South African government has been forced to borrow money from international financial institutions such as the IMF and the World Bank to balance expenditures. According to Naidoo (2021), South Africa was already susceptible to disease before the advent of the Coronavirus. December marked the 97th month of the weakening cycle, according to SARB data. Although a decrease in economic activity during the third quarter of 2021 and the aftermath of the fourth wave of Coronavirus infections indicate that South Africa's economic recovery has stalled, this does not inherently indicate a change in the cycle. In the three months leading up to September 2021, foreign direct investment inflows totaled R559.9 billion, compared to R17.4 billion in the preceding quarter. According to Godongwana (2022), government debt has achieved R4.3 trillion this year and is projected to reach R5.4 trillion.

Throughout the MTEF, it incurs significant debt-service costs, approximately R330 billion per year. The consolidated budget deficit is projected to decline from 5.7% of GDP in 2021/22 to 4.2% in 2024/25, with the debt-to-GDP ratio stabilizing at 75.1% of GDP by that time. According to the statistics mentioned above, South Africa has a problem with high public debt due to macroeconomic factors such as weak economic

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growth, high unemployment, and greater inequality; therefore, this study aims to investigate the determinants of South Africa's public debt. This will aid policymakers and the government in making borrowing-pattern-related decisions. The research will also provide recommendations based on empirical evidence regarding the future of South Africa's public debt and macroeconomic variables.

2. LITERATURE REVIEW

Ricardo (1820) established the Ricardian equivalence economic theory, which states that funding government expenditure with current or future taxation, including current deficits, has the same total effect on the economy. In his 1820 essay "Essay on the Funding System," Ricardo examined whether financing war by issuing government bonds or increasing taxes made a difference. Ricardo concluded that it was irrelevant. Robert Barro revisited the concept in 1974, arguing that, under certain circumstances, financing government expenditures with bonds was equivalent to raising taxes. He concluded that the issuance of government debt and taxation were roughly comparable. This means that efforts to stimulate the economy by increasing debt-financed government spending will be ineffective, as investors and consumers are aware that the debt must be repaid through future taxes. According to Barro (1996), individuals will save because they anticipate that more future taxes will be collected to pay off the debt. This would offset the increase in aggregate demand resulting from increased government spending. This indicates that Keynesian fiscal policy will not boost economic output and growth.

Based on the modern economic theory of rational expectations and the lifetime income hypothesis, Barro (1979; 1996) formally expanded Ricardian equivalence. His interpretation has often been interpreted as undermining the Keynesian fiscal policy as an instrument for enhancing economic performance. Reduced private consumption and investment spending will balance government spending over current tax revenue as investors and consumers modify their current spending and saving patterns in response to realistic assumptions regarding future taxes and anticipated lifetime after-tax income. The fundamental premise is that whether a government increases spending through borrowing or taxation, the consequence is the same, and aggregate demand is unaffected. Some economists, including Ricardo, assert this theory is based on unfounded assumptions. It assumes, for instance, that individuals will accurately anticipate a hypothetical future tax increase and that capital markets will be sufficiently fluid for consumers and taxpayers to quickly shift between present and future expenditure through saving and investment.

A review of developed countries: Gargouri and Keantini (2016) studied the causes of public debt in the 12 European nations from 2000 to 2014. The study utilized a correlated panel standard error model and found that bank nonperforming loans, military expenditures, and imports had a positive impact. In contrast, GDP growth and bank

liquid reserves had a negative impact. Neck and Getzner (2001) researched the political and economic determinants of Austria's public debt development from 1960 to 1999. The study employed and modified Barro's tax-smoothing model and discovered evidence for the systematic influence of government behavior following recent public choice theories and the significant influence of the unemployment rate on Austrian fiscal policy. From 1970 to 2007, Kumar and Woo (2010) examined the relationship between public debt and economic growth in a cohort of advanced and emerging economies. Using a Baseline Panel Regression model, the study discovered an inverse relationship between initial debt and subsequent growth while controlling for other growth determinants. The study also reveals some evidence of nonlinearity, with initial debt levels having a proportionally more significant negative impact on subsequent growth. Sinha et al. (2011) examined the determinants of public debt for countries in the middle-income and high-income groups from 1993 to 2008.

Using an aggregated panel OLS model and Autoregressive multiple regression model, the study found that GDP growth rate is the most significant determinant of debt situation for both high- and middle-income group countries. Public debt is influenced by central government expenditures, education expenditures, and the current account balance, while foreign direct investment and inflation play no role in explaining debt. From 1976 to 2011, Mah et al. (2013) conducted a study on the effect of government spending on the Greek government. The study utilized the VECM and Granger causality models and discovered a significant positive relationship between gross government debt, gross national expenditure, and inflation. Additionally, the study revealed a negative correlation between gross government debt and net foreign direct investment. Gross national expenditure and gross national income were discovered to be Granger causes of gross government debt, whereas gross government debt was discovered to be a Granger cause of inflation.

Isomitdinov et al. (2020) studied the international co-movements and determinants of 115 countries' public debt. Using a Bayesian dynamic factor model, the study revealed that global factors account for a significant portion of the variation in public debt that is frequently greater than that explained by variables in numerous countries. Using panel data from 10 European countries, Chirwa (2018) investigated the determinants of public debt in the Euro area that are either debt-reducing or debt-creating. Although the real interest rate-economic growth differential in debt dynamics can be used to determine whether the debt is explosive or non-explosive, the pace of adjustment is a better predictor, according to the study's findings employing a panel ARDL approach. In addition, the study reveals that while economic growth reduces the debt in the short term, real exchange rate, investment, and population growth reduce debt in the long term. Baskaran (2010) examined the relationship between fiscal decentralization and public debt in 17 OECD nations between 1975 and 2001. Using panel baseline models, the study found that expenditure decentralization significantly reduces public debt, while tax decentralization and vertical fiscal imbalances are insignificant.

Filip (2019) examined the causes of public debt in 28 European Union nations from 1995 to 2017. Using a panel OLS model, the study found that the debt-to-GDP ratio is significantly and positively affected by the previously accumulated public debt, unemployment, and population size. In contrast, real GDP growth, FDI inflows, growing capital formation, and trade balance have significant effects on limiting public debt. Briceo and Perote (2020) studied the determinants of the Eurozone's public debt and its viability in the context of the Covid-19 pandemic. The study applied the GMM model to panel data from 2009 to 2018 and found that economic growth, interest rate, life expectancy at birth, unemployment, government effectiveness, and the most recent sovereign debt crisis were the primary determinants of the evolution of public debt. Sadik-Zada and Gatto (2019) examined the determinants of public debt and the role of natural resources in 184 nations between 1971 and 2011. Using a panel linear regression model, the study found that oil abundance, economic growth rate, the proportion of mineral rent in total revenue, interest rate payments for foreign borrowings, and being a developing country have statistically significant effects on the growth of public debt.

In contrast, defense spending, unemployment rate, and inflation have no statistically significant positive effects on the public debt rate. Delgado-Téllez and Pérez (2020) analyzed the institutional and economic determinants of regional public debt in Spain from 1995 to 2017. The study utilized the GMM model and found that the regional government's fiscal policies responded to the increase in public debt, that a higher degree of regional fiscal responsibility tends to be associated with more subdued debt dynamics, and that the increase in public debt has affected the standard debt.

A review of developing countries: Forslund et al. (2011) studied the determinants of public debt composition in developing and emerging market nations. The study employed a panel OLS model on balanced and unbalanced panel data from 1990 to 2007 and discovered a faint correlation between inflationary history and the composition of public debt. Bader and Magableh (2009) investigated the primary determinants of Jordan's public debt from 1980 to 2005. Using the OLS model, the study discovered that government deficit, savings gap, and real exchange rate significantly impact external debt, with the real exchange rate having the most significant impact. In addition, the study suggests that encouraging domestic savings and regulating the fiscal position can help to reduce debt accumulation and the debt burden. Bittencourt (2015) investigated the determinants of government and external debt from 1970 to 2007 in the young democracies of Southern America.

Utilizing the dynamic panel time-series analysis, the results revealed that economic growth has substantially decreased the region's debt ratios. The study also reveals that a conducive economic environment for generating economic activity and prosperity is a significant factor in keeping regional debt levels in check. Matiti (2013) researched the impact of selected determinants on Kenya's public debt from 2003 to 2012. Using a linear regression model, the study found a direct correlation between public debt,

exchange rates, the balance of payments, and the budget deficit. Manalo et al. (2022) studied the macroeconomic determinants of the Philippines' public debt from 1990 to 2019 using foreign direct investment inflows, gross capital formation, inflation rate, and trade balance. Utilizing a Multiple Linear Regression model, the study revealed that foreign direct investment, trade balance, and inflation are negative determinants of public debt. It suggests that FDI can be relied upon as a debt-reduction strategy due to its negative coefficient. Omrane Belguith and Omrane (2017) examined the macroeconomic determinants of Tunisia's public debt development from 1986 to 2015. Using a VECM model, the study determined that inflation and investment reduce the value of public debt, while real interest rate, budget deficit, and trade openness increase public debt, and that budget deficit is the most influential factor in determining Tunisia's public debt.

A review of South Africa:

Mothibi and Mncayi (2019) investigated the primary causes of government debt in post-Apartheid South Africa. Using time series data from 1994 to 2017 and the ARDL model, this study determined that there is a long-run relationship between government debt and government expenditure, real GDP, inflation, and real interest rates, with government expenditure, real GDP, and interest rates being the primary drivers of government debt in South Africa. Murwirapachena and Kapingura (2015) investigated the determinants of South Africa's external debt from 1980 to 2013. The study using a VECM model revealed that South Africa's external debt is primarily the result of sluggish economic growth and high government expenditure on infrastructure. Bayale (2020) conducted an empirical study of the determinants of public debt in 51 African nations. The study utilized panel data from 1990 to 2018. It employed a Panel Bayesian Model Averaging Approach to determine that, among the 27 regressors considered in the baseline model, those reflecting international financial and institutional conditions and domestic economic prospects tend to have high posterior inclusion probabilities.

According to the literature review, more research has been conducted on the determinants of public debt in developed nations than in developing nations. There is little to limited research on the determinants of public debt in South Africa; thus, this study concentrates on those factors. This will cast light on the South African government's and policymakers' borrowing patterns by proposing recommendations based on empirical evidence that can be adopted. As control variables, government expenditure, economic growth, business confidence, unemployment, consumer price inflation, the Gini coefficient, government revenue, and government debt will be used to examine the determinants of public debt in South Africa. This will cast light on the impact of these variables on public debt, allowing the South African government and policymakers to make rational borrowing decisions in light of the country's high level of public debt.

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3. METHODOLOGY

Table 1. Data Sources and Description

Variable	Description	Unit	Source
LGDEBT	National government debt (At face value): Gross loan debt: Domestic debt - Non-marketable - Other debt	R millions (End of period) (Sum of Monthly Values)	SARB Quarterly Bulletin
LGOV	National government expenditure adjusted for cashflows	% Of GDP	World Bank
LGDP	Gross domestic product (GDP) per capita	% Annual growth rate	World Bank
LBC	BER Composite Business Confidence Index: Total	% (Average of Quarterly Values)	Quantec EasyData
LUNE	Unemployment, total (% of the total labor force) (modeled ILO estimate)	% Of the total labor force	World Bank
LCPI	Consumer prices: All urban areas - Goods: Total goods	% Change (Period)	SARB Quarterly Bulletin
LGINI	RGINM—Gini coefficient at 2011 local municipal/ward-based metro region level	Annual coefficient	Quantec EasyData
LGREV	National government finance: Revenue: Tax revenue - Taxes on income, profits, and capital gains: Income tax	R millions (End of period) (Sum of Monthly Values)	SARB Quarterly Bulletin
LGDEP	Government deposits: National government: SARB	R millions (End of period) (Sum of Monthly Values)	SARB Quarterly Bulletin

Source: Author's compilation

Empirical model estimation: The study utilized secondary data sources such as the South African Reserve Bank, Quantec Easy Data, and The World Bank to compile time series data from 1990 to 2020. The primary objective of the study is to investigate the determinants of public debt in South Africa by formulating a multivariate linear regression equation using explanatory variables such as national government expenditure, gross domestic product as a proxy for economic growth, composite business confidence index, unemployment rate, consumer prices, Gini coefficient, national government revenue, and government deposits as shown in Table 1. These variables have been adopted from Mothibi and Mncayi (2019), Murwirapachena and Kapingura (2015), Gargouri and Keantni (2016), Filip (2019), and Bittencourt (2015). The conceptual structure of this study is described as follows:

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$$LGDEBT = f(LGOV, LGDP, LBC, LUNE, LCPI, LGINI, LGREV, LGDEP) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The study uses logged variables for consistency in the data units as well as to avoid the problem of spurious regressions. This study modifies the conceptual framework into a multivariate linear regression equation as given below:

$$LGDEBT_t = \beta_0 + \beta_1 LGOV_t + \beta_2 LGDP_t + \beta_3 LBC_t + \beta_4 LUNE_t + \beta_5 LCPI_t + \beta_6 LGINI_t + \beta_7 LGREV_t + \beta_8 LGDEP_t + \varepsilon_t \ldots\ldots\ldots (2)$$

Whereby β is the slope coefficient and ε_t is the stochastic error term.

Data Analysis: The study adopts a Simple Switching Regression model employed by Van Norden et al. (1996), Davig (2004), Doğan et al. (2014), and Ng'ang'a et al. (2019)

Numerous financial and economic time series appear to experience episodes in which the series' preceding behavior is drastically altered. A structural break in a series occurs when the behavior of a series changes over time in terms of its mean value, volatility, or the extent to which its present value has changed. Alternately, it may change for a period before reverting to its previous behavior or transitioning to another form of behavior, a phenomenon known as a regime shift or regime change. Hamilton (1989) emphasizes that Regime-Switching Models can capture changes in averages, variances, heteroscedasticity, and mean. White (1987, 1994) and Hamilton (1990, 1996) proposed a set of specifications based on the serial correlation features of the gradient vectors at a given set of parameter estimations. These techniques permit the testing of simple-switching regressions as they enable the creation of fundamental serial correlation, ARCH, and Markov Switching tests. General specifications for the Switching Regression Model are as follows:

$$Y_{1t} = X_{1t}.\beta_1 + \varepsilon_{1t}$$

$$Y_{2t} = X_{2t}.\beta_2 + \varepsilon_{2t}$$

$$Y_{3t} = X_{2t}.\beta_3 + \varepsilon_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$(Y_t = Y_{1t}) \Leftrightarrow Y_{3t} < 0$$

$$\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t} \sim N(0, \begin{pmatrix} \sigma_1 & \sigma_{12} & 0 \\ \sigma_{12} & \sigma_2 & 0 \\ 0 & 0 & 1 \end{pmatrix})$$

Where, Y_t are the observable dependent variables, which are generated by a mixture of different regimes captured by the unobservable (Y_{1t}, Y_{2t}). Y_{3t} is the latent variable that perfectly classifies Y_t into two regimes, X_{3t} represents whatever extra information we must make this classification. Conditioning only on X_{3t}, the probability of being in

regime 1 at t is $\Phi(-X_{3t}.\beta_3,^1$. Van Norden et al. (1996) highlight that if we restrict $\beta_1 = \beta_2$ where $X_1 = X_2$, the regression reduces to:

$$Y_{1t} = X_{1t}.\beta_1 + \varepsilon_{1t}$$

$$Y_{3t} = X_{3t}.\beta_3 + \varepsilon_{3t} \ldots 4$$

$$\varepsilon_t \sim N(0, \sigma_1) \Leftrightarrow Y_{3t} < 0$$

$$\varepsilon_t \sim N(0, \sigma_2) \Leftrightarrow Y_{3t} \geq 0$$

$$E(\varepsilon_t, \varepsilon_{3t}) = 0$$

This says that Y and X now have the usual linear relationship; aside from a particular kind of heteroskedasticity, some errors are generated by a high-variance regime, and some from a low. The primary use of this model is in tests of the non-switching model against switching alternatives.

Granger Causality test: Granger (1969) demonstrated how cointegration exists between two variables in the extended run model requires either bi-directional or unidirectional causation. The Granger causality test may be used to examine the following assumptions for two stationary variables:

$H_0: x_t \; does \; not \; Granger \; Cause \; y_t$ ……

$H_1: x_t \; does \; Granger \; Cause \; y_t$ ……

To determine which hypothesis holds, the Granger Causality test was conducted using the following equations:

$$y_t = \alpha_1 + \sum_{i=1}^{n} \beta_i \, x_{t-i} + \sum_{j-1}^{m} \gamma_j \, y_{t-j} + e_{1t} \ldots\ldots (7)$$

$$y_t = \alpha_2 + \sum_{i=1}^{n} \theta_i \, x_{t-i} + \sum_{j-1}^{m} \delta_j \, y_{t-j} + e_{2t} \ldots\ldots (8)$$

The study used the Augmented Dickey-Fuller and Phillips-Perron unit root tests developed by Dickey et al. (1984) and Phillips and Perron (1988), as shown in Table 2 above, to ascertain the level of integration of the variables and aid in avoiding the problem of spurious regressions. Both the ADF and PP unit root tests confirmed that the variables are stationary at the first difference, i.e., they are integrated at of high order one (I(1)) at the 1%, 5%, and 10% significance levels.

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4. RESULTS AND INTERPRETATION

Table 2. Unit Root Test

Variables	Augmented Dickey-Fuller unit root test				Phillips-Perron unit root			
	Constant		Trend & Intercept		Constant		Trend & Intercept	
	Level	Δ	Level	Δ	Level	Δ	Level	Δ
LGDEBT	-2.6737 *	-4.9137 ***	-3.2468 *	-5.0501 ***	-2.3776	-4.9069 ***	-3.4607 *	-5.0515 ***
LGOV	-0.4370	-5.2049 ***	-1.7933	-4.7281 ***	0.0216	-5.4460 ***	-1.5216	-8.4720 ***
LGDP	-1.5245	-4.4044 ***	-1.2667	-4.8945 ***	-1.4738	-4.1422 ***	-0.3553	-5.4147 ***
LBC	-2.8551 *	-4.2070 ***	-1.6954	-4.3043 **	-2.0633	-4.1307 ***	-1.7755	-4.3940 ***
LUNE	-1.3053	-4.0214 ***	-1.0389	-4.0283 **	-1.4542	-3.9613 ***	-1.3268	-3.9356 **
LCPI	-2.6750 *	-6.4626 ***	-3.8466 **	-6.4730 ***	-2.5306	-7.2289 ***	-2.9580	-7.8065 ***
LGINI	-0.7744	-3.8874 ***	-0.6742	-4.2647 **	-1.1385	-3.8881 ***	-0.8333	-4.2647 **
LGREV	-1.9135	-2.6516 *	0.4506	-3.0963	-1.7071	-2.7610 *	0.4984	-2.5143
LGDEP	-0.3023	-4.4354 ***	-2.6916	-4.4729 ***	-0.7057	-4.5638 ***	-2.0339	-4.6172 ***

Source: Author's computation

LGREV appears non-stationary when evaluating unit-roots on the trend and intercept using ADF and PP unit root tests. This justifies the use of the Regime Switching Model, as highlighted by Perron (1989), Zivot and Andrews (1992), and Kapetanios (2005) regarding the potential for a structural break in the macroeconomic data. The study will employ unique variables to investigate the determinants of South Africa's public debt. The investigation continues to apply the optimal limb length criteria shown in Table 3 to determine the number of legs that can be utilized in the study.

The study used the optimal VAR lag length criterion presented in Table 3 to determine the optimal number of delays it can employ. According to the findings, the optimal number of delays for the investigation is two. This implies that the investigation into the determinants of public debt in South Africa will now employ two lags. The significance of these results is that they demonstrate that the investigation must employ two delays.

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Table 3: Optimal Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-141.6335	NA	3.81e-07	10.75954	11.18774	10.89044
1	-62.75723	101.4123	5.96e-07	10.91123	15.19332	12.22031
2	155.1384	140.0758*	3.60e-10*	1.132973*	9.268936*	3.620218*

Source: Author's computation

Table 4. Simple Switching Regression Model Results

Simple Switching Regression Model Dependent variable: LGDBT				
	Regime 1		Regime 2	
Variable	**Coefficient**	**Probability**	**Coefficient**	**Probability**
DLGOV(-2)	1.491850	0.0000	0.251123	0.1024
DLGDP(2)	-0.093081	0.1562	0.494469	0.0000
DLGDEP(-2)	1.011250	0.0028	-1.178750	0.0000
DLGINI(-2)	-3.577319	0.7919	29.88805	0.0855
DLBC(-2)	0.042838	0.0000	0.079322	0.0000
DLCPI(-2)	-0.214750	0.0000	0.404443	0.0000
DLGREV(-2)	68.25589	0.0000	48.35226	0.0000
DLUNE(-2)	0.180787	0.0000	0.392194	0.0000
Common				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Probability**
AR(1)	-0.940840	0.331649	-2.836856	0.0046
AR(2)	0.197549	0.121598	1.624602	0.1042
AR(3)	0.607388	0.203720	2.981480	0.0029
AR(4)	0.394036	0.100635	3.915485	0.0001
LOG(SIGMA)	-2.874140	0.500124	-5.746855	0.0000
Durban-Watson	1.826793			

Source: Author's computation

The study employed a Simple Switching Regression (SSR) Model, as depicted in Table 4, to account for potential structural disruptions in macroeconomic data caused by the global financial crisis and the Covid-19 pandemic. The SSR paradigm incorporated two regimes, Regime 1 and Regime 2. Table 4 for Regime 1 results shows a positive and statistically insignificant relationship between South Africa's public debt and government expenditures in Regime 1 and Regime 2, respectively. A 1% increase in government spending under Regime 1 and Regime 2 will increase public debt by 1.49 and 0.25 percent, respectively, assuming all other factors remain constant. These

findings align with the research of Mothibi and Mncayi (2019), Murwirapachena and Kapingura (2015), and Gargouri and Keantingi (2016). This indicates that government spending is the most significant factor in developing public debt in South Africa. Therefore, policies that reduce government spending should be promoted to reduce South Africa's public debt.

The results indicate a negative but statistically insignificant relationship between economic growth and public debt in South Africa's regime 1. A 1% increase in economic growth under Regime 1 in South Africa will result in a negligible 0.09% decline in public debt, all else equal. These findings are consistent with those of Filip (2019), Bittencourt (2015), and Murwirapachena and Kapungura (2015). This indicates that economic development plays a significant role in reducing South Africa's public debt. However, Regime 2 has a statistically significant positive correlation between economic growth and public debt. A 1% increase in economic growth results in a 0.49 percentage point increase in the public debt, all else equal. This may result from recent increases in South Africa's public debt, as the government has relied on borrowing to finance its growth. Therefore, policies that increase economic growth and reduce South Africa's public debt must be promoted.

The results also indicate a statistically significant positive relationship between government deposits and public debt in South Africa for Regime 1 and a statistically significant negative relationship for Regime 2. A 1% increase in government deposits will cause the public debt to increase by 1.01% in Regime 1 and decrease by 1.18% in Regime 2, all else being equal. This indicates that government debt is the primary determinant of public debt in the short run, as they positively contribute to the public debt during Regime 1 periods of low variance. In Regime 2, increasing government deposits reduces public debt, which benefits the South African economy. This requires the government to implement policies that encourage an increase in government deposits, as it is a good deterrent for South Africa's public debt, and this will aid in reducing the ever-increasing public debt.

The results also indicate a statistically insignificant negative correlation between the Gini-coefficient and public debt in South Africa in Regime 1, the period of minimal variance. Insignificantly, the public debt will decline by 3.58 percent if nothing else changes. However, in Regime 2, a period of high variance, there is a statistically significant positive correlation between the Gini coefficient and South Africa's public debt. A 1% increase in the Gini coefficient under Regime 2 will considerably increase the public debt by 29.89%, all else equal. This may result from recent increases in South Africa's public debt, as the government has relied on the IMF and other international financial institutions to assist in reducing inequality levels. High levels of inequality characterize South Africa. The government increases its borrowing to fund programs such as RDPs, social grants, and education subsidies to reduce these levels.

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A statistically significant positive relationship exists between corporate confidence and public debt in Regime 1 and Regime 2 in South Africa. A 1% increase in business confidence in South Africa will substantially increase the public debt by 0.04% in Regime 1 and 0.08% in Regime 2, all else equal. This indicates that a rise in business confidence in South Africa significantly determines the country's public debt. As business confidence rises, international monetary institutions become more willing to lend the South African government money to finance its fiscal stimulus, resulting in a rise in public debt. To reduce South Africa's public debt, the government and policymakers must reduce their borrowing during periods of high corporate confidence.

In addition, the results reveal a statistically significant negative and positive relationship between consumer prices and public debt in South Africa under Regime 1 and Regime 2, respectively. A 1% increase in consumer prices will result in a public debt decrease of 0.21% and an increase of 0.40% under Regime 1 and Regime 2 in South Africa, respectively, all else being equal. This implies that in Regime 1, a period of low variance inflation is beneficial for reducing South Africa's public debt. However, in Regime 2, a period of high variance, inflation is detrimental to reducing South Africa's public debt. To reduce South Africa's public debt, the government must promote policies that result in declining consumer prices. Omrane (2017), Mah et al. (2013), Mothibi and Mncayi (2019), and Manalo et al. (2022) have found similar outcomes.

Regime 1 and Regime 2 indicate a statistically significant positive correlation between government revenue and public debt in South Africa. In Regimes 1 and 2, the public debt rises by 68.25% and 48.35% for every 1% increase in government revenue, assuming all other factors remain constant. This indicates that in Regime 1, with low variance, and Regime 2, with high variance, an increase in government revenue plays a significant role in the rise of public debt. The government must disclose its revenue collection policies to reduce South Africa's public debt.

Lastly, the results disclose a statistically significant positive correlation between unemployment and public debt in both South African regimes. A 1% increase in unemployment in South Africa will result in a public debt increase of 0.18% in Regime 1 and 0.39% in Regime 2, all else being equal. This indicates that the unemployment rate significantly determines South Africa's public debt under both administrations. This implies that policies to reduce unemployment must be supported to reduce South Africa's public debt. These findings are consistent with Neck and Getzner (2001), Filip (2019), and Briceo and Perote (2020) studies. These results are also consistent with the recent correlation between higher unemployment rates in South Africa and increased public debt and make economic logic. As shown in Table 5, the research continues to demonstrate transitional summaries.

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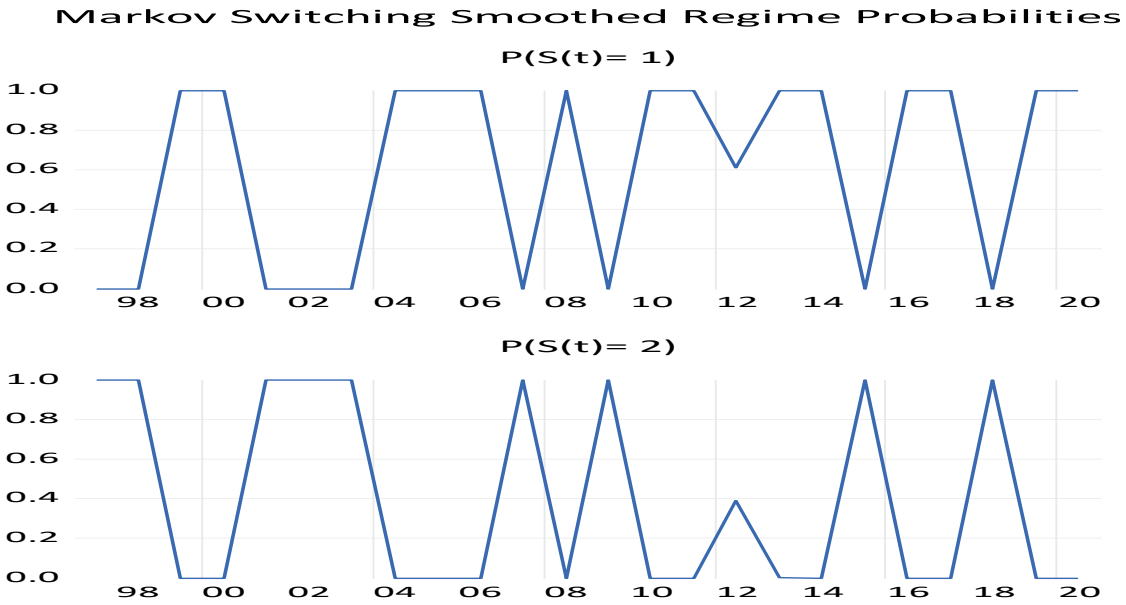
Table 5: Transition summary

Constant Simple Switching Transition Probabilities and Expected Durations		
Constant Transition Probabilities: P(I, k) = P(s(t) = k| s(t-1)=i) (row = i/column = k)		
	1	2
1	0.628842	0.371158
2	0.628842	0.371158
Constant Expected Duration:		
	1	2
	2.694271	1.590224

Source: Author's computation

As shown in Table 5, the research conducted a Constant Simple Switching Transition probability analysis. The results indicate that if public debt is in Regime 1, there is a 62.88 percent chance it will remain in Regime 1. Moving from Regime 1 to Regime 2 is proportionally less likely, with a probability of 37.12%. If public debt is in Regime 2, there is a 37.12 percent chance it will remain there. There is a 62.88 percent chance that public debt will return to Regime 1 from Regime 2. The results also indicate that the constantly expected durations for Regime 1 are 2.69 times longer than those for Regime 2.

Figure 2: Markov Switching Smoothed Regime Probabilities



Source: Author's compilation

As depicted in Figure 2, the investigation employed a Markov Switching Smoothed Regime Probabilities model. The results of Figure 2 indicate that structural fractures have occurred in the utilized macroeconomic time series data. 1998 to 2001, 2003 to 2006, 2007 to 2009, 2009 to 2015, 2015 to 2018, and 2018 to 2019 were characterized by structural breaks in the data due to the global financial crisis of 2007 to 2009, the period of low economic growth from 2010 to 2015, the global economic and financial crisis between 2015 and 2018, and the recent Covivirus-19 pandemic. The investigation continues to conduct the histogram normality test, as depicted in Figure 3.

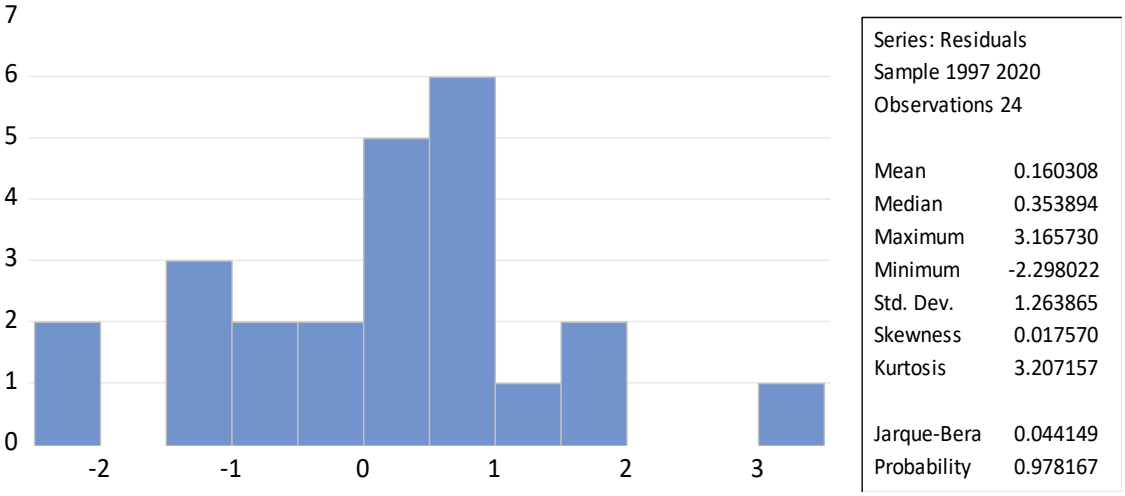


Figure 3. Histogram Normality Test
Source: Author's Illustration

The study conducted a Histogram normality test to determine whether the residuals are normally distributed, as they must be for a traditional linear regression model, as depicted in Figure 3 above. The Jarque-Berra coefficient is 0.044149, and its probability is 0.978167, more significant than the critical value of 0.05. This indicates that the null hypothesis (Ho) that residuals are normally distributed cannot be rejected. This indicates that the results of this study are objective and trustworthy for policymaking. As shown in Table 6, the research continues to estimate the Granger causality tests.

As shown in Table 6, the study used the Granger Causality test to examine causal relationships between the variables in the model. At a significance level of 1%, the results revealed a unidirectional causal relationship between public debt and government spending in South Africa. This means that policies affecting public debt will have a causal effect on South Africa's government expenditures. These findings are consistent with Mah et al.'s (2013) research. Other results indicate no causal relationship between South Africa's economic growth, government deposits, Gini coefficient, business confidence, consumer price inflation, government revenue, unemployment, and public debt.

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Table 6: Granger Causality Test

Pairwise Granger Causality Test Sample: 1990 – 2020 Lags: 2		
Null Hypothesis	**F-Statistic**	**Probability**
DLGOV does not Granger Cause DLGDBT	0.43498	0.6525
DLGDBT does not Granger Cause DLGOV	5.76339	0.0094
DLGDP does not Granger Cause DLGDBT	2.14284	0.1402
DLGDBT does not Granger Cause DLGDP	0.57814	0.5689
DLGDEP does not Granger Cause DLGDBT	1.46394	0.2521
DLGDBT does not Granger Cause DLGDEP	1.71606	0.2020
DGINI does not Granger Cause DLGDBT	0.00159	0.9984
DLGDBT does not Granger Cause DGINI	0.06758	0.9348
DLBC does not Granger Cause DLGDBT	0.31244	0.7347
DLGDBT does not Granger Cause DLBC	0.87749	0.4293
DLCPI does not Granger Cause DLGDBT	1.81366	0.1856
DLGDBT does not Granger Cause DLCPI	0.64036	0.5362
DLGREV does not Granger Cause DLGDBT	0.53318	0.5938
DLGDBT does not Granger Cause DLGREV	0.58413	0.5657
DLUNE does not Granger Cause DLGDBT	0.07729	0.9259
DLGDBT does not Granger Cause DLUNE	0.00488	0.9951

Source: Author's computation

Therefore, these results indicate that South Africa's public debt significantly impacts government spending patterns. This necessitates heightened vigilance on the part of the government regarding matters affecting the public debt, as this will have a causal effect on its spending patterns. As shown in Section 5 below, the study continues with the conclusion and recommendations of the study.

5. CONCLUSION AND RECOMMENDATION

The study examined the determinants of South Africa's public debt from 1990 to 2020. Using a Simple Switching Regression Model and Granger Causality test, the study found that in Regimes 1 and 2, government deposits, business confidence, consumer price inflation, government revenue, and unemployment are significant drivers of public debt. In Regime 2, government expenditure was found to be an insignificant predictor of public debt, whereas only Regime 1 revealed the Gini coefficient as an insignificant predictor of public debt. According to Granger's theory of causality, public debt influences public debt. Therefore, the following are the policy implications of this study based on empirical evidence:

First, a positive relationship exists between government spending and public debt in South Africa under both administrations, supported by a causal effect from public debt to government spending. This mandates that the government reduce its debt-supported fiscal expenditures. To reduce South Africa's public debt, the government must reduce its fiscal reliance on financing and investigate other means, such as taxation. More outstanding public debt is detrimental to the economy because it remains due until future generations have paid it off. This may result in macroeconomic instability because the government will be forced to spend more money on debt repayment than on achieving macroeconomic goals in South Africa, such as economic growth, job creation, price stability, poverty alleviation, and balance of payment stability.

In Regime 1 and Regime 2, respectively, there is a negative insignificant and positive significant relationship between economic growth and public debt. This requires the government and policymakers to review economic development policies. They must implement and support economic development unrelated to the increase in public debt. South Africa must implement policies that encourage increased investment, energy, and exports to increase economic growth and reduce public debt. Thirdly, a statistically significant positive and negative correlation exists between government deposits and public debt in Regime 1 and Regime 2, respectively. This necessitates the implementation of policies to increase government deposits in South Africa. The Corporations for Public Deposits will accept deposits from the public sector and invest those funds in short-term money market instruments and particular Treasury bills. This deposited capital and any accrued interest are payable on demand. This will help reduce South Africa's current elevated level of public debt.

In Regime 1 and Regime 2, respectively, there is a negative insignificant and positive significant relationship between the Gini coefficient and public debt in South Africa. This requires the South African government to implement policies that reduce the Gini coefficient so that income can be distributed equitably. This will help reduce the public debt because a more significant proportion of the population will have a fairly equitable share of the national income, reducing their reliance on government grants. The government may enact policies such as taxation and income transfers to the lowest segment and policies that expand opportunities such as education. This will help people gain access to a wide variety of economic opportunities, thereby reducing their reliance on the government. Fifth, a statistically significant positive correlation exists between corporate confidence and public debt in both Regimes 1 and 2 of South Africa. This requires the government and policymakers to review business confidence-related policies to reduce South Africa's public debt. Possibly because the government has continued to borrow from international financial institutions, business confidence has not yet been able to reduce the public debt. Continued improvement in business confidence must be used to reduce the ever-increasing national debt.

Sixth, there is a significant negative and positive relationship between inflation in consumer prices and public debt in South Africa in Regime 1 and Regime 2, respectively. South Africa's policymakers and government must implement policies that reduce inflation and public debt. An increase in consumption prices weakens the South African Rand, and as a result, the debt will continue to grow as the currency remains weak. This decreases the likelihood that the government will be able to repay the public debt. Moreover, a statistically significant positive correlation exists between government revenue and public debt in Regime 1 and Regime 2 of South Africa. This requires the government and policymakers to disclose their revenue policies so that an increase in government revenue may help reduce public debt. The government must be able to repay its debts to the public and the international community due to an increase in government revenue.

Lastly, a considerable positive correlation exists between unemployment and public debt in Regimes 1 and 2 in South Africa. The government and policymakers must propose policies that reduce unemployment to reduce public debt. The government must increase expenditures on Expanded Public Works Programs (EPWPs), education and training, geographical and employment subsidies, and restrict the influence of labor unions. This will allow the government to increase the likelihood of individuals obtaining employment and collect more tax revenue to reduce public debt.

The primary objective of this study was to investigate the determinants of public debt in South Africa by incorporating government expenditure, economic growth, the Gini coefficient, inflation in consumer prices, government revenue, and unemployment as explanatory variables. This objective was accomplished by employing the Simple Switching Regression Model and Granger Causality test on time series data from 1990 to 2020. It was discovered that government deposits, business confidence, consumer price inflation, government revenue, and unemployment are significant determinants of public debt in Regimes 1 and 2. Government expenditure was discovered to be a negligible determinant of public debt in Regime 2, whereas the Gini coefficient is only an insignificant determinant of public debt in Regime 1. Future research utilizing a Regime-Switching Regression Model to analyze the determinants of public debt should include more observations.

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