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## Determinants of public debt in South Africa: A Regime-Switching Approach

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**Abstract:** The study investigates the determinants of public debt in South Africa. There is a problem of increasing public debt in South Africa accompanied with poor economic growth, high unemployment, high inequality, and proportionately high government spending. The study utilises time series data spanning for the period from 1990 to 2020 collected from secondary online data sources, that is, the South African Reserve Bank, Quantec Easy Data, Statistics South Africa, and the World Bank. The study employed a Simple Switching Regression Model and Granger Causality test to investigate the determinants of public debt in South Africa. Empirical results revealed that government deposits, business confidence, consumer prices inflation, government revenue and unemployment are significant determinants of public debt in both Regime 1 and 2. Government expenditure was found to be an insignificant determinant of public debt in Regime 2 while Gini-coefficient is an insignificant determinant of public debt only in Regime 1. Granger causality revealed that public debt has a causality effect on public debt. The study provided recommendations such as reducing heavy dependency on public debt to finance fiscal stimulus in South Africa.

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

*JEL Specification:* C4, H6, E62, F34

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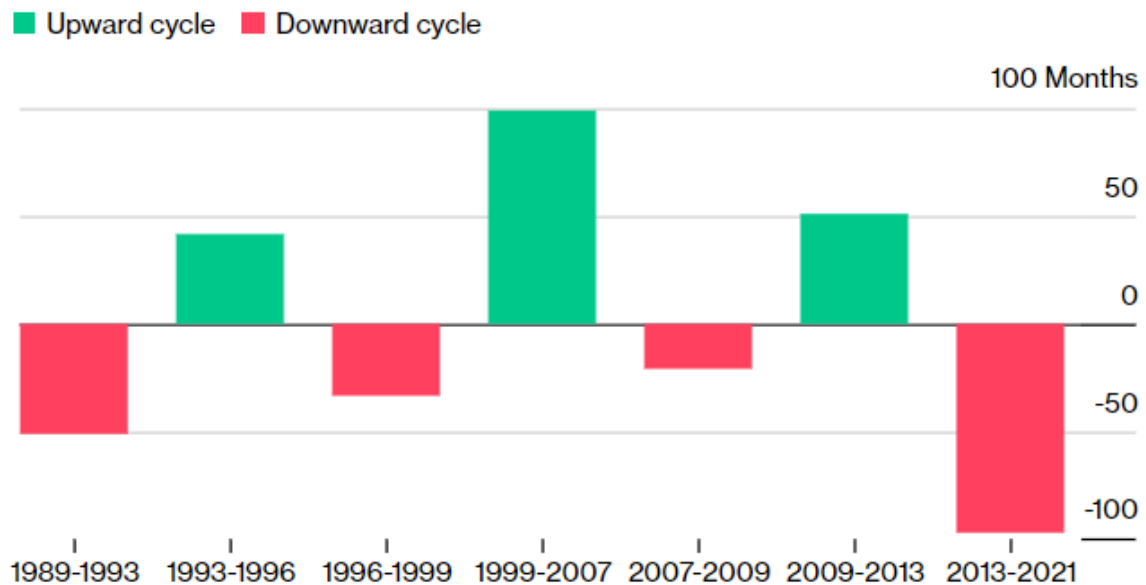
### 1. Introduction

Public debt refers to the sum of all outstanding financial liabilities of the public sector in respect of which there is a primary legal responsibility to repay the original amount borrowed and to repay debt

(Calitz, Steenekamp et al. 2019). Public debt arises primarily because of government's annual budget deficit, which is a consequence of fiscal policy. There are mainly two types of public debt, that is the domestic or internal debt and the foreign or external debt. Internal debt refers to the debt incurred by government when borrowing from domestic residents or institutions, that is, when selling bonds in the domestic primary capital market and is expressed in terms of home currency (Calitz, Steenekamp et al. 2019). Foreign debt refers to debt incurred by government when borrowing from foreign governments, residents, or institutions and is expressed in terms of foreign currency (Calitz, Steenekamp et al. 2019). There is a problem of increasing public debt in South Africa accompanied with poor economic growth, high unemployment, high inequality, and proportionately high government spending.

**Overview of the study:** The Ricardian equivalence theory suggests that the government needs not to concern itself with inter-generational equity, since society will voluntarily effect this equity as is preferred (Calitz, Steenekamp et al. 2019). The Ricardian equivalence theory is applicable to this study since we consider that the public debt in South Africa is made by the government, and we try to reveal the effects of such actions on the rest of the economy. Keynesian economists argue that when unemployment is high, for example, debt-financed fiscal expansion is warranted to stimulate aggregate demand until it equals aggregate supply at the full employment level of income. However, when unemployment is low, Keynesian economist argue that deficit financing may be inflationary and tax increases will be necessary to constrain private spending. The South African national debt is total amount of money borrowed by the South African government at any one moment through the issuance of securities by the South African Treasury and other government entities. According to Treasury (2020), the entire South African government debt as of 2019 and 2020 was R3.18 trillion. The International Monetary Fund estimated the country's debt to GDP ratio in October 2020 to be 82.76 percent of GDP. The South African National Treasury expects the national debt to rise to R4.38 trillion in 2022 and 2023 because of increased government spending and poor economic growth. In 2019 and 2020, almost 90 percent of the national debt was denominated in South African Rands, minimizing borrowing risk due to currency swings. South Africa's government debt was expected to reach about US\$157 billion by September 2020 (Treasury 2020). Within seven months, South African government debt had reached 100 percent of the National Treasury's prediction for the fiscal year ending March 2022, raising the likelihood that obligations will exceed official forecasts (Naidoo 2021). According to the South African Reserve Bank's Quarterly Bulletin, gross debt was at R4.2 trillion (US\$261 billion), or 97.3 percent of the government's projection as of October 31, 2021. In the third quarter medium-term budget policy statement, 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.

**Figure 1: South Africa’s economy is stuck in the longest downward phase since 1945**



Source: South African Reserve Bank

From Figure 1 above, the South African economy has been in the downward cycle for the longest time since 1945 within the period from 2013 to 2021. This has resulted in the South African government having to borrow money from international financial institutions such as the IMF and the World Bank to try balance expenditure. According to Naidoo (2021), South African was already weak prior to the outbreak of the Coronavirus. According to the SARB data, it entered the 97<sup>th</sup> month in the weakening cycle in December. While a reduction in economic activity in the third quarter of 2021, as well as the aftermath from the fourth wave of Coronavirus infections, indicate that South Africa’s economic recovery has stalled but it does not necessarily indicate a shift in the cycle. Foreign direct investment inflows totalled R557.9 billion in the three months to September 2021, compared to R17.4 billion in the preceding quarter. Godongwana (2022) states that government debt has reached R4.3 trillion this year and is expected to climb to R5.4 trillion in the longer term. It incurs significant debt-service expenses, approximately R330 billion per year throughout the MTEF. The consolidated budget deficit is expected to fall from 5.7% of GDP in 2021/22 to 4.2% of GDP in 2024/25 and by then the debt-to-GDP ratio will have stabilised at 75.1% of GDP. From the statistics above, there is a problem of high public debt in South Africa caused by macroeconomic factors such as poor economic growth, high unemployment, and higher inequality hence the significance of this study is to investigate the determinants of public debt in South Africa. This will help policy makers and the government with the decision making concerning its borrowing patterns. The study will also provide recommendations based on empirical evidence on the way forward concerning public debt and the macroeconomic variables in South Africa.

The study therefore continues to outline the literature review in Section 2, methodology in Section 3, results and interpretations in Section 4, and conclusion and recommendations in Section 5 below.

## **2. Literature review**

Ricardian equivalence is an economic theory that states that funding government expenditure with current or future taxes including current deficits has the same total effect on the economy founded by Ricardo (1820). Ricardo (1820) studied whether it made a difference to pay a war by issuing government bonds or increasing taxation in his essay “Essay on the Funding System.” Ricardo concluded that it made no difference. Robert Barro in 1974 revisited the concept, arguing that, under certain conditions, funding government expenditures with bonds was equivalent to raising taxes. He concluded that government debt issuance and taxation were roughly similar. This means that efforts to stimulate the economy by expanding debt-financed government expenditure will be ineffective since investors and consumers realize that the debt will eventually have to be repaid through future taxes. According to Barro (1996), individuals will save because they expect more future taxes to be collected to pay off the debt, and this would counteract the increase in aggregate demand caused by greater government expenditure. This also suggests that Keynesian fiscal policy will be ineffectual in terms of increasing economic production and growth. Based on contemporary economic theory of rational expectations and the lifetime income hypothesis, Barro (1979), Barro (1996), formally expanded Ricardian equivalence and his interpretation has frequently been understood as undercutting Keynesian fiscal policy as a tool for boosting economic performance. Reduced private consumption and investment spending will balance any government spending more than current tax revenue because investors and consumers change their present spending and saving patterns based on realistic assumptions of future taxes and their estimated lifetime after-tax income. The core premise is that regardless of how a government decides to boost spending, whether through borrowing or taxation, the result is the same and aggregate demand remains unaltered. Some economists, notably Ricardo, have claimed that this theory is founded on unrealistic assumptions. It presupposes, for example, that individuals would properly anticipate a hypothetical future tax hike and that capital markets will work fluidly enough that consumers and taxpayers will be able to readily move between present and future spending via saving and investment.

**A review of developed countries:** Gargouri and Keantini (2016) conducted a study on the determinants of public debt in the 12 European countries for the period from 2000 to 2014. The study employed correlated panel corrected standard errors model and found the positive impact of bank nonperforming loans, military expenditures and imports and a negative influence of GDP growth and bank liquid reserves. Neck and Getzner (2001) conducted a study on the politico-economic determinants of public debt growth in Austria for the period from 1960 to 1999. The study employed and modified Barro’s tax-smoothing model and found evidence for systematic influence of government behaviour in accordance with recent public choice theories as well as unemployment rate having a significant

influence on Austrian fiscal policy. Kumar and Woo (2010) conducted a study on the relationship between public debt and economic growth in a panel of advanced and emerging economies from 1970 to 2007. The study employed a Baseline Panel Regression model and found that an inverse relationship between initial debt and subsequent growth, controlling for other determinants of growth. The study further reveals that there is some evidence of nonlinearity with higher levels of initial debt having a proportionately larger negative effect on subsequent growth. Sinha, Arora et al. (2011) investigated the determinants of public debt for middle income and high-income group countries for the period from 1993 to 2008. The study employed pooled panel OLS model and Autoregressive multiple regression model and found that the most important determinant of debt situation is GDP growth rate for both high- and middle-income group countries. The further reveals that central government expenditure, education expenditure and current account balance influences public debt while foreign direct investment and inflation is found to be neutral on explaining debt. Mah, Mukkudem-Petersen et al. (2013) conducted a study on the impact of government expenditure on the Greek government from 1976 to 2011. The study employed VECM and Granger causality model and found that there exists a significant positive relationship between gross government debt and gross national expenditure and gross government debt and inflation. The study also revealed that there is a negative relationship between gross government debt and net foreign direct investment. Gross national expenditure and gross national income was found to Granger cause gross government debt, while gross government debt was found to Granger Cause inflation.

Isomitdinov, Arcabic et al. (2020) conducted a study on the international co-movements and determinants of public debt in 115 countries. By employing a Bayesian dynamic factor model, the study revealed that global factor accounts for a significant of the variation of public debt often more substantial than those explained by variables in many countries. Chirwa (2018) investigated the determinants of public debt in the Euro area that are either debt-reducing or debt-creating using panel data from 10 European countries. The study employed a panel ARDL approach and results revealed that though the real interest rate-economic growth differential in debt dynamics can be used to show whether debt is explosive or non-explosive, the speed of adjustment is found to be a good predictor. Moreso, the study reveals that while economic growth is debt-reducing in the short-run, real exchange rate, investment, population growth is debt-reducing in the long-run. Baskaran (2010) conducted a study on the link between fiscal decentralization and public debt in 17 OECD countries for the period from 1975 to 2001. By employing panel baseline models, the study revealed that expenditure decentralization significantly reduces public indebtedness, whereas tax decentralization and vertical fiscal imbalances are insignificant. Filip (2019) investigated the determinants of public debt in 28 European Union countries for the period from 1995 to 2017. By employing a panel OLS model, the study revealed that debt to GDP ratio is significantly and positively influenced by the previously accumulated public debt, also by unemployment and population size, while real GDP growth, FDI inflows, grows capital

formation and trade balance have significant impacts on limiting the public debt. Briceño and Perote (2020) conducted a study on the determinants of the public debt in the Eurozone and its sustainability amid the Covid-19 pandemic. The study employed GMM model on panel data for the period from 2009 to 2018, and revealed that economic growth, interest rate, life expectancy at birth, unemployment, government effectiveness and the last sovereign debt crisis have resulted as being the main determinants of public debt evolution. Sadik-Zada and Gatto (2019) investigated the determinants of public debt and the role of the natural resources in 184 countries for the period from 1971 to 2011. By employing panel linear regression model, the study revealed that oil abundance, economic growth rate, the share of mineral rent in the total revenue, interest rate payments for foreign borrowings, and being a developing country have statistically significant impact on the growth of the public debt and defence spending, unemployment rate, and inflation do not have a statistically significant positive impact on the public debt rate. Delgado-Téllez and Pérez (2020) conducted a study on the institutional and economic determinants of regional public debt in Spain for the period from 1995 to 2017. The study employed GMM model and revealed that regional government's fiscal policies reacted to public debt increase, higher degree of regional fiscal responsibility tends to be linked to more subdued debt dynamics and increases in public debt have affected the standard debt.

**A review of developing countries:** Forslund, Lima et al. (2011) conducted a study on the determinants of the composition of public debt in developing and emerging market countries. The study employed panel OLS model on balanced and unbalanced panel data spanning for the period from 1990 to 2007 and found weak correlation between inflationary history and the composition of public debt. Bader and Magableh (2009) conducted an enquiry into the main determinants of public debt in Jordan for the period from 1980 to 2005. By employing OLS model, the study found that government deficit, savings gap, and real exchange rate significantly affect external debt, but real exchange rate is the most effective. The study further recommends that, motivating domestic savings and controlling the fiscal position may help to slow down debt accumulation and debt burden. Bittencourt (2015) investigated the determinants of government and external debt from the young democracies of Southern America from 1970 to 2007. By employing the dynamic panel time-series analysis, the results revealed that economic growth has significantly reduced the debt ratios in the region. The study further reveals that an economic environment geared toward generating economic activity and prosperity is an important factor in keeping the debt ratios under control in the region. Matiti (2013) conducted a study on the effect of selected determinants on public debt in Kenya for the period from 2003 to 2012. The study employed a linear regression model and found that there is a direct relationship between public debt and exchange rates, balance of payments and budget deficit. Manalo, Villamiel et al. (2022) conducted a study on the macroeconomic determinants of public debt in the Philippines utilising foreign direct investment inflows, gross capital formation, inflation rate and trade balance for the period from 1990 to 2019. By employing a Multiple Linear Regression model, the study revealed that foreign direct investment, trade

balance and inflation are negative determinants of public debt and recommend that FDI can be relied upon as a debt reduction measure with its negative coefficient. Omrane Belguith and Omrane (2017) investigated the macroeconomic determinants of public debt growth in Tunisia for the period from 1986 to 2015. The study employed a VECM model and revealed 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 important determinant of public debt in Tunisia.

**A review of South Africa:** Mothibi and Mncayi (2019) investigated the key drivers of government debt in South Africa during the post-Apartheid. The study utilized time series data spanning from 1994 to 2017 and employed the ARDL model and found 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 key drivers of government debt in South Africa. Murwirapachena and Kapingura (2015) examined the determinants of external debt in South Africa from 1980 to 2013. The study employed a VECM model and revealed that external debt in South Africa is mainly due to sluggish levels of economic growth and high levels of government spending on infrastructure. Bayale (2020) conducted an empirical investigation into the determinants of public debt for 51 Africa countries. The study utilised panel data spanning from 1990 to 2018 and employed a Panel Bayesian Model Averaging Approach revealing that in the 27 regressors considered in the baseline model, those reflecting international financial and institutional conditions as well as internal economic prospects tend to receive high posterior inclusion probabilities.

From the literature review above, there is more literature on the determinants of public debt in developed countries than developing countries. In terms of the studies on determinants of public debt in South Africa, there is little to limited research hence this study focuses on the determinants of public debt in South Africa. This will help shed light on the borrowing patterns of the South Africa government and policy makers by proposing recommendations that can be adopted based on empirical evidence. The study will focus on the determinants of public debt in South Africa through utilising government expenditure, economic growth, business confidence, unemployment, consumer price inflation, Gini coefficient, government revenue and government debt as control variables. This will help shed light on the impact of these variables on public debt so that the South African government and policymakers can make rational decisions when it comes to borrowing considering the level of public debt in South Africa.



### 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 total labour force) (modelled ILO estimate)	% Of total labour 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 own compilation

**Empirical model estimation:** The study made use of secondary data sources such as South African Reserve Bank, Quantec Easy Data and The World Bank to collect time series data spanning for the period from 1990 to 2020. The study primary goal of the study is to investigate the determinants of public debt in South Africa by utilising explanatory variables such 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 above to formulate a multivariate linear regression equation. These variables were adopted from Mothibi and Mncayi (2019), Murwirapachena and Kapingura (2015), Gargouri and Keantini (2016), Filip (2019), and Bittencourt (2015). The conceptual framework of this study is specified as given below:

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

The study uses logged variables for consistence 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:

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

Whereby,  $\beta$  is the slope coefficients and  $\varepsilon_t$  is the stochastic error term.

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

. Many financial and economic time series appear to go through episodes in which the series behaviour changes substantially from what it was previously. A series behaviour may change over time in terms of its mean value, volatility, or the amount to which its present value is referred to as a structural break in a series. Alternatively, it may alter for a length of time before reverting to its previous behaviour or transitioning to yet another form of behaviour, which is commonly referred to as a regime shift or regime change. Hamilton (1989) stress that Regime-Switching Models may be used to capture against changes in averages, variances, heteroskedasticity and mean. A set of specifications based on the serial correlation features of the gradient vectors at a given set of parameter estimations was proposed by White (1987, 1994) and Hamilton (1990, 1996). Simple-switching regressions may be tested using these techniques as they enable creation of basic serial correlation, ARCH, and Markov Switching tests. The general Switching Regression Model may be specified as follows:

$$\begin{aligned}
 Y_{1t} &= X_{1t} \cdot \beta_1 + \varepsilon_{1t} \\
 Y_{2t} &= X_{2t} \cdot \beta_2 + \varepsilon_{2t} \\
 Y_{3t} &= X_{2t} \cdot \beta_3 + \varepsilon_{3t} \dots (3) \\
 (Y_t = Y_{1t}) &\Leftrightarrow Y_{3t} < 0 \\
 \varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t} &\sim N\left(0, \begin{pmatrix} \sigma_1 & \sigma_{12} & 0 \\ \sigma_{12} & \sigma_2 & 0 \\ 0 & 0 & 1 \end{pmatrix}\right)
 \end{aligned}$$

Where,  $Y_t$  is the observable dependent variables, which is 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  $\Phi(-X_{3t} \cdot \beta_3)$ .<sup>1</sup> Van Norden and Vigfusson (1996) highlights that if we restrict  $\beta_1 = \beta_2$  where  $X_1 = X_2$ , the regression reduces to:

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

$$Y_{3t} = X_{3t} \cdot \beta_3 + \varepsilon_{3t} \dots 4$$

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

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

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

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 main use of this model is in tests of non-switching model against switching alternatives.

**Granger Causality test:** Granger (1969) demonstrated how cointegration exists between two variables in the long 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:

$$H_0: x_t \text{ does not Granger Cause } y_t \dots \dots \dots (5)$$

$$H_1: x_t \text{ does Granger Cause } y_t \dots \dots \dots (6)$$

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

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

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

#### 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 own computation

The study performed the Augmented Dickey-Fuller and Phillips-Perron unit root test developed by Dickey, Hasza et al. (1984) and Phillips and Perron (1988) respectively, as shown in Table 2 above to determine the level of integration of the variables and help avoid the problem of spurious regressions. The results of both the ADF and PP unit root test confirmed that the variables, are stationary at first difference, which is, they are integrated at of high order one or I(1) at 1%, 5% and 10% level of significance. LGREV seems to be non-stationary when testing unit root on the trend and intercept on both the ADF and PP unit root test. This justifies the employment of Regime Switching Model as highlighted by Perron (1989), Zivot and Andrews (1992) and Kapetanios (2005) of a possibility of structural break in the macroeconomic data. The study therefore will utilise differenced variables when investigating the determinants of public debt in South Africa. The study continues to perform the optimal lag length criteria as shown in Table 3 below to determine the number legs it can use in the investigation.

**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 own computation

The study employed a VAR optimal lag length criterion as shown in Table 3 above to determine the number of optimal lags it can employ. The results revealed that the optimal number of lags to be used in the investigation is two lags. This means that the study will now employ two lags for the investigation

of the determinants of public debt in South Africa. The significance of these results is that it reveals that the study must utilise 2 lags.

**Table 4: Simple Switching Regression model results**

<b>Simple Switching Regression Model</b>				
<b>Dependent variable: LGDBT</b>				
	<b>Regime 1</b>		<b>Regime 2</b>	
<b>Variable</b>	<b>Coefficient</b>	<b>Probability</b>	<b>Coefficient</b>	<b>Probability</b>
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
<b>Common</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>z-Statistic</b>	<b>Probability</b>
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 own computation

The study employed a Simple Switching Regression (SSR) Model as shown in Table 4 above to capture for structural breaks in macroeconomic data that may take place due to global financial economic crisis and the Covid-19 pandemic. The SSR model utilised two regimes, that is, a regime 1 and regime 2. As shown in Table 4 for Regime 1 results, there is a positive statistically significant and insignificant relationship between public debt and government expenditure in South Africa in Regime 1 and 2 respectively. A 1% increase in government expenditure in Regime 1 and 2, will significantly and insignificantly result in public debt increasing by 1.49% and 0.25% respectively, *ceteris paribus*. These results are consistent with the studies of Mothibi and Mncayi (2019), Murwirapachena and Kapingura (2015) and Gargouri and Keantini (2016). This means that government expenditure is the most important significant of growth in public debt in South Africa. Therefore, policies that reduces government expenditure should be promoted to reduce public debt in South Africa.

The results further shows that there is a negative statistically insignificant relationship between economic growth and public debt in regime 1 in South Africa. A 1% increase in economic growth in

Regime 1 in South Africa, will insignificantly result in public debt declining by 0.09%, *ceteris paribus*. These results are significant with the studies conducted by Filip (2019), Bittencourt (2015) and Murwirapachena and Kapingura (2015). This means that economic growth plays an important role in reducing public debt in South Africa. In Regime 2, however, there is a positive statistically significant relationship between economic growth and public debt. A 1% increase in economic growth significantly result in public debt increasing by 0.49%, *ceteris paribus*. This may be due to recent increases in public debt in South Africa as the government has been relying on borrowing to finance its growth. Therefore, policies that results in economic growth increasing must be promoted as they reduce public debt in South Africa.

The results also shows that there is a positive statistically significant relationship between government deposits and public debt in South Africa in Regime 1 and negative statistically significant in Regime 2. A 1% increase in government deposits will result in public debt significantly increasing and decreasing by 1.01% and 1.18% in Regime 1 and 2 respectively, *ceteris paribus*. This means that government debt are the main determinants of public debt in the short run as they contribute positively towards public debt in Regime 1 period of low variance. In Regime 2, an increase in government deposits results in a decrease in public debt and this is good for the South African economy. This calls for the government to implement policies that promote an increase in government deposits as it is a good detriment of public debt in South Africa, and this will help reduce the ever-growing public debt.

The results further shows that there is a negative statistically insignificant relationship between Gini-coefficient and public debt in South Africa in Regime 1, the period of low variance. A 1% will insignificantly result in public debt declining by 3.58%, *ceteris paribus*. However, in Regime 2, a period of high variance, there is a positive statistically significant relationship between Gini-coefficient and public debt in South Africa. A 1% increase Gini-coefficient in Regime 2 will significantly result in public debt increasing in 29.89%, *ceteris paribus*. This may be due to the recent increases in public debt in South Africa as the government has relied on the IMF and other international financial institutions to help reduce its levels of inequalities. South Africa is characterised by higher levels of inequality and in the hope to correct that, the government increases its borrowing to finance projects such RDPs, social grants, and education subsidies to reduce higher levels of inequality.

There is a positive statistically significant between business confidence and public debt in both Regime 1 and 2 in South Africa. A 1% increase in business confidence in South Africa will significantly result in public debt increasing by 0.04% and 0.08% in Regime 1 and 2 respectively, *ceteris paribus*. This means that an increase in business confidence in South Africa plays an important role in determining public debt in South Africa. As business confidence increases, international monetary institutions gain confidence in lending the South African government money to finance its fiscal stimulus resulting in

public debt rising. The government and policy makers must take note and reduce their borrowing during periods of good business confidence to reduce public debt in South Africa.

Furthermore, the results reveals that there is a negative and positive statistically significant relationship between consumer prices and public debt in South Africa in Regime 1 and Regime 2, respectively. A 1% increase in consumer prices will significantly result in public debt decreasing and increasing by 0.21% and 0.40% in Regime 1 and 2 in South Africa respectively, *ceteris paribus*. This means that in Regime 1 a period of low variance, inflation is good for reducing the public debt in South Africa. However, in Regime 2 a period of high variance, inflation is not good for reducing public debt in South Africa. The government must therefore promote policies that results in decline in consumer prices to reduce public debt in South Africa. These results are consistent with the studies of Omrane Belguith and Omrane (2017), Mah, Mukkudem-Petersen et al. (2013), Mothibi and Mncayi (2019) and Manalo, Villamiel et al. (2022).

The results also reveals that there is a positive statistically significant relationship between government revenue and public debt in South Africa in both Regime 1 and 2 respectively. A 1% increase in government revenue significantly result in public debt increasing by 68.25% and 48.35% in both Regime 1 and 2 in South Africa respectively, *ceteris paribus*. This means that increase in government revenue plays an important role on increasing public debt in both Regime 1 of low variance and Regime 2 of higher variance. The government must reveal its policies on its revenue collection so it can help reduce public debt in South Africa.

Finally, the results reveals that there's a positive statistically significant relationship between unemployment and public debt in South Africa in both regimes. A 1% increase in unemployment in South Africa will significantly result in public debt increasing by 0.18% and 0.39% in Regime 1 and 2 respectively, *ceteris paribus*. This means that unemployment rate plays an important role in determining public debt in South Africa in both regimes. This entails those policies that aims at reducing unemployment must be encouraged to reduce public debt in South Africa. These results are significant with the studies conducted by Neck and Getzner (2001), Filip (2019) and Briceño and Perote (2020). These results are also consistent with the recent higher unemployment rates in South Africa corresponding with higher public debt and makes economic sense. The study therefore continues to reveal transitional summary as shown in Table 5 below.



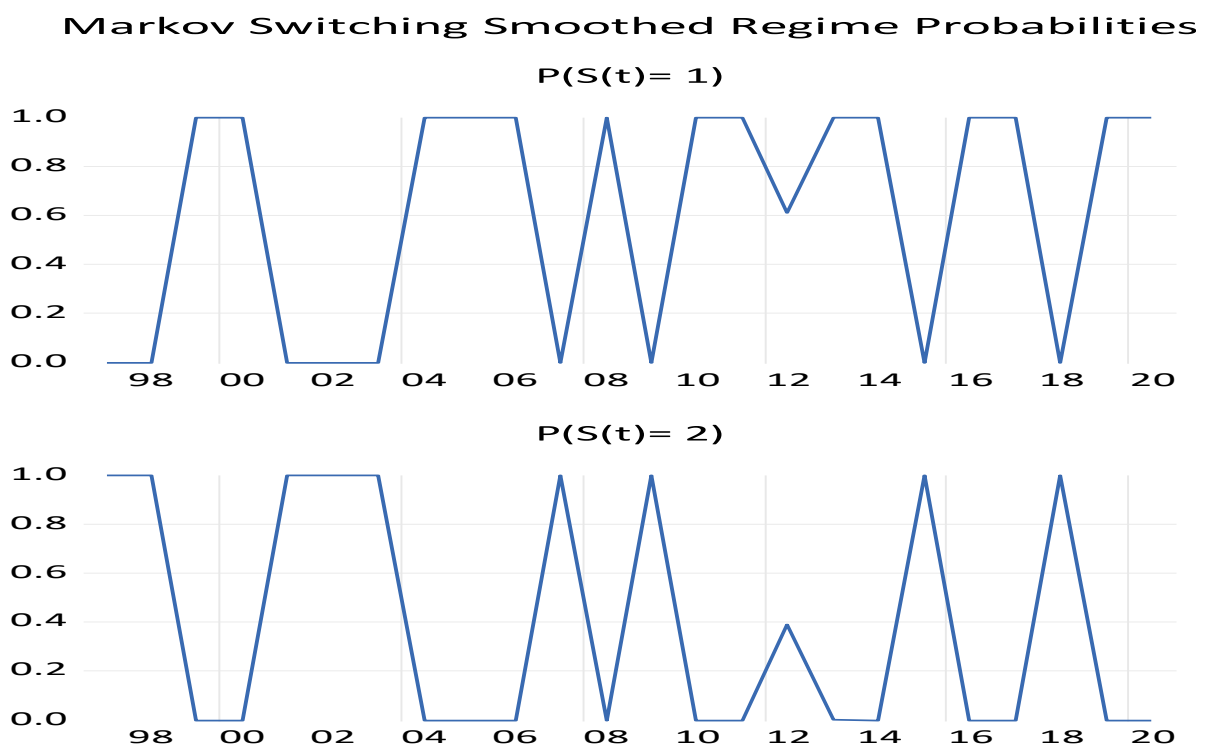
**Table 5: Transition summary**

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 Durations:		
	1	2
	2.694271	1.590224

Source: Author’s own computation

The study performed a Constant Simple Switching Transition probabilities as shown in Table 5 above. The results reveals that there is a 62.88% probability that if public debt is in Regime 1 it will stay in Regime 1. There is a proportionately less probability of moving from Regime 1 to Regime 2 with a probability of 37.12%. The result also reveals that if public debt is in Regime 2, there is a 37.12% that it will stay there. There is a 62.88% probability that public debt will move from Regime 2 back to Regime 1. The results also reveals that the constant expected durations are 2.69 times for Regime 1 and 1.59 times for Regime 2.

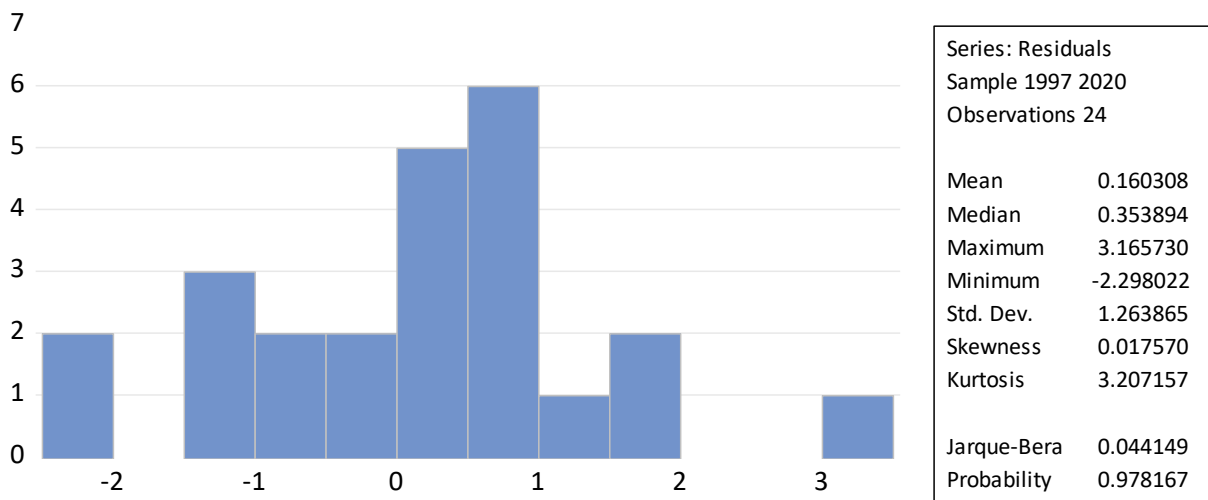
**Figure 2: Markov Switching Smoothed Regime Probabilities**



Source: Author’s own compilation

The study performed a Markov Switching Smoothed Regime Probabilities as shown in Figure 2 above. The results from Figure 2 correspond to show some structural breaks that took place in the macroeconomic time series data utilized. It is evident that the durations between 1998 to 2001, 2003 to 2006, 2007 to 2009, 2009 to 2015, 2015 to 2018 and 2018 to 2019 there were structural breaks in the data due to global financial crisis of 2007 to 2009, period of low economic growth from 2010 to 2015, global economic and financial crisis between 2015 up to 2018 and the recent Covid-19 pandemic had an impact on public debt in South Africa. The study therefore continues to perform the histogram normality test as shown in Figure 3 below.

**Figure 3: Histogram Normality Test**



Source: Author’s own illustration

The study performed a Histogram normality test to check if the residuals are normally distributed as must be the case with a classical linear regression model as shown in Figure 3 above. The coefficient of the Jarque-Berra is 0.044149 and its probability is 0.978167 that is above the critical value of 0.05. This implies that we fail to reject the null hypothesis (Ho) that the residuals are normally distributed. This means that the results from this study are unbiased and reliable for policy making. The study therefore continues to estimate the Granger causality checks as shown in Table 6 below.

**Table 6: Granger Causality Test**

<b>Pairwise Granger Causality Test</b>		
<b>Sample: 1990 – 2020</b>		
<b>Lags: 2</b>		
<b>Null Hypothesis</b>	<b>F-Statistic</b>	<b>Probability</b>
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 own computation

The study performed the Granger Causality test to check for causal relationships between the variables in the model as shown in Table 6 above. The results revealed that there is unidirectional causality running from public debt to government expenditure in South Africa at 1% level of significance. This means that policies that affect public debt will have causality effect on government expenditure in South Africa. These results are consistent with the study conducted by Mah, Mukkudem-Petersen et al. (2013). Other results shows that there is no causality between economic growth, government deposits, Gini-coefficient, business confidence, consumer prices inflation, government revenue, unemployment, and public debt in South Africa. Therefore, these results shows that public debt plays an important role on government expenditure patterns in South Africa. This means that the government must be on high alert on matters that affect public debt as this will have a causal impact on its spending patterns. The study therefore continues to give the conclusion and recommendations of the study as shown in Section 5 below.

## **5. Conclusion and Recommendation**

The study examined the factors that determine public debt in South Africa from 1990 to 2020. The study found that in both Regimes 1 and 2, government deposits, business confidence, consumer price inflation, government revenue, and unemployment are major drivers of public debt, using a Simple Switching Regression Model and Granger Causality test. In Regimes 2, government spending was shown to be an insignificant predictor of public debt, whereas the Gini-coefficient was found to be an insignificant determinant of public debt only in Regime 1. Public debt has a causal influence on public debt, according to Granger causality. Therefore, the policy implications of this study based on empirical evidence are as follows:

Firstly, there is a positive relationship between government expenditure and public debt in South Africa in both regimes substantiated by a casual effect running from public debt to government expenditure. This calls for the government to reduce its fiscal spending that is supported by public debt. By reducing its fiscal reliance on borrowing, the government must explore other means such as taxation to reduce public debt in South Africa. A higher public debt is not good for the economy as it remains owing until the generations that finishes paying. This may result in macroeconomic instability when the government will have to take more funds paying back the debt instead of using those funds for improving macroeconomic objectives in South Africa such as economic growth, job creation, price stability, poverty alleviation, and balance of payment stability.

Secondly, there is a negative insignificant and positive significant relationship between economic growth and public debt in Regime 1 and 2 respectively. This calls for the government and policy makers to review polices on economic growth. They must implement and support economic growth that is not because of increase in public debt. Policies that support increase in investment, energy and exports must be implemented to increase economic growth and help make economic growth reduce public debt in South Africa.

Thirdly, there is positive and negative statistically significant relationship between government deposits and public debt in Regime 1 and 2 respectively. This calls for the government to implement policies that increases government deposits in South Africa. The Corporations for Public Deposits will receive the public sector deposits and invests them in short-term money market instruments and special Treasury Bills. This money invested as well as any interest received, are receivable on demand. This will help reduce the higher public debt that South Africa currently have.

Fourthly, there is a negative insignificant and positive significant relationship between Gini-coefficient and public debt in South Africa in Regime 1 and 2 respectively. This calls for the government to implement policies that reduce the Gini coefficient so that there can be equitable distribution of income in South Africa. This will help reduce public debt as many people will be having a fairly equitable share of income in the country that can reduce heavy dependency on the government to provide them with grants support. The government may introduce policies such as taxation and income transfers to the poorest segment and increasing opportunities such as education. This will help people be able to access vast options in the economy to share the economic cake thereby reducing heavy dependency on the government.

Fifth, there is a positive statistically significant relationship between business confidence and public debt in South Africa in both Regime 1 and 2. This calls for the government and policy makers review policies that concern business confidence so that it can be able to reduce public debt in South Africa. Business confidence has not yet been able to reduce public debt as this may be the case that the government has continued borrowing from the international financial institutions. Continued improvement in business confidence must be diverted to help reduce the ever-growing public debt.

Sixthly, there is a negative and positive significant relationship between consumer prices inflation and public debt in South Africa in Regime 1 and 2 respectively. The policy makers and government must implement policies that help make inflation reduce public debt in South Africa. An increasing consumer prices weakens the currency of the South African Rand, and this will make the debt ever increasing as the currency will be weak. This weakens the probability of the government being able to pay back the public debt.

More so, there is a positive statistically significant relationship between government revenue and public debt in South Africa in Regime 1 and 2. This calls for the government and policy makers to reveal policies on its revenue so that an increase in government revenue may be able to help reduce public debt. Increase in government revenue must afford the government an opportunity to help payback the money it owes to both the public and international community.

Finally, there is a positive significant relationship between unemployment and public debt in South Africa in both Regime 1 and 2. The government and policy makers must propose policies that help reduce unemployment to be able to reduce public debt. The government must increase investment in Expanded Public Works Programs (EPWPs), education and training, geographical subsidies, employment subsidies and limit power of trade unions. This will enable

the government to increase chances of people getting jobs, thereby affording the government to get more money in terms of taxes that it can use to offset the public debt.

In conclusion, the main objective of this study was to investigate the determinants of public debt in South Africa by incorporating government expenditure, economic growth, Gini coefficient, consumer prices inflation, government revenue and unemployment as explanatory variables. This objective was achieved by employing Simple Switching Regression Model and Granger Causality test on time series data spanning for the period from 1990 to 2020 and found that government deposits, business confidence, consumer prices inflation, government revenue and unemployment are significant determinants of public debt in both Regime 1 and 2. Government expenditure was found to be an insignificant determinant of public debt in Regime 2 while Gini-coefficient is an insignificant determinant of public debt only in Regime 1. The research in future should consider increasing observations when employing a Regime-Switching Regression Model to analyse the determinants of public debt.

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